Open Letter To The Astronomical Community

Having worked at many astronomical observatories around the world, I have a very good overview of astronomy. I have also had the privilege of working in the solar industry and I was the manager of the largest utility solar photovoltaic power system in the USA that was launched by President Barack Obama. Witnessing the incompetence that was in the utility solar industry and is still present within the industry led me to the belief that the astronomy community must turn its views toward the environment that we are living in. We live in truly unbelievable times. Autism is an epidemic in most western countries, western governments are nothing more than corrupt corporations, and corporations are routinely suppressing information regarding the toxicity of many common household items. The result is that many people are unnecessarily suffering from easily preventable developmental problems, sickness and cancer.

Much of this illness stems from incorrect human environmental conditions and is easily preventable by simply moving the human into the correct environmental conditions. Astronomers must return to studying environmental radiation for associations to human problems and incorrect environmental conditions. The future of the next generation relies on astronomers obtaining a full understanding of the rapidly changing human environmental conditions and the halting of biologically toxic corporate government policies. The overloading of the electromagnetic environment is one of these disastrous policies that must stop.

Dark Energy is poorly understood and it is clear that we are currently moving into exploring the complete electromagnetic spectrum that also includes the study of atmospheric pressure waves, atmospheric voltage effects on the cellular system, and the biological effects of the various forms of atmospheric radiation transmission. Light and the human is poorly understood by the astronomical profession, with many astronomers not understanding which light bulbs they should have in their own homes and offices! It is embarrassing that astronomers do not understand the many forms of artificial lighting that they are exposed to every day and how it affects them. It is a sad state of affairs that I do not know of any astronomer that fully understands the energy in their own daily environment. Until this changes, Dark Energy will always be a mystery to the astronomical community.

We see a continuation of astronomical incompetence in their own facilities. Promoted to the public as the latest generation facility, the 2.4 billion dollar Thirty Meter Telescope project is a continuation of environmental human biological problems that I observed on the summit of Mauna Kea, Hawaii, USA. I worked on Mauna Kea for over five years and saw my health severely degrade during that time. The two long term summit workers that I knew well died of disease conditions, another worker went on to commit suicide, and others were argumentative. Astronomers know the site is biologically toxic to their workers health, but do not inform the new hires of it, other than they may get altitude sickness and direct them to use the company supplied drugs to offset that sickness. They know that workers are inappropriately acclimatizing on a daily basis, which further aggravates the altitude sickness symptoms. The insatiable quest for knowledge is far greater than the quest for worker health and safety. If a company is advising workers to take drugs to perform their job, they probably should not be working there. Mauna Kea is a known biologically hostile work environment and one can only wonder why the astronomy community is investing 2.4 billion dollars to build the world's largest telescope there.

Steven Magee – Chartered Electrical Engineer, The Institution of Engineering and Technology (IET)
Contents

Social Media ............................................................................................................................................. 10
Latest News ................................................................................................................................................ 13
Hawaiian Mauna Kea Beliefs ...................................................................................................................... 17
Steven Magee Quotes ................................................................................................................................. 19
Altitude Diseases: Altitude Damage ........................................................................................................... 20
Altitude Diseases: Mal-Acclimatization ...................................................................................................... 24
Altitude Diseases: Oxygen Starvation Hazards ....................................................................................... 26
Altitude Diseases: Hypocapnia .................................................................................................................... 30
Altitude Diseases: Intermittent Hypoxia .................................................................................................... 31
Altitude Diseases: Hypoxia .......................................................................................................................... 35
Altitude Diseases: Cerebral Hypoxia .......................................................................................................... 37
Altitude Diseases: Hypoxic Hypoxia .......................................................................................................... 38
Altitude Diseases: Hypobaric Hypoxia ....................................................................................................... 39
Altitude Diseases: Brain Hypoxia ............................................................................................................... 45
Altitude Diseases: Hypoxia & Hallucinations ............................................................................................ 46
Altitude Diseases: Neuroinflammation ...................................................................................................... 47
Altitude Diseases: Asthma & Allergies ....................................................................................................... 49
Altitude Diseases: Anemia Hazards .......................................................................................................... 51
Altitude Diseases: Radiation Hazards ...................................................................................................... 54
Altitude Diseases: Cosmic-Ray Hazards .................................................................................................. 57
Altitude Diseases: Diseases Associated With Ionizing Radiation Exposure ............................................. 58
Altitude Diseases: Radiation Damage ....................................................................................................... 72
Altitude Diseases: Magee’s Radiation Induced Colon Cleansing ................................................................. 76
Altitude Diseases: Effect of radiation on the human reproductive system ............................................... 77
Altitude Diseases: Light & Biological Effects (Daytime) ........................................................................... 78
Altitude Diseases: Light & Biological Effects (Nighttime) ...................................................................... 87
Altitude Diseases: Light & Biological Effects (Brain) ............................................................................... 90
Altitude Diseases: Light & Biological Effects (Too Bright) .................................................................... 91
Altitude Diseases: Light Deprivation ....................................................................................................... 94
Altitude Diseases: Circadian Rhythm Disorders ...................................................................................... 99
Altitude Diseases: Industrial High Powered LASER Hazards ................................................................. 105
Altitude Diseases: High Energy Visible Light (HEV) Dangers ............................................................... 108
Altitude Diseases: Infrared Hazards ......................................................................................................... 112
Altitude Diseases: Solar Retinopathy ....................................................................................................... 120
Altitude Diseases: Ultraviolet (UV) Radiation Hazards ........................................................................ 122
Altitude Diseases: UV & Cancer .............................................................................................................. 128
Altitude Diseases: UV & Immune System ............................................................................................... 130
Altitude Diseases: UV & Eye Damage ..................................................................................................... 131
Altitude Diseases: UV & Reproduction ................................................................................................... 132
Altitude Diseases: UV, Asthma & Allergies ............................................................................................. 135
Altitude Diseases: UV & Skin Microbiome ............................................................................................. 138
Altitude Diseases: UV & Dermatology ................................................................................................... 139
Altitude Diseases: UV & Vitamin D Deficiency ..................................................................................... 140
| Altitude Diseases: Hypocapnia                     | 241 |
| Altitude Diseases: Respiratory Alkalosis          | 243 |
| Altitude Diseases: Bacterial Infections           | 246 |
| Altitude Diseases: Oxygen Administration Health Risks | 247 |
| Altitude Diseases: Vasodilators                   | 250 |
| Altitude Diseases: High-Altitude Edema            | 251 |
| Altitude Diseases: Headache                        | 252 |
| Altitude Diseases: High Altitude Seizures (HAS)   | 254 |
| Altitude Diseases: High Altitude Stroke (HAS)     | 256 |
| Altitude Diseases: High Altitude Retinopathy (HAR)| 257 |
| Altitude Diseases: Dry Eyes                        | 258 |
| Altitude Diseases: High Altitude Renal Syndrome (HARS) | 259 |
| Altitude Diseases: High Altitude Retinal Hemorrhage (HARH) | 261 |
| Altitude Diseases: Amaurosis                       | 263 |
| Altitude Diseases: Barotrauma                      | 265 |
| Altitude Diseases: Barometric Pressure Issues     | 268 |
| Altitude Diseases: Pressure Sensitivity            | 270 |
| Altitude Diseases: Humidity                        | 271 |
| Altitude Diseases: Mood Changes                    | 272 |
| Altitude Diseases: Mood & Weather                  | 273 |
| Altitude Diseases: Skeletal Hazards                | 274 |
| Altitude Diseases: Polycythemia - Thick Blood      | 275 |
| Altitude Diseases: Blood Clotting                  | 278 |
| Altitude Diseases: Deep Vein Thrombosis (DVT)      | 279 |
| Altitude Diseases: Pulmonary Embolism (PE)         | 280 |
| Altitude Diseases: Cerebral Vascular Thrombosis (CVT) | 281 |
| Altitude Diseases: Cerebral Venous Sinus Thrombosis (CVST) | 282 |
| Altitude Diseases: Sleep Degradation               | 283 |
| Altitude Diseases: Altitude Insomnia               | 284 |
| Altitude Diseases: Sleep Apnea                      | 286 |
| Altitude Diseases: Sleep Apnea & Eyes              | 289 |
| Altitude Diseases: Central Sleep Apnea             | 291 |
| Altitude Diseases: Complex Sleep Apnea             | 296 |
| Altitude Diseases: Periodic Breathing              | 298 |
| Altitude Diseases: Positional Sleep Apnea          | 300 |
| Altitude Diseases: Sleep Apnea & Drugs             | 302 |
| Altitude Diseases: Nocturnal Angina                | 303 |
| Altitude Diseases: Sleep Apnea At High Altitude    | 304 |
| Altitude Diseases: Sleep Apnea Mental Health Issues | 306 |
| Altitude Diseases: Hormones & Sleep Apnea          | 307 |
| Altitude Diseases: Dying From Sleep Apnea Complications | 310 |
| Altitude Diseases: Magee’s Sleep Movement Disorder | 312 |
| Altitude Diseases: Night Shift Diseases            | 315 |
| Altitude Diseases: High Altitude Flatus Expulsion (HAFE) | 318 |
| Altitude Diseases: Inflammation Hazards            | 320 |
| Altitude Diseases: Gastrointestinal                | 323 |
Altitude Diseases: Altitude Induced Acid Reflux (AIAR) & Antacid Use ......................................................... 324
Altitude Diseases: Bruxism .......................................................................................................................... 326
Altitude Diseases: Dental Issues ............................................................................................................... 327
Altitude Diseases: Malnutrition Hazards .................................................................................................. 328
Altitude Diseases: Biochemical Adaptations ............................................................................................. 331
Altitude Diseases: Altered Hormones ....................................................................................................... 332
Altitude Diseases: Altered Glucoregulatory hormones ............................................................................ 337
Altitude Diseases: Altered Erythropoietin Hormone .............................................................................. 338
Altitude Diseases: Altered Thyroid Hormones ......................................................................................... 339
Altitude Diseases: Altered Growth Hormones .......................................................................................... 340
Altitude Diseases: Altered Sodium Hormones .......................................................................................... 341
Altitude Diseases: Altered Acetylcholine, Dopamine & Serotonin Hormones ........................................ 342
Altitude Diseases: Altered Male Hormones ............................................................................................... 349
Altitude Diseases: Altered Female Hormones ........................................................................................... 353
Altitude Diseases: Altered Sodium Hormones .......................................................................................... 355
Altitude Diseases: Altered Hormones ....................................................................................................... 357
Altitude Diseases: Altered Thyroid Hormones ......................................................................................... 361
Altitude Diseases: Drug Hazards ............................................................................................................. 363
Altitude Diseases: Mercury Poisoning ..................................................................................................... 365
Altitude Diseases: Mercury Lung Hazards ............................................................................................... 370
Altitude Diseases: Mercury Kidney Hazards ............................................................................................ 379
Altitude Diseases: Long Term Effects Of Mercury Poisoning ................................................................ 380
Altitude Diseases: Broken Mercury Filled Florescent Lamps – Hazards ................................................. 381
Altitude Diseases: Broken Mercury Filled Spectral Lamps - Hazards ..................................................... 384
Altitude Diseases: Industrial Gas Hazards ............................................................................................... 385
Altitude Diseases: Ethnicity ....................................................................................................................... 387
Altitude Diseases: Mental Health ............................................................................................................. 392
Altitude Diseases: Altered Lifespan ......................................................................................................... 393
Altitude Diseases: Dementia ..................................................................................................................... 396
Altitude Diseases: Social Isolation Hazards ............................................................................................. 397
Altitude Diseases: Summit Brain .............................................................................................................. 398
Altitude Diseases: Summit Brain .............................................................................................................. 401
Altitude Diseases: Mental Response to High Altitudes ........................................................................... 402
Altitude Diseases: Working Memory Attenuation .................................................................................... 404
Altitude Diseases: Amnestic Disorders ................................................................................................... 405
Altitude Diseases: Cognition ..................................................................................................................... 407
Altitude Diseases: Isolated High Altitude Psychosis ............................................................................... 409
Altitude Diseases: Invisible Friend ........................................................................................................... 410
Altitude Diseases: Delusional Disorders ................................................................................................. 411
Altitude Diseases: Wrecked Brain Cells .................................................................................................... 413
Altitude Diseases: Conflict Control ........................................................................................................ 414
Altitude Diseases: Malignant Brain Tumors ............................................................................................. 415
Altitude Diseases: Magee’s Descent Fatigue ............................................................................................ 416
Altitude Diseases: De-Acclimatization ..................................................................................................... 417
Altitude Diseases: High Altitude De-Adaptation Response (HADAR) ..................................................... 418
Altitude Diseases: High-Altitude De-Acclimatization Syndrome ........................................................... 419
Island Hazards.................................................................................................................. 543
Fatigue Hazards............................................................................................................... 545
Depression Hazards......................................................................................................... 547
Digestive Tract Hazards.................................................................................................... 549
Food Hazards.................................................................................................................. 551
High Altitude Diets.......................................................................................................... 552
Drinking Water Hazards................................................................................................. 555
High Altitude Beverages................................................................................................. 559
Feet Hazards.................................................................................................................... 561
Mercury Vapor Detectors................................................................................................. 562
Mercury Training Courses............................................................................................... 563
Oxygen Hazards............................................................................................................... 564
Nitrogen Hazards............................................................................................................. 569
Helium Hazards............................................................................................................... 571
Carbon Dioxide Hazards................................................................................................. 572
Industrial Gas Use In Chemical Weapons...................................................................... 576
Cryogenic & Industrial Gas Safety Courses.................................................................... 577
Professions That Breath Gas............................................................................................ 578
Multiple Chemical Sensitivity (MCS) From Breathing Abnormal Or Polluted Air...... 581
B12 Deficiencies From Breathing Abnormal Or Polluted Air........................................ 583
B12 Deficiencies................................................................................................................ 584
Leukemia Hazards............................................................................................................ 588
Radiation Researcher Sickness....................................................................................... 589
Fall Hazards..................................................................................................................... 595
Extreme Night Shift Hazards........................................................................................... 596
Sleep Disorder Hazards.................................................................................................... 599
Detecting Sleep Apnea..................................................................................................... 604
Sleep Apnea: CPAP Insomnia.......................................................................................... 605
Sleep Apnea: CPAP Conclusion Induced Fatigue............................................................ 607
Sleep Apnea: CPAP Aerophagia Hazards....................................................................... 609
Sleep Apnea: BiPAP Machine......................................................................................... 611
Oxygen Administration During Sleep.............................................................................. 612
Stimulant Hazards............................................................................................................ 614
Sleeping Tablet Hazards.................................................................................................. 616
Mauna Kea Hazards......................................................................................................... 617
Harassment....................................................................................................................... 623
Statement by Finnish Astronomers and Astrophysicists on Harassment.................... 624
Sonic Boom Hazards......................................................................................................... 625
Radio Frequency Hazards............................................................................................... 626
Dirty Electricity Hazards.................................................................................................. 629
Faraday Cage Sickness..................................................................................................... 630
Travel Hazards................................................................................................................. 631
Recommended High Altitude Road Signs....................................................................... 634
Extreme Weather Hazards............................................................................................... 635
Lightning Hazards............................................................................................................ 636
Sick Building Syndrome................................................................................................ 638
Acclimatization.............................................................................................................................. 642
Law Enforcement At Very High Altitudes.................................................................................. 643
Hiring Very High Altitude Workers......................................................................................... 645
Astronomical Incompetence....................................................................................................... 646
Astronomical White Elephants................................................................................................. 648
Failure to Perform Adequate Maintenance............................................................................. 649
Social Problems in High Altitude Astronomy........................................................................... 653
 Destruction Of Staff Records ..................................................................................................... 654
Altidiots........................................................................................................................................ 655
Disability Hazards....................................................................................................................... 656
Workers Compensation.............................................................................................................. 663
Workers Compensation - Occupational Diseases...................................................................... 667
Workers Compensation Generic Application Letter................................................................. 671
Columbia University Workers Compensation – New York...................................................... 672
PMA Insurance Denials.............................................................................................................. 673
Dartmouth College Workers Compensation – New Hampshire & Arizona.......................... 674
Travelers Insurance Denials....................................................................................................... 676
W. M. Keck Observatory Workers Compensation - Hawaii.................................................... 678
HEMIC Insurance Denials......................................................................................................... 680
Workers Compensation – Problems......................................................................................... 683
Mauna Kea Sickness (MKS)....................................................................................................... 685
Mauna Kea Sickness (MKS) in Steven Magee......................................................................... 687
Mauna Kea Sickness (MKS) Prescriptions.............................................................................. 689
The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers....................... 690
Suggested Cancer Classification For High Altitudes................................................................. 692
Steven Magee's Astronomical Observatories............................................................................. 693
Steven Magee's Resume............................................................................................................... 694
Steven Magee’s Published Articles........................................................................................... 695
Research By Steven Magee That Relates To High Altitude Astronomy..................................... 696
Recommended Medical Screening Of Very High Altitude Workers......................................... 704
Recommended Medical Treatment Of Very High Altitude Sickened Workers........................ 706
Recommended Books For Treating Damaged High Altitude Workers..................................... 708
Repairing Altitude Brain Damage............................................................................................ 710
U.S. Food and Drug Administration (FDA)............................................................................. 712
The United States Pharmacopoeia (USP).................................................................................. 713
Federal Aviation Administration(FAA)........................................................................................ 714
US Department of Labor.............................................................................................................. 715
U.S. Equal Employment Opportunity Commission............................................................... 716
Armed Forces Radiobiology Research Institute....................................................................... 717
US Army Research Institute of Environmental Medicine (USARIEM).................................... 718
Altitude Research Centers.......................................................................................................... 719
Future Large Telescopes............................................................................................................ 720
Occupational Safety and Health Administration (OSHA)........................................................ 721
Breaking State or Federal Laws Leading To Fines Or Jail........................................................ 724
Government Health & Safety Websites..................................................................................... 726
Health & Safety Books.............................................................................................................. 727

“Professional surfer and former Kauai mayoral candidate Dustin Barca was among those arrested Thursday while conducting peaceful demonstrations at the summit of Mauna Kea...But activists have been outspoken in their opposition to the project, including actor Jason Momoa, who took to Instagram to ask other Hawaii-based celebrities--including Dwayne "The Rock" Johnson and Kelly Slater--to join protesters atop Mauna Kea.“ [http://www.hawaiinewsnow.com/story/28730585/local-celebrities-take-part-in-mauna-kea-protests](http://www.hawaiinewsnow.com/story/28730585/local-celebrities-take-part-in-mauna-kea-protests)

**Social Media**

**Facebook**
- Environmental Radiation LLC: [https://www.facebook.com/EnvironmentEMR/](https://www.facebook.com/EnvironmentEMR/)
- Protect Mauna Kea: [https://www.facebook.com/protectmaunakea/](https://www.facebook.com/protectmaunakea/)
- We Are Mauna Kea: [https://www.facebook.com/groups/393211327547061/](https://www.facebook.com/groups/393211327547061/)

**Twitter**
- Bruno Mars: [https://twitter.com/BrunoMars](https://twitter.com/BrunoMars)
- Dustin Barca: [https://twitter.com/barca4mayor](https://twitter.com/barca4mayor)
- Dwayne "The Rock" Johnson: [https://twitter.com/TheRock](https://twitter.com/TheRock)
- Ian Somerhalder: [https://twitter.com/iansomerhalder](https://twitter.com/iansomerhalder)
- Jason Momoa: [https://twitter.com/PrideofGypsies](https://twitter.com/PrideofGypsies)
- Jill Wagner: [https://twitter.com/JillWagner](https://twitter.com/JillWagner)
- Kelly Slater: [https://twitter.com/kellyslater](https://twitter.com/kellyslater)
- Nicole Scherzinger: [https://twitter.com/NicoleScherzy](https://twitter.com/NicoleScherzy)
- Protect Mauna Kea: [https://twitter.com/ProtectMaunaKea](https://twitter.com/ProtectMaunaKea)
- Environmental Radiation LLC: [https://twitter.com/EnvironmentEMR](https://twitter.com/EnvironmentEMR)
- TMTshutdown: [https://twitter.com/TMTshutdown](https://twitter.com/TMTshutdown)
- We Are Mauna Kea: [https://twitter.com/WeAreMaunaKea](https://twitter.com/WeAreMaunaKea)
- Zoe Isabella Kravitz: [https://twitter.com/ZoeKravitz](https://twitter.com/ZoeKravitz)

**Instagram**
- Dustin Barca: [https://www.instagram.com/barcalive/](https://www.instagram.com/barcalive/)
- Dwayne "The Rock" Johnson: [https://www.instagram.com/dwaynej0hnson/](https://www.instagram.com/dwaynej0hnson/)
- Environmental Radiation LLC: [https://www.instagram.com/environmental_radiation_llc/](https://www.instagram.com/environmental_radiation_llc/)
- Ian Somerhalder: [https://www.instagram.com/iansomerhalder/](https://www.instagram.com/iansomerhalder/)
- Jason Momoa: [https://www.instagram.com/prideofgypsies/](https://www.instagram.com/prideofgypsies/)
- Jill Wagner: [https://www.instagram.com/jillwagner/](https://www.instagram.com/jillwagner/)
- Kelly Slater: [https://www.instagram.com/kellyslater/](https://www.instagram.com/kellyslater/)
Leonardo DiCaprio: https://www.instagram.com/leonardodicaprio/
Nicole Scherzinger: https://www.instagram.com/nicolescherzy/
#protectmaunakea: https://www.instagram.com/explore/tags/protectmaunakea/
#wearemaunakea: https://www.instagram.com/explore/tags/wearemaunakea/
Zoe Isabella Kravitz: https://www.instagram.com/zoeisabellakravitz/

Websites
“Jack Johnson (musician)” https://jackjohnsonmusic.com/

Petitions
“The Immediate Halt to the Construction of the TMT telescope on Mauna Kea”
“Over 245,000 people are opposed to the construction of the TMT telescope on Mauna Kea in 2019.” Steven Magee CEng MIET
“Foes of the Thirty Meter Telescope on Monday delivered to Gov. David Ige a petition with more than 53,000 signatures opposed to the $1.4 billion project on Mauna Kea.”
“Stop TMT Construction and Arrests of Mauna Kea Protectors”

Hashtags
#protectmaunakea
#TMTshutdown
#KuKiaiMauna (Ku Kiaʻi Mauna means “the guardians of the mountain” in Hawaiian.)
#AlohaAinaPatriots (Aloha ʻĀina means “love of the land” in Hawaiian.)
#WeAreMaunaKea

#WeAreMaunaKea & #ProtectMaunaKea Posters
“Abnormal Air” http://www.environmentalradiation.com/AbnormalAir.jpg
“Acclimatization” https://www.environmentalradiation.com/Acclimatization.jpg
“Amnestic Disorders” https://www.environmentalradiation.com/AmnesticDisorders.jpg
“Biological Science” http://www.environmentalradiation.com/BiologicalScience.jpg
“Cardiovascular System” http://www.environmentalradiation.com/CardiovascularSystem.jpg
“Drugs” http://www.environmentalradiation.com/Drugs.jpg
“Fatal Altitude Sickness” http://environmentalradiation.com/FatalAltitudeSickness.jpg
“Magee’s Disease” http://www.environmentalradiation.com/MageesDisease.jpg
- “Make America Safe Again” [https://www.environmentalradiation.com/BernieSanders.jpg]
- “Mauna Kea Sickness” [http://www.environmentalradiation.com/MaunaKeaSickness.jpg]
- “Mercury Poisoning” [http://www.environmentalradiation.com/MercuryPoisoning.jpg]
- “Mountain Madness” [http://www.environmentalradiation.com/Mountain%20Madness.jpg]
- “Observatory Workers Killed” [http://www.environmentalradiation.com/ObservatoryWorkersKilled.jpg]
- “Protect Mauna Kea” [https://www.environmentalradiation.com/ProtectMaunaKea.jpg]
- “Radiation Sickness” [http://www.environmentalradiation.com/RadiationSickness.jpg]
- “Retinal Hemorrhages” [http://www.environmentalradiation.com/Retinal%20Hemorrhages.jpg]
- “Sacred Mauna Kea” [https://www.environmentalradiation.com/SacredMaunaKea.jpg]
- “Sleep Apnea” [http://www.environmentalradiation.com/sleep%20apnea.jpg]
- “Summit Brain” [http://www.environmentalradiation.com/SummitBrain.jpg]
- "Very High Altitude Worker Hazards" [http://www.environmentalradiation.com/VeryHighAltitudeWorkerHazards.jpg]
- "We Are Mauna Kea" [https://www.environmentalradiation.com/We%20Are%20Mauna%20Kea.jpg]
- "Worker Gender Issues" [http://www.environmentalradiation.com/WorkerGenderIssues.jpg]
Latest News

- “The pandemic hasn’t stopped Native Hawaiians’ fight to protect Maunakea. Protectors are no longer on the sacred mountain, but they are still working to prevent the construction of a massive telescope...It is one of the most sacred sites — if not the most sacred — in Hawaiian culture... It is sacred not only in its religious capacity but also because of the lack of oxygen. At 13,796 feet, there is 40 percent less air pressure at the summit than at sea level. Visitors are advised to heed signs of altitude sickness and pulmonary and cerebral edemas. Even employees at existing observatories have reported feeling fatigued working at that elevation. “It’s a place where humans don’t belong,” says Noe Noe Wong-Wilson, one of the kupuna arrested that day. “Where gods reside.”” [https://www.vox.com/2020/8/7/21354619/mauna-kea-tmt-telescope-native-hawaiians]

- “Construction of Thirty Meter Telescope probably won’t resume until 2021...construction will probably not happen until sometime after spring or summer of 2021. “With the pandemic and other factors that have come in, winter seems like a long ways away, but it’s not that far away and for us to resume construction activities on site, winter on Mauna Kea just isn’t feasible,” Squires said.” [https://www.hawaiinewsnow.com/2020/07/15/construction-tmt-project-wont-start-until-after-spring-or-summer/]

- “COVID-19: Kia‘i Leave Maunakea, Observatories Suspend Operations...“Due to the continuing and growing threat of the COVID-19,” said Paul Neves, Ali‘i Noeau Loa of the Royal Order of Kamehameha I, who appeared in a video distributed by supporters of the TMT opposition movement, “we concur with the camp leadership here at Maunakea. It is necessary and prudent that active participation here at Pu‘uhuluhulu be temporarily suspended.”” [https://www.bigislandvideonews.com/2020/03/26/covid-19-kiai-leave-maunakea-observatories-suspend-operations/]

- “Giant Hawaii telescope cost estimate increases to $2.4B...“The increase of nearly one billion dollars is due to the delay in starting on-site construction in Hawaii, as well as inflation and world market cost increases for some construction items,” Squires said. “We will not know the true cost of the project until we finalize a construction site and do an analysis.”” [https://www.hawaiinewsnow.com/2020/03/18/giant-hawaii-telescope-cost-estimate-increases-b/]

- “Like a Mighty Wave: A Maunakea Film” [https://youtu.be/4J3ZCzHMMPQ]

- “‘The Calling’: As TMT stalemate continues, those on both sides prepare for long fight.” [https://www.hawaiinewsnow.com/2019/12/20/calling-tmt-stalemate-continues-those-both-sides-prepare-long-fight/]

- “5 months after standoff with TMT protesters began, Ige pulls law enforcement from Mauna Kea” [https://www.hawaiinewsnow.com/2019/12/19/ige-pull-law-enforcement-mauna-kea-amid-ongoing-protests-against-tmt-project/]

- “Hawaii County Getting $10 Million From State For Mauna Kea Costs...It has been four months since the effort to start construction of the Thirty Meter Telescope on Maunakea was halted by opponents of the project, and on Tuesday the County of Hawai‘i will take the first step to get reimbursed by the State for costs related to the ongoing standoff.” [https://www.bigislandvideonews.com/2019/11/18/hawaii-county-getting-10-million-from-state-for-mauna-kea-response/]

- “Retired Lt. Files Complaint Over HPD Mauna Kea Operation...From 08-15-19 to present, the
Hawaii Police Department has been conducting a tactical military style operation, under the pretext of traffic enforcement (for safety reasons), in the area surrounding the Hwy 200 & Mauna Kea Access Rd. junction, where native Hawaiian citizens are engaged in a peaceful civil protest, upon Hawaiian Homelands, by deliberately employing a stratagem that creates a punitive area surrounding the protest area that deters or discourages citizens from participating in, supporting, or visiting the site of the protest. The enforcement efforts are in reality and in consequences, a method of sanctioning citizens through selective and targeted enforcement methods and strategies that have had an intentionally suppressive and chilling effect on the free exercise of state and federal constitutionally protected rights, with the goal of debilitating this civil movement. It has also subjected the general population and visitors to this island to a threatening and intimidating police presence designed to project a militarized atmosphere with personnel patrolling and conducting incessant “roadblocks” in military style combat uniforms. This operation that the Police Chief and his subordinate commanders have ordered, authorized, and sanctioned, is in violation of federal laws 34U.S.C. § 12601 and 42 U.S.C. § 2000d et seq. and 34 U.S.C. § 10228, and has now become institutionalized police misconduct. These are (racially) discriminatory harassment tactics involving targeting and profiling of native Hawaiians and other citizens. It is also in violation of the County Charter which states that law enforcement “shall be based on due regard for the constitutional rights of all persons and promote the highest possible degree of mutual respect between law enforcement officers and the people of the county”. These actions have brought the department into disrepute, in violation of HPD General Order 300, Standards of Conduct, and has disgraced the institution’s mission statement of “being committed to Preserving the Spirit of Aloha”.


• “Unconscionable’: Altitude sickness in officers assigned to Mauna Kea draws concern at least four deputy sheriffs and one attorney general investigator assigned to the TMT protest were evacuated from Mauna Kea and hospitalized…"It's disturbing and it's concerning because it's been a while and they've been up there too long,” said Kelli Keawe, union steward in the Department of Public Safety...Their symptoms of altitude sickness included spiking blood pressure, vision problems and cognitive issues such as slurred speech and inability to complete sentences.” https://www.hawaiinewsnow.com/2019/10/19/new-concerns-over-law-enforcement-altitude-sickness-shifts-mauna-kea/

• “Altitude sickness challenges state officers and TMT protesters...Altitude sickness is a very real danger on Mauna Kea. And law enforcement officers assigned to the Thirty Meter Telescope protest on the mountain are quickly learning that. Hawaii News Now has learned that seven state law enforcement officers were forced off the mountain in September because of altitude sickness. Five were evacuated and hospitalized. “HGEA is extremely concerned with the health and safety of deputy sheriffs,” wrote HGEA executive director Randy Perreira. The state Attorney General’s office confirmed three deputy sheriffs and one attorney general investigator were transported in separate incidents in an ambulance, but did not release specific dates. Sources told Hawaii News Now the officers have filed for workers compensation.” https://www.hawaiinewsnow.com/2019/10/18/handful-law-enforcement-officers-evacuated-mauna-kea-after-altitude-sickness/

• “Politicians Weigh In On TMT Protests As Standoff Continues” https://www.civilbeat.org/2019/07/bernie-sanders-among-the-politicians-weighing-in-on-tmt-protests/

“TMT backers to seek permit for alternative site in Canary Islands...Canary Islands Astrophysics Institute Director Rafael Rebolo told The Associated Press on Monday that he received a letter from the head of the Thirty Meter Telescope project saying its board recently decided “to proceed with the request to seek a building permit” for the island of La Palma...“Our mountains are not sacred,” he said.” https://www.hawaiinewsnow.com/2019/08/05/tmt-backers-seek-permit-alternative-site-canary-islands/


“Actor Jason Momoa rallies TMT protesters at Mauna Kea: ‘Telescope’s not being built here’. TMT opponents got support from Hawaii’s Bruno Mars. He posted a photo on Instagram of the kupuna, or Native Hawaiian elders, who have been at the base of Mauna Kea for the past several weeks. The caption reads, “I love you Hawaii, and I’m with you.”...Dwayne “The Rock” Johnson made a surprise visit to the camp, meeting with kupuna and calling for “leadership with empathy” to find a peaceful resolution to the conflict...The truth is the mountain is their church. It would be like building on their church...Hollywood A-lister Leonardo DiCaprio also posted his support for protesters in an Instagram post on Tuesday.” https://www.hawaiinewsnow.com/2019/07/31/bruno-mars-takes-social-media-support-protest-against-tmt-project/


"When asked about references Nees cited in his written, direct testimony, he said they were incorrect. Flores also asked Nees about the exhibits that were associated with his testimony.
Nees stated that he did not read nor was he familiar with the majority of the exhibits.

http://bigislandnow.com/2016/12/06/tmt-hearing-uh-calls-archeologist-to-the-stand/

- "Mental exam ordered for alleged telescope attacker"

- "40% less oxygen and high radiation levels can do strange things to sea level adapted humans." Steven Magee CEng MIET - Q

- "We think of hypoxemia as something that happens all at once leading to unconsciousness, but it’s often not like that. The victim can be mildly to severely confused and even combative for a period of time." https://www.planeandpilotmag.com/article/flying-high-unpressurized/#.WEkSC2r_q00

- “High altitude makes you stupid.” http://www.pbs.org/newshour/updates/reporters-notebook/

- “Abnormal radiation exposure and oxygen starvation teaches you that reality is just a perception that is derived from your immediate environmental conditions in conjunction with your prior environmental exposures, your health problems, your age, and the area that you grew up in and adapted to.” Steven Magee CEng MIET - Q

- "The Hawaii state Supreme Court today invalidated the permit allowing construction of the Thirty Meter Telescope atop Mauna Kea...Today’s order could set back the project months to years while it goes through permitting again." https://www.staradvertiser.com/breaking-news/state-supreme-court-vacates-permit-for-thirty-meter-telescope/

- "The scandal with the Thirty Meter Telescope (TMT) atop Mauna Kea is how it managed to obtain a construction permit to build a manned telescope in a known biologically toxic environment to workers. How many more people need to die, get injured or develop long term very high altitude sickness that will last a lifetime?” Steven Magee CEng MIET - Q

- "...incidents claimed the lives of four workers during the construction of the telescope" https://en.wikipedia.org/wiki/Subaru_Telescope

- “The wrap around effect of the wind could be very severe at times,” Arimoto added, “which can swing the heavy metal door to create this kind of dent on it. The director reminded staff to be extra careful about this kind of wind effect when working outside of the enclosure.” http://www.bigislandvideonews.com/2015/06/08/subaru-damage-not-from-bullet-observatory-confirms/

- "astronomer...crushed to death between a door and a 150-ton revolving telescope dome"  http://www.nytimes.com/1987/05/02/us/marc-a-aaronson-astronomer-killed-by-revolving-dome.html
Hawaiian Mauna Kea Beliefs

- “The Heart of the Hawaiian Peoples’ Arguments Against the Telescope on Mauna Kea. Native Hawaiians are not protesting science, but instead are seeking respect for sacred places, and our planet” [https://www.smithsonianmag.com/smithsonian-institution/heart-hawaiian-people-arguments-arguments-against-telescope-mauna-kea-180955057/]
- “Welcome to “Sacred Mauna Kea-He Makahiapo Kapu Na Wakea” (the sacred Firstborn child of Wakea, the Hawaiian God, of the Sky). Mauna Kea is the piko, umbilical cord, or center, of existence for Hawaiians. This page is meant to examine this custom and how this is so through history and present, oral, written, spiritual traditions and practices.” [https://sacredmaunakea.wordpress.com/about/]
- “Indigenous Religious Traditions. Mauna Kea...Mauna Kea is sacred to the Native Hawaiians and is the zenith of their ancestral ties to creation. The upper regions, Wao Akua, are the realms of the Akua (creator) and the summit is a temple of the Supreme Being in not only Hawaiian culture but also in many histories throughout Polynesia. It is the home of Na Akua (divine deities) and Na’Aumakua (divine ancestors) as well as the meeting place of Papa (Earth Mother) and Wakea (Sky Father) who are progenitors of the Hawaiian people. It is also both a burial ground and the embodiment of ancestors that include Na Alii and Kahuna (high ranking chiefs and priests.)” [http://sites.coloradocollege.edu/indigenoustraditions/sacred-lands/sacred-lands-mauna-kea/]
- “This sacred mountain is the focal point of a fight over a giant telescope. Finally tonight, a most unusual battle between scientists and native Hawaiians over the construction of a massive observatory. And it is all about a plan to build the largest telescope on Earth on a shield volcano. Astronomers say it can offer unique sights to view the cosmos, but it would be created on what is also considered sacred ground.” [https://www.pbs.org/newshour/show/sacred-mountain-focal-point-fight-giant-telescope]
- “The sacred and the scientific clash on Hawaii’s Mauna Kea. Over a thousand years ago, Polynesians followed the stars in the Mauna Kea sky on their path to Hawaii. Those stars are now of interest to astronomers, who believe the mountain's summit is the perfect spot to build a giant, cutting-edge telescope. But native Hawaiians view that peak as a sacred space.” [https://www.pbs.org/newshour/show/sacred-scientific-clash-hawaiis-mauna-kea]
- “What we need to learn about Mauna Kea is not only the top of the mountain, because Mauna Kea is inclusive of all, down to the base. I think what Mauna Kea has given us is the many different levels of life. —Pualani Kanahele, Kumu Hula (hula master)” [http://www.mauna-a-wakea.info/maunakea/index.html]
- “Currently there are 13 telescopes atop Mauna Kea but many Hawaiians are angry about the push to add more telescopes to the mountain, insisting enough is enough. A resurgence of Hawaiian culture and language has led to the reclamation of sacred sites, including Mauna Kea, as areas of high cultural significance. Hawaiians wanting to preserve their cultural heritage are now clashing with proponents of the TMT. In recent months, protesters have blocked access to the mountain, halting development of the telescope.” [http://theconversation.com/mauna-a-wakea-hawaiis-sacred-mountain-and-the-contentious-thirty-meter-telescope-46069]
- “The summits of the five volcanoes of Hawaii are revered as sacred mountains; and Mauna
Kea's summit, the highest, is the most sacred.[37][38] For this reason, a kapu (ancient Hawaiian law) restricted visitor rights to high-ranking aliʻi. Hawaiians associated elements of their natural environment with particular deities. In Hawaiian mythology, the summit of Mauna Kea was seen as the "region of the gods", a place where benevolent spirits reside. Poliʻahu, deity of snow, also resides there.[34] In Hawaiian, Mauna Kea is a shortened form of Mauna a Wakea which denotes the mountain's connection to the sky father Wakea;[39] however, the English translation of Mauna Kea is "white mountain" in reference to its seasonally snow-capped summit.[40]" https://en.wikipedia.org/wiki/Mauna_Kea

- “The culture of the Native Hawaiians is about 1500 years old and has its origins in the Polynesians who voyaged to and settled Hawaii. These Native Hawaiians developed culinary, artistic, and religious culture and practices.” https://en.wikipedia.org/wiki/Culture_of_the_Native_Hawaiians
- “I have great respect for Hawaiians and their unique culture.” Steven Magee CEng MIET - Q
- “The unique Hawaiian culture needs to be preserved and protected.” Steven Magee CEng MIET - Q
- “I came to the belief that Mauna Kea was indeed sacred because all the visions that I had on the mountain were of Hawaiians.” Steven Magee CEng MIET - Q
- “Over time, wonder replaced fear of the Hawaiian visions.” Steven Magee CEng MIET - Q
- “I feel very honored that the Hawaiian spirits chose to contact me.” Steven Magee CEng MIET - Q
- “The native Hawaiians are a great nation of people and as the years have passed my respect for them has grown. During the same time I have lost respect for what I now know to be the biologically toxic field of high altitude astronomy.” Steven Magee CEng MIET - Q
- “I was driving down alone from the summit of Mauna Kea to Hale Pohaku. Out of the dark appeared a beautiful Hawaiian princess on a horse in the middle of the road. I hit the brakes hard as I thought I was going to hit her. We spent some time looking at each other and I was wondering why she was there. I looked away, looked back and she was gone. Many years later I discovered that her name was Poliʻahu, the snow goddess of Mauna Kea, and I now understand why she contacted me.” Steven Magee CEng MIET - Q
- “Poliʻahu. In Hawaiian mythology, Poliʻahu (Cloaked bosom or temple bosom) is one of the four goddesses of snow, all enemies of Pele. She was thought to reside on Mauna Kea, which if measured from the seafloor is the world's tallest mountain.” https://en.wikipedia.org/wiki/Poliʻahu
- “The native Hawaiians are a great nation of people and as the years have passed my respect for them has grown. During the same time I have lost respect for what I now know to be the biologically toxic field of high altitude astronomy.” Steven Magee CEng MIET - Q
- “When I was hired from Europe to work atop Mauna Kea, I had no idea how sacred the mountain was to the Hawaiians. Today, I am ashamed that I worked at the Mauna Kea Observatories (MKO).” Steven Magee CEng MIET - Q
- “There is a social responsibility for professionals to not take jobs on projects that have disrespected the indigenous population and their beliefs.” Steven Magee CEng MIET - Q
Steven Magee Quotes

- "When I took a job at the Mauna Kea Observatories (MKO), I never knew that I would end up researching its toxicity to the sea level adapted human." Steven Magee CEng MIET – Q
- "When I managed the world’s largest telescopes atop Mauna Kea, I never knew that I would end up campaigning for their closure." Steven Magee CEng MIET – Q
- "It is truly an honor to be associated with #WeAreMaunaKea." Steven Magee CEng MIET – Q
- "High altitude astronomy is a biologically toxic job for sea level adapted humans that has a myriad of long term health issues associated with it." Steven Magee CEng MIET – Q
- "When we get down to basics, we find that the Thirty Meter Telescope (TMT) atop Mauna Kea is nothing more than a corrupt group of scientists trying to build a known biologically toxic project atop a sacred Hawaiian mountain." Steven Magee CEng MIET – Q
- "I am coming after you with something that is far more potent than a gun: Scientific Discovery." Steven Magee CEng MIET – Q
- "My message to my high altitude frenemies is this: Your luck has ran out." Steven Magee CEng MIET – Q
- "I attribute my ability to diagnose and treat my chronic health conditions to the Red Cross and St. John’s Ambulance training that I did in my youth." Steven Magee CEng MIET – Q
- "I got far more than I expected when I worked in high altitude astronomy." Steven Magee CEng MIET – Q
- "Whether I like it or not, I am in a life long relationship with low level radiation sickness (LLRS) and high altitude observatory diseases (HAOD)." Steven Magee CEng MIET – Q
- "As my research into electromagnetic radiation progressed, I was turning into a strange mixture of Nikola Tesla, Bruce Banner, John Ott and Karen Silkwood." Steven Magee CEng MIET – Q
- "The only thing sacred to a corporate scientist is their scientific data." Steven Magee CEng MIET – Q
- "From the viewpoint of sea level adapted human biology, the very high altitude summit of Mauna Kea as a workplace does not work." Steven Magee CEng MIET – Q
- "My research is indicating that professional astronomers crossed over the line that divides lawful from illegal decades ago." Steven Magee CEng MIET – Q
Altitude Diseases: Altitude Damage

- “Altitude Diseases...Altitude diseases occur because of a lack of oxygen at high altitudes. Symptoms include headache, tiredness, nausea or loss of appetite, irritability, and in more serious cases, shortness of breath, confusion, and even coma. Doctors diagnose altitude diseases primarily based on the symptoms. Treatment may include rest, descending to a lower altitude, and sometimes drugs, extra oxygen, or both. People may prevent these disorders by ascending slowly and sometimes by taking drugs. As altitude increases, the atmospheric pressure decreases, thinning the air so that less oxygen is available. For example, compared with the air at sea level, the air at 19,000 feet (5,800 meters) contains only half the amount of oxygen. In Denver, which is located about 5,300 feet (1,615 meters) above sea level, the air contains 20% less oxygen. Most people can ascend to 5,000 to 6,500 feet (1,500 to 2,000 meters) in one day without problems, but about 20% of people who ascend to 8,000 feet (2,500 meters) and 40% who ascend to 10,000 feet (3,000 meters) develop some form of altitude disease. The rate of ascent, highest altitude reached, and sleeping altitude all influence the likelihood of developing the disorder. The organs most commonly affected by altitude diseases are the: Brain (causing acute mountain sickness and rarely high-altitude cerebral edema). Lungs (causing high-altitude pulmonary edema)” https://www.merckmanuals.com/home/injuries-and-poisoning/altitude-diseases/altitude-diseases

- “Since the mid-20th century, a number of astronomical observatories have been constructed at very high altitudes, above 4,000–5,000 m (13,000–16,000 ft). The largest and most notable of these is the Mauna Kea Observatory, located near the summit of a 4,205 m (13,796 ft) volcano in Hawai‘i. The Chacaltaya Astrophysical Observatory in Bolivia, at 5,230 m (17,160 ft), was the world's highest permanent astronomical observatory from the time of its construction during the 1940s until 2009. It has now been surpassed by the new University of Tokyo Atacama Observatory, an optical-infrared telescope on a remote 5,640 m (18,500 ft) mountaintop in the Atacama Desert of Chile.” https://en.wikipedia.org/wiki/Observatory#Highest_astronomical_observatories

- “Since the mid-20th century, an increasing number of high altitude observatory sites have been developed at locations around the world, including numerous sites in Arizona, Hawaii, Chile, and the Canary Islands. The initial wave of high-altitude sites were mostly in the 2,000–2,500 m (6,600–8,200 ft) range, but astronomers soon sought even higher sites above 3,000 m (9,800 ft). Among the largest, best developed, and most renowned of these high altitude sites is the Mauna Kea Observatory located near the summit of a 4,205 m (13,796 ft) volcano in Hawaii, which has grown to include over a dozen major telescopes during the four decades since it was founded. In the first decade of the 21st century, there has been a new wave of observatory construction at very high altitudes above 4,500 m (14,800 ft), with such observatories constructed in India, Mexico, and most notably the Atacama Desert in northern Chile, now the site of several of the world's highest observatories. The scientific benefits of these sites outweigh the numerous logistical and physiological challenges which must be overcome during the construction and operation of observatories in remote mountain locations, even in desert, polar, and tropical island sites which magnify the challenges but confer additional observational advantages.” https://en.wikipedia.org/wiki/List_of_highest_astronomical_observatories

- “Altitude sickness is a great danger for high-altitude mountaineering (above 4000 or 5000 m), a moderate danger for mountain sports (such as skiing at 3000–4000 m, notably in Colorado), and
a moderate danger when flying in to a high-altitude city around 3500 m, notably Tibet (Lhasa), Peru (Cusco, especially for the Inca Trail), and Bolivia (La Paz). For moderate altitudes (such as 3500 m), the main solution is to acclimatize for a night or two at a lower altitude (near 2500 m) and take it easy for the first few days, rather than flying in and immediately going skiing or hiking. Acetazolamide (ACZ) is the most commonly used drug for prevention, and is particularly useful for flying into a high-altitude city. For higher altitudes much more care, preparation, and gradual ascent is necessary, and potent treatments are available. Particularly dangerous are tall, easy mountains, notably Kilimanjaro (5895 m) and Aconcagua (6961 m), where it's easy to get dangerously high quickly. Acclimation requires time, and rushing causes altitude sickness.”

**“Into thin air: Medical problems at new heights...** Although a low oxygen level is the most obvious and important cause of altitude sickness, several factors actually combine to trigger problems:
- **Oxygen.** Oxygen levels are highest at sea level, but they fall steadily at increasing altitudes. Most men won't notice any effect until about 5,000 feet; even at one mile above sea level, breathing is comfortable at rest but becomes labored with exertion. And the higher you go, the harder your lungs have to work to take in the oxygen you need. Barometric pressure. When the forecaster predicts low pressure at home, you expect dull, heavy air. But as men ascend to high altitude, low pressure means less efficient oxygen uptake. Falling temperatures. At home, it's easier to exercise when it's cool. But at heights, cool temperatures mean that your body will have to divert some of its oxygen simply to keep you warm. On average, ambient temperature falls about 4°F for each 1,000 feet of elevation. Ultraviolet (UV) radiation. Thin air lets in more UV radiation, resulting in a higher risk of snow blindness and sunburn. Dehydration. Mountain air is dry, and breathing is fast at heights. The result: Lots of fluid is lost from the lungs.”

**Altitude sickness...** Very high altitude. At very high altitude, 3,500 to 5,500 metres (11,500 to 18,000 ft), maximum SaO2 falls below 90% as the arterial PO2 falls below 60mmHg. Extreme hypoxemia may occur during exercise, during sleep, and in the presence of high altitude pulmonary edema or other acute lung conditions. Severe altitude illness occurs most commonly in this range.”

**Altitude-Oxygen Chart.** Use the tables below to see how the effective amount of oxygen in the air varies at different altitudes. Although air contains 20.9% oxygen at all altitudes, lower air pressure at high altitude makes it feel like there is a lower percentage of oxygen. The charts are based on the ideal gas law equation for pressure versus altitude*, assuming a constant atmospheric temperature of 32 degrees Fahrenheit (0 Celsius), and 1 atmosphere pressure at sea level.”

"After a decade of working in high altitude astronomy the medical profession discovered that I had high cholesterol, a hole in my heart, heart arrhythmia's, erratic low blood oxygen levels, small airways disease of the lungs, asthma, allergies, and various brain issues including amnesia, absence seizures and sleep disorders. High cholesterol, sleep disorders, heart, lung and brain problems appear to be long term known adverse health aspects of high altitude work and unnatural electromagnetic radiation exposures." Steven Magee CEng MIET - Q

"someone who races up to an elevation of 15,000 feet will be worse for the wear"

"A slow ascent with ample time for acclimatization do not safeguard against illness"
"experienced and professional climbers tend to show higher levels of chronic damage, suggesting that high altitude's effects may be cumulative and lasting."

http://healthyliving.azcentral.com/high-altitude-effects-mountain-climbers-4931.html

"Three attributes of a good mountaineer are high pain threshold, bad memory, and ... I forget the third. — Joke in a mountaineering Internet chat room"

http://www.scientificamerican.com/article/brain-cells-into-thin-air/

"At the age of 45, most days in Tucson were spent feeling like I was on the summit of Mauna Kea, as I was exhibiting debilitating health symptoms that corresponded to what I saw at very high altitude. I was later to find that I had erratic low blood oxygen levels after almost a decade of high altitude work.” Steven Magee CEng MIET - Q

“Causes of Low Blood Oxygen Levels”

http://www.livestrong.com/article/112012-causes-low-blood-oxygen-levels/

“Does high altitude affect You more...I've live'd in the mile high city surroundings for two years now, and it seems that every time I go away, I feel better. Not completely, but somewhat. Is it stress or is it altitude, how to tell???? I was away for 3 weeks at sea level, and only once or twice did I get mild seizures. Come back home, and here they are, with my face drooping again, and headaches starting again. ..I live at high elevation and I notice a great reduction in pain when I go to the coast.” https://www.dailystrength.org/group/fibromyalgia/discussion/does-high-altitude-affect-you-more

“Astronomers rarely visit the summit of Mauna Kea. They sit in near sea level offices and obtain their astronomical data remotely using very high altitude workers on the summit of the mountain to control the telescope and computers.” Steven Magee CEng MIET - Q

“It was clear to me that upper management and astronomers were adverse to going to very high altitude observatories.” Steven Magee CEng MIET - Q

“The engineering mountain managers went to the summit of Mauna Kea two to three days per week, whereas the technicians went there four days per week. It was apparent to me that the technicians were sicker than the engineers.” Steven Magee CEng MIET - Q

“The longer I worked in high altitude astronomy, the sicker I became.” Steven Magee CEng MIET - Q

“I regard putting a sea level adapted human into a car and driving them to the very high altitude summit of Mauna Kea on a daily basis to be a form of workplace abuse.” Steven Magee CEng MIET - Q

“Preexisting Medical Conditions at Altitude...High Blood Pressure (HBP)...Heart Disease (Coronary Artery Disease)...Arrhythmias...Congenital Heart Problems...Heart Failure...Pulmonary Hypertension...Asthma...COPD/Emphysema...Cystic Fibrosis...Migraine...Stroke/TIA...Brain Tumors...Seizures...High Altitude Resident Mothers...Low Altitude Resident Mothers Visiting High Altitude...Recommendations for pregnant tourists visiting high altitude...Pregnancy and Travel to Altitude FAQ...ANEMIA...BLOOD CLOTTING DISORDERS...CARBON MONOXIDE...CAROTID SURGERY...DELAYED WOUND HEALING...Diabetes Mellitus...EYE PROBLEMS...IMMUNOSUPPRESSION...Obesity...SICKLE CELL DISEASE...SLEEP DISTURBANCES” http://www.altitudemedicine.org/altitude-and-pre-existing-conditions/

“Decompression sickness (DCS; also known as divers' disease, the bends or caisson disease) describes a condition arising from dissolved gases coming out of solution into bubbles inside
the body on depressurisation. DCS most commonly refers to problems arising from underwater diving decompression (i.e., during ascent), but may be experienced in other depressurisation events such as emerging from a caisson, flying in an unpressurised aircraft at altitude, and extravehicular activity from spacecraft. DCS and arterial gas embolism are collectively referred to as decompression illness...Signs and symptoms. While bubbles can form anywhere in the body, DCS is most frequently observed in the shoulders, elbows, knees, and ankles. Joint pain ("the bends") accounts for about 60% to 70% of all altitude DCS cases, with the shoulder being the most common site. Neurological symptoms are present in 10% to 15% of DCS cases with headache and visual disturbances being the most common symptom. Skin manifestations are present in about 10% to 15% of cases. Pulmonary DCS ("the chokes") is very rare in divers and has been observed much less frequently in aviators since the introduction of oxygen pre-breathing protocols.” https://en.wikipedia.org/wiki/Decompression_sickness

- “Need for cabin pressurization. Pressurization becomes increasingly necessary at altitudes above 10,000 feet (3,000 m) above sea level to protect crew and passengers from the risk of a number of physiological problems caused by the low outside air pressure above that altitude. For private aircraft operating in the US, crew members are required to use oxygen masks if the cabin altitude stays above 12,500ft for more than 30 minutes, or if the cabin altitude reaches 14,000ft at any time. At altitudes above 15,000ft, passengers are required to be provided oxygen masks as well. On commercial aircraft, the cabin altitude must be maintained at 8,000ft or less. Pressurization of the cargo hold is also required to prevent damage to pressure-sensitive goods that might leak, expand, burst or be crushed on re-pressurization.” https://en.wikipedia.org/wiki/Cabin_pressurization

- “Empty plastic water bottles near seal level would become pressurized by the time we reached the very high altitude summit of Mauna Kea and empty plastic water bottles at the summit would become crushed by the time we were near sea level.” Steven Magee CEng MIET - Q

- “Bags of chips (crisps) when taken to the very high altitude summit of Mauna Kea would commonly explode.” Steven Magee CEng MIET - Q

- “Wards in the Sky: The RAF's Remarkable Nursing Service...because most people will go up to a certain height and just start feeling really unwell, so they have to come back down to sea level to sort themselves out.” https://books.google.com/books?id=oVwTDQAAQBAJ&pg=PT418&lpg=PT418&dq=raf%20altitude+sickness&source=bl&ots=Zp8R4eqOok&sig=8kjIo_hB2M6jMlrU--TiwUBfnpA&hl=en&sa=X&ved=0ahUKEwjRmN_d6aucAhUFFHwKHTzqDhY4ChDoAQg7MAQ#v=onepage&q=raf%20altitude%20sickness&f=false

- “Altitude sickness 'two illnesses' says Edinburgh University study...The condition, triggered by falling oxygen levels, causes mild sickness, headaches and life-threatening problems affecting the heart, lungs and brain...One group experienced disrupted sleep but minimal headache, while another group only reported headaches and little disruption to sleep.” https://www.bbc.com/news/uk-scotland-edinburgh-east-fife-26786483

- “It is well known to altitude researchers that the sea level adapted human should avoid spending time above 4,900 feet and should never venture above 10,000 feet.” Steven Magee CEng MIET - Q

- “Having researched the biological toxicity of high altitudes, I would not take any sea level adapted human above 10,000 feet under any circumstances.” Steven Magee CEng MIET - Q
Altitude Diseases: Mal-Acclimatization

- “Mal-acclimatization occurs when the human has no long term adaptation to any altitude due to frequent changes in altitude over 4,900 feet. Mal-acclimatization may lead to long term sickness, gender issues, genetic changes, disease and premature death in the human.” Steven Magee CEng MIET - Q
- “Mauna Kea summit workers are kept in a state of mal-acclimatization, as they are never fully acclimatized to near sea level or to the very high altitude mountain summit.” Steven Magee CEng MIET - Q
- “The big difference that I see between mountain climbers and observatory workers is that mountain climbers may venture from sea level to very high altitude several times a year, whereas some observatory workers do it approximately two hundred times per year.” Steven Magee CEng MIET - Q
- “High Altitude and Respiratory System...Sudden ascent to high altitude and stay there without adaptation is risky with high susceptibility to high altitude associated illnesses such as Acute Mountain Sickness (AMS), High Altitude Cerebral Edema (HACE) and High Altitude Pulmonary Edema (HAPE). Their frequency increases with increasing altitude. Thus height of stay matters so also rate of ascent, physical conditioning and associated morbidity, besides individual susceptibility. Young, obese and old are vulnerable. There are no specific markers to predict susceptibility but those with poor hypoxic ventilatory response(HVR) are at greater risk.” http://www.apiindia.org/pdf/medicine_update_2017/mu_056.pdf
- “If you are planning to visit the summit, we highly recommend that you stop at the Visitor Information Station (VIS) at 9,200 ft to receive a current weather update, safety information, and to adjust to the change in altitude. Mauna kea is one of the only places in the world where you can drive from sea level to 14,000 feet in about 2 hours, so altitude sickness is a high possibility. At 14,000 feet, there is 40% less oxygen than at sea level, so visitors should acclimatize to the altitude before proceeding further up the mountain. Anyone in poor health should consult their physician before planning a visit to Maunakea. We do not recommend anyone who is pregnant to go further than the VIS. People under the age of 13 should not go any further because their bodies are still developing and they are affected more rapidly when going to a high altitude. If you plan to scuba dive, do not plan to go up to the summit within 24 hours after your dive. Furthermore, we do not recommend anyone with a heart or respiratory problem to travel above the VIS.” http://www.ifa.hawaii.edu/info/vis/visiting-mauna-kea/visiting-the-summit.html
- “Mal-Aclimitaisation heart damage: Sea level adapted humans ascending rapidly in an unpressurized environment increases the risk of heart attacks.” Steven Magee CEng MIET
- “I suspect that if the long term summit workers of the Mauna Kea Observatories (MKO) were studied, they would find elevated levels of mental and physical illness, gender dysphoria, disease and premature death that comes from keeping them in an abnormal state of mal-acclimatization.” Steven Magee CEng MIET - Q
- “Effect of High-Altitude Exposure in the Elderly...More than 5 million people/year over age 60 visit high altitude, which may exacerbate underlying cardiac or pulmonary disease. We hypothesized that the elderly would exhibit an impaired functional capacity at altitude, with increased myocardial ischemia compared with sea level (SL)….Moderate altitude exposure in the elderly is associated with hypoxemia, sympathetic activation, and pulmonary hypertension...”
resulting in a reduced exercise capacity that is predictable based on exercise performance at SL. Patients with coronary artery disease who are well compensated at SL do well at moderate altitude, although acutely ischemia may be provoked at modestly lower myocardial and systemic work rates. The elderly acclimatize well with normalization of SL performance after 5 days. A prudent policy would be for elderly individuals, particularly those with coronary artery disease, to limit their activity during the first few days at altitude to allow this acclimatization process to occur.”

- "I would feel lousy at the Roque De Los Muchachos Observatory in La Palma which was at 7,861 feet, and I would have to take company supplied drugs and oxygen to stay at the Mauna Kea Observatories (MKO) in Hawaii at 13,796 feet. In both cases we would rapidly ascend to the summit in two hours or less from near sea level." Steven Magee CEng MIET – Q

- "I developed a panic disorder at the Roque De Los Muchachos Observatory after two years of working there and routinely sleeping atop the high altitude summit." Steven Magee CEng MIET – Q

- "This is your brain. This is your brain at altitude...Considering that only amateurs showed evidence of irreversible lesions in the brain, the research suggested that a lack of proper acclimatization may effect negative changes in the brain... Nevertheless, many considered the results significant enough to sound an alarm within the mountaineering community that resonated across mountain ranges the world over — high altitude kills brain cells. “It shows fairly terrifying results of scarring and cognitive impact on the brain due to high-altitude exposure,” Moniz says, “even on mountains like Kilamanjaro.”"

https://www.boulderweekly.com/adventure/this-is-your-brain-this-is-your-brain-at-altitude/
Altitude Diseases: Oxygen Starvation Hazards

- “When the brain is deprived of oxygen, irreversible damage may be the result, even when the deprivation has been for a short period of time. Oxygen deficiency may also lead to anemia in the organs, which can progress to arrhythmia and heart failure. Hypoxemia occurs when arterial blood is not being oxygenated sufficiently. This is a serious condition and needs to be treated quickly.” [http://www.petmd.com/dog/conditions/cardiovascular/c_multi_hypoxemia](http://www.petmd.com/dog/conditions/cardiovascular/c_multi_hypoxemia)
- “Oxygen Deprivation in Newborn Foals...complications just before, during, or after birth can result in a decreased oxygen supply to the foal’s brain. Various terms such as hypoxic ischemic encephalopathy or neonatal maladjustment syndrome have been used to describe the manifestations of oxygen deprivation. Around the barn, managers refer to these foals as wanderers, sleepers, barkers, or dummy foals.” [https://ker.com/equinews/oxygen-deprivation-in-newborn-foals/](https://ker.com/equinews/oxygen-deprivation-in-newborn-foals/)
- “Low oxygen levels will rob you of your eye sight, short term memory, and your energy. Eventually low oxygen levels will weaken your heart muscle.” [http://heartfailuresolutions.com/34/oxygen/low-oxygen-levels-how-low-is-too-low-and-should-you-worry](http://heartfailuresolutions.com/34/oxygen/low-oxygen-levels-how-low-is-too-low-and-should-you-worry)
- “Every time your oxygen level falls below 92% saturation the cells of your body are oxygen starved! The problem is that if you don’t look for evidence of this vitality draining issue, you will not find it! Low oxygen levels are identified most commonly during a hospitalization for the severe issues that are CAUSED by low oxygen. You have likely been experiencing the effects of periodic low blood oxygen LONG before a health crisis gets your attention.” [http://heartfailuresolutions.com/4782/oxygen/5-facts-to-remember-about-blood-oxygen-saturation-levels](http://heartfailuresolutions.com/4782/oxygen/5-facts-to-remember-about-blood-oxygen-saturation-levels)
- “The body needs enough oxygen to keep the blood adequately saturated, so that cells and tissues get enough oxygen to function properly. Furthermore, cells and tissues can neither "save up" nor "catch up" on oxygen — they need a constant supply. When the oxygen saturation falls below 89 percent, or the arterial oxygen pressure falls below 60 mmHg — whether during rest, activity, sleep or at altitude — then supplemental oxygen is needed.” [https://www.ucsfhealth.org/education/supplemental_oxygen/the_need_for_supplemental_oxygen](https://www.ucsfhealth.org/education/supplemental_oxygen/the_need_for_supplemental_oxygen)
- “Let me explain what does it mean to have an abnormal low level of oxygen in your blood. First of all, anything below 88% oxygen saturation is dangerous and debilitating to your entire body. In a hospital environment, blood oxygen levels below 95% cause a concern, and below 90% require intervention.” [http://www.sleep-apnea-guide.com/low-blood-oxygen-and-sleep-apnea.html](http://www.sleep-apnea-guide.com/low-blood-oxygen-and-sleep-apnea.html)
- "Federal Aviation Regulations Sec. 135.89 — Pilot requirements: Use of oxygen.(a) Unpressurized aircraft. Each pilot of an unpressurized aircraft shall use oxygen continuously when flying—(1) At altitudes above 10,000 feet through 12,000 feet MSL for that part of the flight at those altitudes that is of more than 30 minutes duration; and (2) Above 12,000 feet MSL.” [http://www.risingup.com/fars/info/part135-89-FAR.shtml](http://www.risingup.com/fars/info/part135-89-FAR.shtml)
"At altitude above 10,000 ft, a person may fail to adjust to the low level of oxygen"

“14,000 feet. Blood oxygen saturation is down to a dangerous 85%. You will be increasingly
disabled at this altitude. Vision will dim. You will experience serious degradation of judgment,
memory and thought. The impairment of judgment will leave you feeling just fine and confident
in your performance, however. If hypoxia is not recognized and corrected at this stage of
impairment, it is unlikely that it will be recognized. You are in serious danger.”

“Pressurization becomes increasingly necessary at altitudes above 12,500 feet (3,800 m) to
14,000 feet (4,300 m) above sea level to protect crew and passengers from the risk of a number
of physiological problems caused by the low outside air pressure above that altitude”
https://en.wikipedia.org/wiki/Cabin_pressurization

“climbers are advised by medical experts to ascend only 300 meters a day at altitudes over
3,000 meters to give their bodies time to adapt.” https://www.ucalgary.ca/utoday/issue/2016-01-
27/study-looks-effects-oxygen-depletion-high-altitude-workers-chile

“The Neurology of Altitude” https://www.peacehealth.org/sites/default/files/Documents/mcgirr-
neurology-of-altitude.pdf

"Very high altitude astronomy only works by ignoring established biological science" Steven
Magee CEng MIET - Q

"Everyone atop Mauna Kea should have a Pulse Oximeter." Steven Magee CEng MIET – Q
http://amzn.com/B00B8L8ZXE

"Low Brain Oxygen Ups Alzheimer's Risk"
oxygen

"you could suffer brain damage by going from sea level to 14,000 feet in a couple days"
http://climbing.about.com/od/mountainclimbing/a/AltitudeStudy.htm

“Tolerance to Hypoxia...People living at sea level have poor tolerance to hypoxia.”
https://zuniv.net/pub/TolerancetoHypoxiaFiziol.pdf

"I consider myself fortunate that I spent three years working at 7,775 feet before spending five
years working at 13,796 feet on the summit of Mauna Kea. I can only wonder how much more
severe my long term very high altitude sickness could have been without the initial adaptation
to the lower altitude.”  Steven Magee CEng MIET - Q

"Low oxygen levels affect a number of systems in the body" http://www.copdbfrg.org/?
page_id=984

“When your body doesn't have enough oxygen, you could get hypoxemia or hypoxia. These are
dangerous conditions. Without oxygen, your brain, liver, and other organs can be damaged just
minutes after symptoms start.” http://www.webmd.com/asthma/guide/hypoxia-hypoxemia#1

“The oxygen inside the facility, which began at 20.9%, fell at a steady pace and after 16 months
was down to 14.5%. This is equivalent to the oxygen availability at an elevation of 4,080 meters
(13,400 ft). Since some biospherians were starting to have symptoms like sleep apnea and
fatigue, Walford and the medical team decided to boost oxygen with injections in January and

“More dangerous was the decline in oxygen. That night in 1992, their oxygen levels dipped
temporarily, but overall their oxygen levels declined from 20.9 percent to 14.5 percent. (Any
environment below 19.5 percent oxygen is defined as oxygen-deficient by the Occupational
Safety and Health Administration, or OSHA.) The low oxygen made them lethargic. For months they couldn’t sleep properly because it gave them sleep apnea.

http://mentalfloss.com/article/81553/how-living-inside-biosphere-2-changed-these-scientists-lives

- “Research suggests that sea level adapted humans that work at the very high altitude 13,796 feet summit of Mauna Kea may eventually develop sleep apnea and fatigue from the low oxygen environment.” Steven Magee CEng MIET - Q
- “High altitude workers should be screened annually for Sleep Apnea.” Steven Magee CEng MIET - Q
- “Chest pain may occur if the heart is not receiving enough oxygen, which is especially likely if the arteries leading to the heart are narrowed by coronary artery disease...Fatigue, lethargy and irritability are common symptoms, as is impaired judgment. Breathing may be irregular, and abnormal heart rhythms are often present.” http://www.livestrong.com/article/112789-effects-low-blood-oxygen-levels/
- “Immediate signs of poor oxygen circulation to the brain may include: Difficulty with complex tasks; Poor short-term memory capacity; Decreased motor control; Cyanosis (bluish tone) of the skin; Increased heart rate; Fainting” https://www.dementia.org/oxygen-deprivation-dementia
- "Blood Oxygen From Sea Level to 9,200 feet and Back to Sea Level" Steven Magee CEng MIET http://www.environmentalradiation.com/Steven_Magee_9200_Feet_SPO2_Pulse.jpg
- "excessive or inappropriate supplemental oxygen can be deleterious" http://www.uptodate.com/contents/oxygen-toxicity
- “The Science Behind The Super Abilities Of Sherpas...In hospitals, as many as 25 percent of people with hypoxia die, Murray says, and those who survive don't recover their previous quality of life. Treatment has traditionally focused on increasing oxygen levels however possible, but that strategy often doesn't work and may even cause harm.” https://www.npr.org/sections/goatsandsoda/2017/05/28/530204187/the-science-behind-the-super-abilities-of-sherpas
- "Yup, pretty much how it works" W. M. Keck Observatory http://xkcd.com/1463/
- 'we were briefed on high-altitude hazards, such as dehydration, intense solar radiation and altitude illness, which can lead to life-threatening conditions such as high-altitude pulmonary edema and high-altitude cerebral edema. “There’s 40 percent less oxygen up there than you’re used to,” said Joy Pollard, who works in outreach for the Gemini Observatory. “It’ll feel like you’ve had a cocktail or two … Most people don’t get sick, but almost everyone feels something.” http://www.honolulumagazine.com/Honolulu-Magazine/January-2016/Walk-Inside-the-Controversial-Telescopes-Atop-Mauna-Kea-Starting-This-Month/index.php?cparticle=2&siarticle=1#artanc
- “The Mauna Kea observatories and the Imiloa Astronomy Center will hold what is being called the first Kamaaina Observatory Experience tour Saturday, Jan. 16. The tour is a free, monthly community event that welcomes Hawaii residents to the science reserve atop Mauna Kea to see world-class telescopes and learn about the cultural and environmental importance of the mountain. Those interested must be 16 years of age or older and possess a valid Hawaii ID.” http://khon2.com/2016/01/12/monthly-observatory-tours-on-mauna-kea-begin-this-weekend/
- “It is totally nuts to take healthy sixteen year old sea level adapted children to the 13,796 feet
very high altitude summit of Mauna Kea and put them on “Rx Only” prescription medical oxygen for two hours! I really hope that they acclimatize correctly, that they have pulse oximeters and doctors prescriptions to ensure that the medical prescription oxygen is administered correctly and legally.” Steven Magee CEng MIET - Q

- “The United Nations Convention on the Rights of the Child defines child as "a human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier". This is ratified by 192 of 194 member countries. In U.S. Immigration Law, a child refers to anyone who is under the age of 21.” [https://en.wikipedia.org/wiki/Child](https://en.wikipedia.org/wiki/Child)

- “I regard taking healthy sea level adapted children to the 13,796 feet very high altitude summit of Mauna Kea as a form of child abuse.” Steven Magee CEng MIET - Q

- “It is the responsibility of parents to ensure that irresponsible scientists do not endanger their children.” Steven Magee CEng MIET - Q

- “I saw a guy faint at the W. M. Keck Observatory, he stepped out from the tour group and said to me "I'm feeling sick" and then his eyes rolled back and his knees gave way! The group caught him on his way to the ground and he got free emergency medical oxygen for half an hour before being evacuated off the summit by his tour group!!! His friends stated that he was considered the healthiest person in the group while he was gasping for breaths of life on the summit of Mauna Kea! Never saw him again.” Steven Magee CEng MIET - Q

- “Low oxygen levels in tumors ‘trigger spread of breast cancer’...Researchers have discovered that low oxygen conditions can trigger the production of proteins that contribute to the spread of breast cancer cells. This is according to a study published in the Proceedings of the National Academy of Sciences. Biologists from Johns Hopkins University found that low oxygen conditions prompted increased production of proteins called RhoA and ROCK1. High levels of these proteins are known to give cancer cells the ability to move and spread, leading to worse outcomes for breast cancer patients.” [http://www.health.am/cr/more/tumors-trigger-spread-of-breast-cancer/](http://www.health.am/cr/more/tumors-trigger-spread-of-breast-cancer/)

- “Oxygen and Cancer. Low Levels Of Oxygen Can Breed Cancer...Increasing Cellular Oxygen Can Kill Cancerous Cells. The link between oxygen and cancer is clear. In fact, an underlying cause of cancer is usually low cellular oxygenation levels. In newly formed cells, low levels of oxygen damage respiration enzymes so that the cells cannot produce energy using oxygen. These cells can then turn cancerous because they don't make enough energy to function normally in the body. In 1931 Dr. Warburg won his first Nobel Prize for proving cancer is caused by a lack of oxygen respiration in cells. He stated in an article titled "The Prime Cause and Prevention of Cancer... the cause of cancer is no longer a mystery, we know it occurs whenever any cell is denied 60% of its oxygen requirements..." [http://www.cancerfightingstrategies.com/oxygen-and-cancer.html](http://www.cancerfightingstrategies.com/oxygen-and-cancer.html)

- "There was a serious shortage of oxygen administration equipment for treating ‘Summit Brain’ in the workers at the Mauna Kea Observatories (MKO) in Hawaii." Steven Magee CEng MIET - Q
Altitude Diseases: Hypocapnia

- “Hypocapnia or hypocapnea (from the Greek words υπό meaning below normal and καπνός καπνός meaning smoke), also known as hypocarbia, sometimes incorrectly called acapnia, is a state of reduced carbon dioxide in the blood. Hypocapnia usually results from deep or rapid breathing, known as hyperventilation.” [https://en.wikipedia.org/wiki/Hypocapnia](https://en.wikipedia.org/wiki/Hypocapnia)

- “Possible Value of Inhalation of Carbon Dioxide in Climbing Great Altitudes...MOUNTAIN sickness is a form of asphyxia due to the diminished partial pressure of oxygen at great altitudes. The functional disturbances in this disorder are, however, not merely anoxial, but are largely the expression of a secondary and almost equally important deficiency of carbon dioxide in the blood and tissues. Deficiency of oxygen induces hyperpnea and acapnia: that is, overbreathing and the resulting deficiency of carbon dioxide. Acapnia in turn induces subnormal respiration and a continued or even increased deficiency of oxygen. Haldane, Priestley and Douglas1 demonstrated the correctness of Miescher's somewhat poetical formulation: “Over the oxygen supply of the body carbon dioxide spreads its protecting wings.”2 Henderson3 confirmed the importance of the relation between the two gases in respiration when he found that it was possible to produce so great a deficiency of carbon dioxide by over-ventilation of the lungs that thereafter an animal may die of lack of oxygen with no effort to breathe.” [https://www.nature.com/articles/135457a0](https://www.nature.com/articles/135457a0)

- “Angelo Mosso's Experiments at Very Low Barometric Pressures...Di Giulio C, and West JB. Angelo Moss's experiments at very low barometric pressures. High Alt Med Biol 14:78–79, 2013.—In 1898, Angelo Mosso (1846–1910) used his low-pressure chambers to carry out some remarkable experiments that are not well known. Paul Bert (1833–1886) had previously demonstrated that the deleterious effects of high altitude were due to low Po2, but this conclusion was disputed by many of the eminent scientists of the day. Mosso believed that the physiological effects of high altitude were caused by a low Pco2 (acapnia) and he made a series of low-pressure chamber experiments to test this. In some studies he added oxygen to the air in the chambers so that he could study the effects of extreme hypobaria; in one experiment he survived a barometric pressure of only 192 mm Hg equivalent to an altitude of about 10,800 m. Some of his experiments were observed by his daughter Mimi who wrote a colorful account in her book dedicated to her father “Un cercatore d'ignoto” (A seeker of the unknown).” [https://www.liebertpub.com/doi/abs/10.1089/ham.2012.1082?src=recsys&journalCode=ham](https://www.liebertpub.com/doi/abs/10.1089/ham.2012.1082?src=recsys&journalCode=ham)

- “Voluntary hyperventilation at high altitude...In the nineteenth century, most, but not all, of those who studied the effects of altitude commented on shortness of breath on high mountains. Mosso attributed mountain sickness to the acapnia caused by the hyperventilation he observed. In the last few decades, the relationship has been more fully appreciated. Hypoxia stimulates breathing; hyperventilation mitigates hypoxemia. Overbreathing is the principal defense against lack of oxygen, so the more sensitive the hypoxic ventilatory response, the less will be the impact of hypoxia, all other factors being equal...Most climbers recognize the improvement that follows a few deliberately deeper breaths but are content to let their respiratory control mechanisms take charge. However, in an emergency, carefully controlled deliberate hyperventilation may be life-saving.” [https://www.wemjournal.org/article/S0953-9859(94)71149-9/pdf](https://www.wemjournal.org/article/S0953-9859(94)71149-9/pdf)
Altitude Diseases: Intermittent Hypoxia

- “High Altitude Observatory Disease (HAOD) is a disease of intermittent hypoxia.” Steven Magee CEng MIET - Q
- “Intermittent hypoxia (also known as episodic hypoxia) is an intervention in which a person or animal undergoes alternating periods of normoxia and hypoxia. Normoxia is defined as exposure to oxygen levels normally found in earth's atmosphere (~21% O2) and hypoxia as any oxygen levels lower than those of normoxia. Normally, exposure to hypoxia is negatively associated to physiological changes to the body, such as altitude sickness.[1] However, when used in moderation, intermittent hypoxia may be used clinically as a means to alleviate various pathological conditions.” https://en.wikipedia.org/wiki/Intermittent_hypoxia
- “Intermittent Hypoxia Research in the Former Soviet Union and the Commonwealth of Independent States: History and Review of the Concept and Selected Applications... intermittent hypoxic training (IHT) has been used extensively for altitude preacclimatization; for the treatment of a variety of clinical disorders, including chronic lung diseases, bronchial asthma, hypertension, diabetes mellitus, Parkinson’s disease, emotional disorders, and radiation toxicity, in prophylaxis of certain occupational diseases; and in sports...IN CHILDREN AND ADULTS, profound, prolonged hypoxia may cause disability and even death. Less clear are the effects of tolera- ble, brief hypoxia for a few minutes or of tran- sient hypoxia lasting one to several hours. Particularly at issue are the effects in humans of such transient bouts of hypoxia when repeated many times, a practice designated as intermittent hypoxia... IHT induces in- creased ventilatory sensitivity to hypoxia in the absence of PCO2 or pH changes; that it induces other hypoxia-related physiological changes such as increased hematopoiesis and decreased plasma volume and increase in alveolar ventilation and lung diffusion capacity; and that it may be useful in the management of certain disease states.” http://www.go2altitude.com/data/HAMBJ/IHT_Research_Soviet_Union_Tatiana_Serebrovskaya.pdf
- “Intermittent hypoxia and sleep-disordered breathing: current concepts and perspectives...There are three major types of sleep-disordered breathing (SDB) with respect to prevalence and health consequences, i.e. obstructive sleep apnoea syndrome (OSAS), Cheyne–Stokes respiration and central sleep apnoea (CSR-CSA) in chronic heart failure, and obesity hypoventilation syndrome (OHS). In all three conditions, hypoxia appears to affect body functioning in different ways. Most of the molecular and cellular mechanisms that occur in response to SDB-related hypoxia remain unknown. In OSAS, an inflammatory cascade mainly dependent upon intermittent hypoxia has been described. There is a strong interaction between haemodynamic and inflammatory changes in promoting vascular remodelling. Moreover, during OSAS, most organ, tissue or functional impairment is related to the severity of nocturnal hypoxia. CSR-CSA occurring during heart failure is primarily a consequence of cardiac impairment. CSR-CSA has deleterious consequences for cardiac prognosis and mortality since it favours sympathetic activation, ventricular ectopy and atrial fibrillation. Although correction of CSR-CSA seems to be critical, there is a need to establish therapy guidelines in large randomised controlled trials. Finally, OHS is a growing health concern, owing to the worldwide obesity epidemic and OHS orbidities. The pathophysiology of OHS remains largely unknown. However, resistance to eptin, obesity and severe nocturnal hypoxia lead to insulin resistance and endothelial ysfuction. In addition, several adipokines may be triggered by hypoxia and explain, at least in
art, OHS morbidity and mortality. Overall, chronic intermittent hypoxia appears to have specific genomic effects that differ notably from continuous hypoxia. Further research is required to fully elucidate the molecular and cellular mechanisms.”

https://erj.ersjournals.com/content/32/4/1082

- “Chronic intermittent hypoxia mimicking sleep apnoea increases spontaneous tumorigenesis in mice...Obstructive sleep apnoea (OSA) is a very prevalent disorder with well proven mid- and long-term deleterious consequences, such as increased risk of cardiovascular, metabolic and neurocognitive diseases [1]. Recently, considerable data from both animal models and patient studies also suggest that OSA increases the risk of cancer incidence and mortality [2]. Some of these studies indicate that nocturnal hypoxic events experienced by OSA patients as a consequence of recurrent upper airway obstructions may be a main challenge driving tumour progression [3, 4]. Although the clinical and experimental data available do not undoubtedly prove a relationship between cancer and OSA [5], its plausibility has raised the interest of basic and clinical researchers in the field, warranting further investigation [6].”

https://erj.ersjournals.com/content/49/2/1602111

- “Vascular Effects of Intermittent Hypoxia...Animal models of sleep apnea have added substantially to scientists’ understanding of the vascular consequences of this condition. The most important contribution may be the consistent observation that sleep apnea leads to a small but significant increase in arterial pressure independent of comorbidities. The observation that systemic hemodynamics and peripheral vascular function are also altered strengthens the justification for aggressive treatment of apneas and oxygen desaturations with continuous positive airway pressure (CPAP) devices. In addition, the confirmed presence of endothelial pathologies suggests that the long term consequences of untreated sleep apnea include damage in multiple organ systems. Ongoing studies indicate that endocrine factors and oxidative stress are important players in the vascular pathologies of sleep apnea. Future studies in these areas are expected to identify potential therapeutic targets for the prevention of sleep apnea– induced vascular disease.”


- “Intermittent Hypoxia and Human Diseases...The scientific field of intermittent hypoxia and its effects on living organisms is surrounded by divergent and controversial findings. Does the condition play pathogenic roles in disease states, such as sleep apnea, chronic pulmonary disease, cardiovascular disease and cancer? Or does exposure to intermittent hypoxia actually induce protective responses?”


- “Intermittent hypoxia promotes melanoma lung metastasis via oxidative stress and inflammation responses in a mouse model of obstructive sleep apnea...Recently, increased tumor incidence and cancer-related mortality have been reported among patients with obstructive sleep apnea (OSA). Intermittent hypoxia (IH), the hallmark feature of OSA, contributes to the metastasis of tumors. However, the molecular mechanisms by which tumor metastasis is accelerated by OSA-like IH remain to be elucidated.”


- “Intermittent Hypoxia and Hypercapnia Reproducibly Change the Gut Microbiome and Metabolome across Rodent Model Systems... In Ldlr−/− mice, we reported significant shifts in the bacterial and chemical composition of the gut on IHH exposure. The key chemical alterations included changes in microbe-dependent metabolites such as gut-derived estrogen-like molecules (phytoestrogens) and bile acids.”

https://msystems.asm.org/content/4/2/e0058-19
“Intermittent Hypoxia Induces Hyperlipidemia in Lean Mice...Obstructive sleep apnea, a syndrome leading to recurrent intermittent hypoxia (IH), has been associated previously with hypercholesterolemia, independent of underlying obesity. We examined the effects of experimentally induced IH on serum lipid levels and pathways of lipid metabolism in the absence and presence of obesity. Lean C57BL/6J mice and leptin-deficient obese C57BL/6J-Lepob mice were exposed to IH for five days to determine changes in serum lipid profile, liver lipid content, and expression of key hepatic genes of lipid metabolism. In lean mice, exposure to IH increased fasting serum levels of total cholesterol, high-density lipoprotein (HDL) cholesterol, phospholipids (PLs), and triglycerides (TGs), as well as liver TG content. These changes were not observed in obese mice, which had hyperlipidemia and fatty liver at baseline. In lean mice, IH increased sterol regulatory element binding protein 1 (SREBP-1) levels in the liver, increased mRNA and protein levels of stearoyl–coenzyme A desaturase 1 (SCD-1), an important gene of TG and PL biosynthesis controlled by SREBP-1, and increased monounsaturated fatty acid content in serum, which indicated augmented SCD-1 activity. In addition, in lean mice, IH decreased protein levels of scavenger receptor B1, regulating uptake of cholesterol esters and HDL by the liver. We conclude that exposure to IH for five days increases serum cholesterol and PL levels, upregulates pathways of TG and PL biosynthesis, and inhibits pathways of cholesterol uptake in the liver in the lean state but does not exacerbate the pre-existing hyperlipidemia and metabolic disturbances in leptin-deficient obesity.”

“Chronic intermittent hypoxia induces oxidative stress and inflammation in brain regions associated with early-stage neurodegeneration...Sleep apnea is a common comorbidity of neurodegenerative diseases, such as Alzheimer’s disease (AD) and Parkinson’s disease (PD). Previous studies have shown an association between elevated oxidative stress and inflammation with severe sleep apnea. Elevated oxidative stress and inflammation are also hallmarks of neurodegenerative diseases. We show increased oxidative stress and inflammation in a manner consistent with early stages of neurodegenerative disease in an animal model of mild sleep apnea. Male rats were exposed to 7 days chronic intermittent hypoxia (CIH) for 8 h/day during the light period. Following CIH, plasma was collected and tested for circulating oxidative stress and inflammatory markers associated with proinflammatory M1 or anti-inflammatory M2 profiles. Tissue punches from brain regions associated with different stages of neurodegenerative diseases (early stage: substantia nigra and entorhinal cortex; intermediate: hippocampus; late stage: rostral ventrolateral medulla and solitary tract nucleus) were also assayed for inflammatory markers. A subset of the samples was examined for 8-hydroxydeoxyguanosine (8-OHdG) expression, a marker of oxidative stress-induced DNA damage. Our results showed increased circulating oxidative stress and inflammation. Furthermore, brain regions associated with early-stage (but not late-stage) AD and PD expressed oxidative stress and inflammatory profiles consistent with reported observations in preclinical neurodegenerative disease populations. These results suggest mild CIH induces key features that are characteristic of early-stage neurodegenerative diseases and may be an effective model to investigate mechanisms contributing to oxidative stress and inflammation in those brain regions.”

“Effects of Acute Intermittent Hypoxia on Working Memory in Young Healthy Adults.... This study demonstrated that short-term exposure to IH per se (i.e., without the confounding influence of sleep fragmentation and medical comorbidities) can negatively impact performance on spatial working memory tasks, even in healthy young adults.”
Altitude Diseases: Hypoxia

- “Signs of High-Altitude Sickness, Treatment and Prevention...Hypoxia is a silent killer on the mountain. It is a medical condition that occurs when the tissues in the body are deprived of oxygen. The telltale sign that a climber is suffering from the effects of hypoxia is the presence of noticeable confusion. In many cases, a climber isn’t identified as being affected by hypoxia unless the observer is present for a significant amount of time to see the changes in behavior. In the beginning stages, a person with hypoxia can seem sure about their actions, only the actions themselves are what is wrong. They just aren’t mentally capable of identifying this. Historically, hypoxia has been the cause of many deaths on high-altitude climbs...In the later stages of hypoxia, a climber can become more noticeably unsure of their actions, confused, volatile and uncooperative...The only treatment for hypoxia is the immediate descent of the climber to a more manageable elevation and the introduction of oxygen into the patient’s system.” [https://basecampmagazine.com/2019/04/13/signs-high-altitude-sickness-treatment-prevention/]

- “Training to recognize, treat and prevent hypoxia: a silent killer...Hypoxia is one of the most deadly and silent killers that aircrew members, high altitude skydivers, mountain climbers or balloonists can face. Hypoxia is a state of oxygen deficiency in the blood cells and tissue that, if untreated, can cause mental and physical impairment, unconsciousness, or even death.” [https://asunow.asu.edu/content/training-recognize-treat-and-prevent-hypoxia-silent-killer]

- “Hypoxia...Sometimes called mountain sickness or altitude sickness, hypoxia is simply a lack of oxygen at the tissue level of the body due to a decreased partial pressure of oxygen in the inspired air. Hypoxia is serious, because it may lead to death...Hypoxia may be prevented with the use of supplemental oxygen at altitudes specified by regulation, or by flying pressurized airplanes. An immediate descent below 10,000-feet msl will provide rapid recovery from hypoxia's symptoms. Some susceptible persons will require supplemental oxygen at altitudes lower than those specified by regulation.” [https://www.mountainflying.com/Pages/mountain-flying/hypoxia.html]

- “Effects of Acute, Profound Hypoxia on Healthy Humans: Implications for Safety of Tests Evaluating Pulse Oximetry or Tissue Oximetry Performance...Extended periods of oxygen deprivation can produce acidosis, inflammation, energy failure, cell stress, or cell death. However, brief profound hypoxia (here defined as Sao2 50%–70% for approximately 10 minutes) is not associated with cardiovascular compromise and is tolerated by healthy humans without apparent ill effects. In contrast, chronic hypoxia induces a suite of adaptations and stresses that can result in either increased tolerance of hypoxia or disease, as in adaptation to altitude or in the syndrome of chronic mountain sickness. In healthy humans, brief profound hypoxia produces increased minute ventilation and increased cardiac output, but little or no alteration in blood chemistry. Central nervous system effects of acute profound hypoxia include transiently decreased cognitive performance, based on alterations in attention brought about by interruptions of frontal/central cerebral connectivity. However, provided there is no decrease in cardiac output or ischemia, brief profound hypoxemia in healthy humans is well tolerated without evidence of acidosis or lasting cognitive impairment.” [https://journals.lww.com/anesthesia-analgesia/Fulltext/2017/01000/Effects_of_Acute,_Profound_Hypoxia_on_Healthy.20.aspx]

- “Hypoxia: Why You Should Care About Your Oxygen Levels...“In all serious disease states, we
find a concomitant low oxygen state. Low oxygen in the body tissues is a sure indicator for disease. Hypoxia, or lack of oxygen in the tissues, is the fundamental cause for all degenerative disease. Oxygen is the source of life to all cells.” - Stephen Levine

Hypoxia is quite simply an insufficient amount of oxygen reaching the tissues. The mitochondria need oxygen to create adenosine triphosphate or ATP. ATP is the energy required for cells to carry out their specific functions. Nerve impulses, tissue repair, muscle contraction, the synthesis of biochemical agents within cells, and more -- all these actions require ATP. Any movement or metabolic process needs ATP. A constant supply is imperative to maintain cellular processes for life. Without the mitochondria producing ATP from oxygen and the food we eat, life would cease...Oxygen levels in the atmosphere at sea level are approximately 21%. This percentage goes down as altitude increases. The weight of the air pushing down on the earth also creates pressure gently forcing air into our lungs helping us breathe. The pressure in our lungs is naturally less to create this phenomenon, so air automatically enters into our lungs. This pressure lessens with higher altitudes because there is a decreasing amount of air weighing down on the earth. This combination of low pressure and lower amounts of available oxygen can induce hypoxia quite quickly. The level at which this affects an individual depends on how fast they ascend and how well their body can adapt. Extreme cases can result in severe headaches, hallucinations, and retinal bleeding. (5) Hypoxia is why a mountain climber cannot just decide to climb Mount Everest without extensive preparation and body acclimation.”


- "Hypoxic pilot refuses to wear a mask...DOVER AIR FORCE BASE, Del. — C-17 copilot and staunch conspiracy theorist Air Force 1st Lt. Kyle Korrigan received harsh criticism and a nap yesterday after refusing to wear a mask, according to sources. An unexpected depressurization at 37,000 feet knocked the pilot out, leaving the copilot claiming that supplemental oxygen is part of a “liberal agenda.”...The rest of the crew was reported in good condition after they followed basic, common-sense instructions designed to keep them safe, such as “Put on a mask” and “Don’t take the mask off while the plane is depressurized.”...“But you can die from hypoxia.” All military aircrew are required to practice in an altitude chamber every few years to build awareness of dangerous hypoxia symptoms...Korrigan is expected to make a full recovery but is currently dealing with a severe headache.”

Altitude Diseases: Cerebral Hypoxia

- “Cerebral hypoxia is a form of hypoxia (reduced supply of oxygen), specifically involving the brain; when the brain is completely deprived of oxygen, it is called cerebral anoxia. There are four categories of cerebral hypoxia; they are, in order of severity: diffuse cerebral hypoxia (DCH), focal cerebral ischemia, cerebral infarction, and global cerebral ischemia. Prolonged hypoxia induces neuronal cell death via apoptosis, resulting in a hypoxic brain injury.[1][2] Cases of total oxygen deprivation are termed "anoxia", which can be hypoxic in origin (reduced oxygen availability) or ischemic in origin (oxygen deprivation due to a disruption in blood flow). Brain injury as a result of oxygen deprivation either due to hypoxic or anoxic mechanisms are generally termed hypoxic/anoxic injuries (HAI). Hypoxic ischemic encephalopathy (HIE) is a condition that occurs when the entire brain is deprived of an adequate oxygen supply, but the deprivation is not total. While HIE is associated in most cases with oxygen deprivation in the neonate due to birth asphyxia, it can occur in all age groups, and is often a complication of cardiac arrest…However, if blood flow cannot be increased or if doubled blood flow does not correct the problem, symptoms of cerebral hypoxia will begin to appear. Mild symptoms include difficulties with complex learning tasks and reductions in short-term memory. If oxygen deprivation continues, cognitive disturbances, and decreased motor control will result.[6] The skin may also appear bluish (cyanosis) and heart rate increases. Continued oxygen deprivation results in fainting, long-term loss of consciousness, coma, seizures, cessation of brain stem reflexes, and brain death.[7] Objective measurements of the severity of cerebral hypoxia depend on the cause. Blood oxygen saturation may be used for hypoxic hypoxia, but is generally meaningless in other forms of hypoxia. In hypoxic hypoxia 95–100% saturation is considered normal; 91–94% is considered mild and 86–90% moderate. Anything below 86% is considered severe...Cerebral hypoxia can be caused by any event that severely interferes with the brain's ability to receive or process oxygen. This event may be internal or external to the body. Mild and moderate forms of cerebral hypoxia may be caused by various diseases that interfere with breathing and blood oxygenation. Severe asthma and various sorts of anemia can cause some degree of diffuse cerebral hypoxia. Other causes include status epilepticus, work in nitrogen-rich environments, ascent from a deep-water dive, flying at high altitudes in an unpressurized cabin without supplemental oxygen, and intense exercise at high altitudes prior to acclimatization.”  https://en.wikipedia.org/wiki/Cerebral_hypoxia
Altitude Diseases: Hypoxic Hypoxia

- “Hypoxic hypoxia is a result of insufficient oxygen available to the lungs. A blocked airway, drowning or a reduction in partial pressure (high altitude above 3048 meters) are examples of how lungs can be deprived of oxygen. Some medical examples are abnormal pulmonary function or respiratory obstruction. Hypoxic hypoxia is seen in patients suffering from chronic obstructive pulmonary diseases (COPD), neuromuscular diseases or interstitial lung disease.”
  https://en.wikipedia.org/wiki/Hypoxic_hypoxia
Altitude Diseases: Hypobaric Hypoxia

- “Hypobaric hypoxia is a condition where the body is deprived of a sufficient supply of oxygen from the air to supply for body tissues whether in quantity or molecular concentration. Hypoxic hypoxia affects the body’s ability to transfer oxygen from the lungs to the bloodstream. Oxygen is the main component required to maintain our body functions because it is involved in the oxidation of complex chemical food-stuff to produce energy for our other biological processes that happen inside our body. Hypoxic hypoxia therefore does not mean that erythrocytes are not enough to carry oxygen around from the alveoli of the lungs to the body tissues but simply the oxygen molecule that is to be carried is insufficient. This condition is particularly more likely to happen when a person ascends to a higher altitude. Hypoxia can lead to a loss of cognition, which can be detrimental, particularly for pilots who have to make important decisions that affect the safety of all passengers and crewmembers onboard. A total absence of oxygen in the human body is called anoxia. Hypobaric Hypoxia is the most commonly experienced form of hypoxia in flight and therefore is the main focus here on. Other forms of Hypoxia include the Anaemic hypoxia, Ischaemic hypoxia and Histotoxic hypoxia.”

- “Hypobaric hypoxia induces oxidative stress in rat brain...High altitude exposure results in decreased partial pressure of oxygen and an increased formation of reactive oxygen and nitrogen species (RONS), which causes oxidative damage to lipids, proteins and DNA. Exposure to high altitude appears to decrease the activity and effectiveness of antioxidant enzyme system. The antioxidant system is very less in brain tissue and is very much susceptible to hypoxic stress. The aim of the present study was to investigate the time dependent and region specific changes in cortex, hippocampus and striatum on oxidative stress markers on chronic exposure to hypobaric hypoxia. The rats were exposed to simulated high altitude equivalent to 6100 m in animal decompression chamber for 3 and 7 days. Results indicate an increase in oxidative stress as seen by increase in free radical production, nitric oxide level, lipid peroxidation and lactate dehydrogenase levels. The magnitude of increase in oxidative stress was more in 7 days exposure group as compared to 3 days exposure group. The antioxidant defence system such as reduced glutathione (GSH), glutathione peroxidase (GPx), glutathione reductase (GR), superoxide dismutase (SOD) and reduced/oxidized glutathione (GSH/GSSG) levels were significantly decreased in all the three regions. The observation suggests that the hippocampus is more susceptible to hypoxia than the cortex and striatum. It may be concluded that hypoxia differentially affects the antioxidant status in the cortex, hippocampus and striatum.”

- “Hypobaric Hypoxia Regulates Brain Iron Homeostasis in Rats...Disruption of iron homeostasis in brain has been found to be closely involved in several neurodegenerative diseases. Recent studies have reported that appropriate intermittent hypobaric hypoxia played a protective role in brain injury caused by acute hypoxia. However, the mechanisms of this protective effect have not been fully understood. In this study, Sprague-Dawley (SD) rat models were developed by hypobaric hypoxia treatment in an altitude chamber, and the iron level and iron related protein levels were determined in rat brain after 4 weeks of treatment. We found that the iron levels significantly decreased in the cortex and hippocampus of rat brain as compared to that of the control rats without hypobaric hypoxia treatment. The expression levels of iron storage protein L-ferritin and iron transport proteins, including transferrin receptor-1 (TfR1), divalent metal
transporter 1 (DMT1), and ferroportin1 (FPN1), were also altered. Further studies found that the iron regulatory protein 2 (IRP2) played a dominant regulatory role in the changes of iron hemostasis, whereas iron regulatory protein 1 (IRP1) mainly acted as cis-aconitase. These results, for the first time, showed the alteration of iron metabolism during hypobaric hypoxia in rat models, which link the potential neuroprotective role of hypobaric hypoxia treatment to the decreased iron level in brain. This may provide insight into the treatment of iron-overloaded neurodegenerative diseases.”

“Hypobaric hypoxia exposure in rats differentially alters antidepressant efficacy of the selective serotonin reuptake inhibitors fluoxetine, paroxetine, escitalopram and sertraline…Highlights. Treatment-resistant depression is highly linked to suicidal behavior. Living at altitude (in hypobaric hypoxia) is linked to high MDD and suicide rates. In a rodent model, depression-like behavior increases with altitude of housing. We therefore studied SSRI efficacy in a rodent model of hypobaric hypoxia. Prozac®, Paxil® and Lexapro® lose efficacy at altitude, but Zoloft® does not. Zoloft® (sertraline) may thus be the SSRI of choice for MDD in chronic hypoxia...Treatment-resistant depression, a chronic condition that affects 30% of depressed patients on antidepressants, is highly linked to suicidal behavior. Chronic hypoxia exposure via living at altitude (hypobaric hypoxia) or with chronic hypoxic diseases is demographically linked to increased risk for depression and suicide. We previously demonstrated that housing rats at altitude for a week incrementally increases depression-like behavior in the forced swim test (FST) in females, but not males. In animal models, high altitude exposure reduces brain serotonin, and selective serotonin reuptake inhibitors (SSRIs) can lose efficacy when brain serotonin levels are low. To address whether residence at moderate altitude is detrimental to SSRI function, we examined SSRI efficacy in the FST after a week of housing rats at altitudes of 4500 ft. or 10,000 ft. as compared to at sea level. In females, the tricyclic antidepressant desipramine (positive control) functioned well in all groups, increasing latency to immobility and decreasing immobility, by increasing climbing. However, the SSRIs fluoxetine, paroxetine and escitalopram were ineffective in females in all groups: only paroxetine improved swimming in the FST as expected of a SSRI, while all three unexpectedly reduced climbing. Fluoxetine was also ineffective in male rats. Sertraline was the only SSRI with antidepressant efficacy at altitude in both females and males, increasing swimming, climbing and latency to immobility, and reducing immobility. Hypobaric hypoxia thus appears to be detrimental to efficacy of the SSRIs fluoxetine, paroxetine and escitalopram, but not of sertraline. Unlike the other SSRIs, sertraline can improve both serotonergic and dopaminergic transmission, and may be less impacted by a hypoxia-induced serotonin deficit. A targeted approach may thus be necessary for successful antidepressant treatment in patients with depression who live at altitude or with chronic hypoxic diseases, and that sertraline may be the SSRI of choice for prescription for this population.”

“Effects of Hypobaric Hypoxia on Rat Retina and Protective Response of Resveratrol to the Stress...High-altitude retinopathy represents retinal functional changes associated with environmental challenges imposed by hypobaric hypoxia, but the detailed cellular and molecular mechanism underlying this process remains unclear. Our current investigation was to explore the effect of hypobaric hypoxia on the rat retina and determine whether resveratrol has a protective efficacy on the hypoxic damage to the retina. Experiment rats were randomly grouped as the control group, hypoxia group and resveratrol intervention group. The hypoxia group and the resveratrol intervention group were maintained in a low-pressure oxygen cabin, and the resveratrol intervention group was given daily intraperitoneal injections with
resveratrol. We found that hypobaric hypoxia increased thioredoxin 1 (Trx1) and thioredoxin 2 (Trx2) expression in retinas, and resveratrol treatment significantly reversed these changes (P < 0.05, P < 0.05 respectively). In comparison with controls, hypoxia upregulated the mRNA expression levels of caspase3 (P < 0.001), caspase9 (P < 0.01), heat shock protein 70 (Hsp70) (P < 0.05), heat shock protein 90 (Hsp90) (P < 0.001) and hypoxia-inducible factor-1 (HIF-1) (P < 0.05). Resveratrol administration caused a significant decrease in the gene expression of caspase3 (P< 0.001), HSP90 (P < 0.05) and HIF-1 mRNA (P < 0.01) as well as an increase in HSP70 mRNA when compared with the hypoxia group. These findings indicated that resveratrol exerted an anti-oxidative role by modulating hypoxia stress- associated genes and an anti-apoptosis role by regulating apoptosis-related cytokines. In conclusion, hypobaric hypoxia may have a pathological impact on rat retinas. The intervention of resveratrol reverses the effect induced by hypobaric hypoxia and elicits a protective response to the stress.”

“Brain adaptation to chronic hypobaric hypoxia in rats...Rats were exposed to hypobaric hypoxia (0.5 atm) for up to 3 wk. Hypoxic rats failed to gain weight but maintained normal brain water and ion content. Blood hematocrit was increased by 48% to a level of 71% after 3 wk of hypoxia compared with littermate controls. Brain blood flow was increased by an average of 38% in rats exposed to 15 min of 10% normobaric oxygen and by 23% after 3 h but was not different from normobaric normoxic rats after 3 wk of hypoxia. Sucrose space, as a measure of brain plasma volume, was not changed under any hypoxic conditions. The mean brain microvessel density was increased by 76% in the frontopolar cerebral cortex, 46% in the frontal motor cortex, 54% in the frontal sensory cortex, 65% in the parietal motor cortex, 68% in the parietal sensory cortex, 68% in the hippocampal CA1 region, 57% in the hippocampal CA3 region, 26% in the striatum, and 56% in the cerebellum. The results indicate that hypoxia elicits three main responses that affect brain oxygen availability. The acute effect of hypoxia is an increase in regional blood flow, which returns to control levels on continued hypoxic exposure. Longer-term effects of continued moderate hypoxic exposure are erythropoiesis and a decrease in intercapillary distance as a result of angiogenesis. The rise in hematocrit and the increase in microvessel density together increase oxygen availability to the brain to within normal limits, although this does not imply that tissue PO2 is restored to normal.”

“Neuroprotectants attenuate hypobaric hypoxia-induced brain injuries in cynomolgus monkeys...Hypobaric hypoxia (HH) exposure can cause serious brain injury as well as life-threatening cerebral edema in severe cases. Previous studies on the mechanisms of HH-induced brain injury have been conducted primarily using non-primate animal models that are genetically distant to humans, thus hindering the development of disease treatment. Here, we report that cynomolgus monkeys (Macaca fascicularis) exposed to acute HH developed human-like HH syndrome involving severe brain injury and abnormal behavior. Transcriptome profiling of white blood cells and brain tissue from monkeys exposed to increasing altitude revealed the central role of the HIF-1 and other novel signaling pathways, such as the vitamin D receptor (VDR) signaling pathway, in co-regulating HH-induced inflammation processes. We also observed profound transcriptomic alterations in brains after exposure to acute HH, including the activation of angiogenesis and impairment of aerobic respiration and protein folding processes, which likely underlie the pathological effects of HH-induced brain injury. Administration of progesterone (PROG) and steroid neuroprotectant 5α-androst-3β,5,6β-triol (TRIOL) significantly attenuated brain injuries and rescued the transcriptomic changes induced
by acute HH. Functional investigation of the affected genes suggested that these two neuroprotectants protect the brain by targeting different pathways, with PROG enhancing erythropoiesis and TRIOL suppressing glutamate-induced excitotoxicity. Thus, this study advances our understanding of the pathology induced by acute HH and provides potential compounds for the development of neuroprotectant drugs for therapeutic treatment.”


- “Oxidative Stress in Acute Hypobaric Hypoxia...The effects of acute hypobaric hypoxia endured by mountaineers were studied, specifically as evidenced by acute mountain sickness (AMS) and oxidative stress damage. Ten male volunteers were exposed to acute hypobaric hypoxia, and AMS was evaluated through arterial oxygen saturation (SaO2), cardiac rate, and the Lake Louise Score (LLS). Oxidative stress was determined through blood profile tests performed 24 hours before and after high-altitude exposure, assessing the oxidative damage and antioxidant profiles. Dietary habits were assessed using the Chilean Mediterranean Diet Index. During ascent (i.e., first 8 hours), all volunteers presented AMS (LLS ≥3 points), as manifested by a median LLS increment of four points, a 15 bpm cardiac rate, and 17% decrease in SaO2. Additionally, plasma lipid oxidative damage increased after the expedition, as evaluated through malondialdehyde, which was directly correlated with the LLS (R(2) = 0.720, p = 0.003) and inversely correlated with SaO2 (R(2) = 0.436; p = 0.035) at a high altitude. Preascent carbonyl levels were inversely correlated to SaO2 (R(2) = 0.490; p = 0.008) and directly correlated to cardiac rate (R(2) = 0.225; p = 0.016) at a high altitude. Moreover, dietary habits were inversely correlated with increased carbonyls during the expedition (R(2) = 0.436; p = 0.047). In conclusion, acute hypobaric hypoxia induced AMS and an increment in oxidative stress markers 24 hours after altitude exposure in the volunteers. Furthermore, oxidative stress damage was related to AMS severity. Finally, volunteers with closer adherence to a Mediterranean diet presented a lower increase in oxidative damage during ascent, reflecting the potential preventive role of diet against AMS.”

https://www.researchgate.net/publication/315532823_Oxidative_Stress_in_Acute_Hypobaric_Hypoxia

- “Much hypoxia research has been carried out at high altitude in a hypobaric hypoxia (HH) environment. Many research teams seek to replicate high-altitude conditions at lower altitudes in either hypobaric hypoxic conditions or normobaric hypoxic (NH) laboratories. Implicit in this approach is the assumption that the only relevant condition that differs between these settings is the partial pressure of oxygen (PO2), which is commonly presumed to be the principal physiological stimulus to adaptation at high altitude. This systematic review is the first to present an overview of the current available literature regarding crossover studies relating to the different effects of HH and NH on human physiology. After applying our inclusion and exclusion criteria, 13 studies were deemed eligible for inclusion. Several studies reported a number of variables (e.g. minute ventilation and NO levels) that were different between the two conditions, lending support to the notion that true physiological difference is indeed present. However, the presence of confounding factors such as time spent in hypoxia, temperature, and humidity, and the limited statistical power due to small sample sizes, limit the conclusions that can be drawn from these findings. Standardisation of the study methods and reporting may aid interpretation of future studies and thereby improve the quality of data in this area. This is important to improve the quality of data that is used for improving the understanding of hypoxia tolerance, both at altitude and in the clinical setting.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4342204/
“Hypobaric hypoxia...Bjørn Bendz and colleagues (Nov 11, p 1657) report that exposure over 8 h to a simulated altitude of 2400 m leads to remarkable in-vivo thrombin formation, shown by high concentrations of thrombin antithrombin (TAT)-III complexes and prothrombin fragment 1+2 (PTF 1+2). However, at 4559 m, we saw no increase in in-vivo fibrin or thrombin formation in resting mountaineers who had ascended on foot...We studied healthy mountaineers who ascended within 22 h to 4559 m, starting on foot at 3200 m. Oxygen saturation was 80% at rest and 70% during exercise...A massive activation of coagulation at moderate altitude in resting individuals contrasts with negative findings in mountaineers acutely exposed to much higher altitudes.”

“Acute Exercise in Hypobaric Hypoxia Attenuates Endothelial Shedding in Subjects Unacclimatized to High Altitudes...Travel of unacclimatized subjects to a high altitude has been growing in popularity. Changes in endothelial shedding [circulating endothelial cells (ECs)] and hematopoietic stem and progenitor cells (CPCs) during physical exercise in hypobaric hypoxia, however, are not well understood. We investigated the change in ECs and CPCs when exposed to high altitude, after acute exercise therein, and after an overnight stay in hypobaric hypoxia in 11 healthy unacclimatized subjects. Blood withdrawal was done at baseline (520 m a.s.l.; baseline), after passive ascent to 3,883 m a.s.l. (arrival), after acute physical exercise (±400 m, postexercise) and after an overnight stay at 3,883 m a.s.l. (24 h). Mature blood cells, ECs, and CPCs were assessed by a hematology analyzer and flow cytometry, respectively. The presence of matrix metalloproteinases (MMPs), their activity, and hematopoietic cytokines were assessed in serum and plasma. EC and CPC concentrations significantly decreased after exercise (p = 0.019, p = 0.007, respectively). CPCs remained low until the next morning (24 h, p = 0.002), while EC concentrations returned back to baseline. MMP-9 decreased at arrival (p = 0.021), stayed low postexercise (p = 0.033), and returned to baseline at 24 h (p = 0.035 to postexercise). MMP-activity did not change throughout the study. Circulating MMP-9 concentrations, but not MMP-activity, were associated with EC concentrations (rrm = 0.48, p = 0.010). CPC concentrations were not linked to hematopoietic cytokines. Acute exercise at high altitude attenuated endothelial shedding, but did not enhance regenerative CPCs. Results were not linked to endothelial matrix remodeling or CPC mobilization. These results provide information to better understand the endothelium and immature immune system during an active, short-term sojourn at high altitude...Exposure to hypobaric hypoxia at rest comes with an increase in heart rate (HR) and ventilation, a decrease in oxygen saturation, and an activation of angiogenesis and the endothelium (Luks, 2015) by, e.g., increased shedding of endothelial cells (ECs) from the vascular walls (Rabelink et al., 2010). The effect of acute exercise under hypoxic conditions on EC number, however, is controversial. Although studies have found a decrease in endothelial shedding after a 12-day trek at high altitude (Mancuso et al., 2008), acute physical exercise for 30 min in normobaric hypoxia showed elevated EC numbers (Tsai et al., 2016). Since endothelial shedding has been connected to adverse cardiovascular events including stroke (Bartsch and Gibbs, 2007; Deng et al., 2017)."
days at sea level, in a cycle repeated for several years. This Chronic Intermittent Hypoxia (CIH) constitutes an unusual condition for workers involving a series of changes at the physiological, cellular and molecular levels attempting to compensate for the decrease in the environmental partial pressure of oxygen (PO2). The mine worker must become acclimatized to CIH, and consequently undergoes an acute acclimatization process when he reaches the worksite and an acute reverse process when he reaches sea level. We have observed that after a period of 3 to 8 years of CIH exposure workers acclimatize well, and evidence from our studies and those of others indicates that CIH induces acute and chronic multisystem adjustments which are effective in offsetting the reduced availability of oxygen at high altitudes. The aims of this review are to summarize findings of the physiological responses to CIH exposure, highlighting outstanding issues in the field.”

- “Hypobaric hypoxia” [https://www.researchgate.net/publication/12045319_Hypobaric_hypoxia](https://www.researchgate.net/publication/12045319_Hypobaric_hypoxia)
Altitude Diseases: Brain Hypoxia

- “Brain Hypoxia...Brain hypoxia is when the brain isn’t getting enough oxygen. This can occur when someone is drowning, choking, suffocating, or in cardiac arrest. Brain injury, stroke, and carbon monoxide poisoning are other possible causes of brain hypoxia. The condition can be serious because brain cells need an uninterrupted flow of oxygen to function properly...traveling to high altitudes (above 8,000 feet)...Brain hypoxia symptoms range from mild to severe. Mild symptoms include: temporary memory loss, reduced ability to move your body, difficulty paying attention, difficulty making sound decisions...Recovering from brain hypoxia depends largely on how long your brain has gone without oxygen. Depending on the severity of your condition, you may have recovery challenges that eventually resolve. The potential challenges include: insomnia, hallucinations, amnesia, muscle spasms” https://www.healthline.com/health/cerebral-hypoxia
Altitude Diseases: Hypoxia & Hallucinations

- “If you are at the point of hallucinating at high altitude, you should immediately descend to sea level to treat the dangerous levels of hypoxia.” Steven Magee CEng MIET
- “Hypoxia, Hallucinations and the Power of Hubris….I was watching a TV programme yesterday and the characters were discussing how “hypoxia” created powerful “hallucinations” and this was used a an “explanation” of various Near-Death perceptions …. in other words, hypoxia causes the hallucinations and therefore explains them using a simple application of materialist-reductionist science. Neat, tidy, rational and convincing. Problem solved. There is nothing at all odd or strange about the NDE, nor its associated perceptions of an OBE state and vivid visual, tactile and auditory experiences.” https://www.anthonypeake.com/hypoxia-hallucinations-and-the-power-of-hubris/
- “Near-Death Experiences Linked to Oxygen Deprivation...People who report near-death experiences have elevated levels of carbon dioxide in their blood and may be suffering oxygen deprivations, according to a new study published in the medical journal Critical Care...Exactly why has remained a mystery, but the new study provides a clue. The link between oxygen deprivation in the brain and near-death experience has been suggested for many years. British researcher Dr. Susan Blackmore, author of "Dying to Live: Near-Death Experiences" (Prometheus Books, 1993), notes that many NDEs (such as euphoria and the feeling of moving toward a white light) are in fact typical symptoms of oxygen deprivation….Not only are the symptoms of anoxia (oxygen deprivation) very similar to the symptoms of an NDE, but patients who had the highest concentrations of carbon dioxide in their blood reported significantly more NDEs than those with lower levels. In response to the stress of the heart attack, pain-killing endorphins are released, which can create elation and hallucinations.” https://www.livescience.com/11010-death-experiences-linked-oxygen-deprivation.html
Altitude Diseases: Neuroinflammation

- "Neuroinflammation...Neuroinflammation is a symptom of many diseases and thought to be a part of ME. Alzheimer’s disease, Parkinson’s disease, and multiple sclerosis are illnesses in which the brain experiences decline in structure and function, and also where it shows clear signs of neuroinflammation. Inflammation of the brain is linked to activated microglia, cytokine presence in the brain,[6] and changes in the neurochemicals produced by the brain.[7] These effects also occur in ME which is why researchers are searching to more strongly show neuroinflammation in these patients.” [https://me-pedia.org/wiki/Neuroinflammation](https://me-pedia.org/wiki/Neuroinflammation)

- What is neuroinflammation?...A short video explaining the general concept of neuroinflammation and how it may drive pain, fatigue and other chronic conditions.” [https://youtu.be/_ijlkRwORfM](https://youtu.be/_ijlkRwORfM)

- “Do you have a hot brain?...In this video we are discussing a new imaging technique that allows us to measure the temperature of the brain. We will be using this scan to better understand fibromyalgia, chronic fatigue syndrome, multiple sclerosis, traumatic brain injury, rheumatoid arthritis, depression, and other conditions.” [https://youtu.be/1p6UojKL010](https://youtu.be/1p6UojKL010)

- “Episode #49: Brain on Fire with Dr. Mary Ackerley, MD...In this episode, you will learn about inflammation, its effects on the brain, and its role in chronic health challenges such as Chronic Inflammatory Response Syndrome (CIRS).” [https://www.betterhealthguy.com/episode49](https://www.betterhealthguy.com/episode49)

- “Fibromyalgia, Chronic Fatigue Syndrome, Gulf War Illness – the Widespread Neuroinflammation Diseases...It’s complex; it causes fatigue, pain, sleep and cognitive problems; it’s underfunded; and it’s not chronic fatigue syndrome (ME/CFS) or fibromyalgia (FM) – it’s Gulf War Illness (GWI) – and it may be more relevant than you think. We do have quite a bit in common. Imagine being healthy and strong, and then suddenly not being that way and then staying that way for decades. We can relate. It took less than a year for Coalition ground forces to prevail during the first Gulf War, but nearly three decades later many are still suffering. It’s a remarkable thing that several wars and almost 3 decades later, about 30% of Gulf War Veterans are still sick.” [https://www.healthrising.org/blog/2020/05/02/fibromyalgia-chronic-fatigue-syndrome-gulf-war-illness-neuroinflammation/](https://www.healthrising.org/blog/2020/05/02/fibromyalgia-chronic-fatigue-syndrome-gulf-war-illness-neuroinflammation/)

- “Inflammation correlates with symptoms in chronic fatigue syndrome...It is not unusual for patients who say they are sick to have normal results on standard laboratory testing. The physician often concludes that there is no “real” illness and that the patients’ symptoms likely stem from a psychological disorder. An alternative conclusion, often honored in the breach, is that the standard laboratory tests are measuring the wrong things. Chronic fatigue syndrome (CFS)—also called myalgic encephalomyelitis/chronic fatigue syndrome—is such an illness. Often, the condition begins suddenly, following an “infectious-like” illness. For years, patients do not return to full health. The illness waxes and wanes, and at its worst leads patients to be bedridden or unable to leave their homes. A report from the National Academies estimates that CFS affects up to 2.5 million people in the United States and generates direct and indirect expenses of $17–24 billion annually (1). The most widely used case definition (2) consists only of symptoms. This, along with typically normal results on standard laboratory tests, has raised the question of whether there are any “real” objective, biological abnormalities in CFS. In PNAS, Montoya et al. (3) report the latest evidence that there are such abnormalities. Indeed, research over the past 30 y has discovered pathology involving the central nervous system (CNS) and autonomic nervous system (ANS), energy metabolism (with associated oxidative
and nitrosative stress), and the immune system, as described in a detailed review (4). This Commentary will briefly summarize the evidence, providing citations only to work published since this review. I will then place the report by Montoya et al. (3) in context, and speculate about the pathophysiology of the illness.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5576849/

- “Reversal of cognitive decline in Alzheimer's disease...Alzheimer's disease is one of the most significant healthcare problems nationally and globally. Recently, the first description of the reversal of cognitive decline in patients with early Alzheimer's disease or its precursors, MCI (mild cognitive impairment) and SCI (subjective cognitive impairment), was published [1]. The therapeutic approach used was programmatic and personalized rather than monotherapeutic and invariant, and was dubbed metabolic enhancement for neurodegeneration (MEND). Patients who had had to discontinue work were able to return to work, and those struggling at work were able to improve their performance. The patients, their spouses, and their co-workers all reported clear improvements. Here we report the results from quantitative MRI and neuropsychological testing in ten patients with cognitive decline, nine ApoE4+ (five homozygous and four heterozygous) and one ApoE4-, who were treated with the MEND protocol for 5-24 months. The magnitude of the improvement is unprecedented, providing additional objective evidence that this programmatic approach to cognitive decline is highly effective. These results have far-reaching implications for the treatment of Alzheimer's disease, MCI, and SCI; for personalized programs that may enhance pharmaceutical efficacy; and for personal identification of ApoE genotype.”

https://www.aging-us.com/article/100981

- “Study Highlights the MEND Approach to Reversing Alzheimer's Disease...Each of the ten people involved in this study participated in a personalized treatment plan that involved multiple components according to their test results. Some of their directives included increasing their amount of sleep per night, taking melatonin (a natural supplement) to improve sleep, improving their diet to reduce sugar, gluten, meat, and simple grains, and to increase fruits, vegetables, blueberries, and non-farmed fish, fasting prior to sleep at night for at least 3 hours and a total of 12 hours overnight, daily supplements of vitamin D3, C and/or E, daily doses of citicoline, improved dental hygiene, daily doses of coconut oil and curcumin (turmeric), hormone therapy, stress management such as yoga, regular physical exercise, and regular mental exercise. The Results. Each of the ten people involved in this study experienced significant improvements in their cognition, based both on their own reports and that of their loved ones, as well as the results of cognitive testing. These improvements were such that at the end of the study, most participants didn't meet the criteria for a diagnosis of Alzheimer's or mild cognitive impairment. Additionally, their cognitive functioning has remained stable for up to four years now, which is the longest time one of the individuals has been on this protocol. This maintained improvement is essentially unheard of when discussing the treatment of Alzheimer's disease.”

https://www.verywellhealth.com/mend-approach-to-reversing-alzheimer-s-4074147
Altitude Diseases: Asthma & Allergies

- “After working in high altitude astronomy, I was diagnosed with asthma and allergies.” Steven Magee CEng MIET - Q

- “Asthma and High Elevation Activity...Why High Elevation Triggers Asthma. If your child has asthma, they may experience struggling for air in high elevation territory because the amount of oxygen in the air decreases as altitude increases. Lungs will struggle for air and deep or quick breathing can occur. When the air is dry, especially during the winter months, it can also trigger asthma. When your child inhales cold, dry air, it can dry the mucus membranes lining their lungs. Mucus membranes are your child’s natural defense mechanism against viruses and bacteria. When your child’s mucus membranes are dry it can activate allergy symptoms. Considering 75 percent of asthmatics have allergies, this is important information to know. Continue reading! If your child’s asthma is stable, altitude will generally have little effect on their asthma. “If your child’s asthma is severe and you’re interested in traveling to high altitude, your child should see their doctor ahead of time to assure they are taking proper medications and that your child’s asthma has stabilized,” says Arnold Platzker, MD, from the Division of Pediatric Pulmonology at Children’s Hospital Los Angeles.”

- “Allergies at High Altitudes...There tend to be fewer pollen related allergens at high altitudes, and at extremely high altitudes, dust mites cannot survive either. Dryer climates also reduce some types of mold spores. High altitude water supplies tend to be high in minerals, and water may also be more alkaline than at lower altitudes, in some places. The affect on individuals can vary widely, some people improve, others struggle with the change. While wind blown pollens tend to be lower, the amount of wind in general means that there is more dust, and more potential for exposure from the pollens that do circulate. Sort of like we say about snow - there isn't much of it, but nature makes the most of it! Allergy related asthma may improve or worsen. High altitude tends to make asthma more reactive anyway, so you could go either way.”

- “ALLERGEN LEVELS AND ALTITUDE...The issue of the impact of altitude on aeroallergens is an interesting one. The benefit of high mountains on asthma control was commented on ninety years ago. But it wasn't until over forty years later than dust mites were discovered, with the subsequent realization that the decreased humidity (comparing the Netherlands to Switzerland) meant lesser mite exposure. The question of pollens isn't so clear. Altitude per se does not mean lower pollen counts. Davies discussed this in a couple of articles in 1969. The counts depended on prevailing winds, and species of grass. Buck and Levetin showed grass pollen counts in the mountains of Colorado that were considerably higher than counts we saw down in the plains around Denver. Their site was near Crested Butte, west of the Continental Divide. Since prevailing winds in North America are from the west, I suspect moist air was carrying rain to deposit as it hit the Rockies. So it depends on how much moisture there is.”

- “Does Altitude Affect Asthma?... If the asthma is so severe that the person's blood oxygen is low (very unusual except during an acute attack), being at altitude or on an air flight would further reduce the blood oxygen level. The dry and often cool conditions experienced at
significant altitude might trigger asthma symptoms. Humid air is more ideal for keeping the airways moist. Even the effects of dry, cool air, however, can be prevented by keeping the asthmatic condition under good control.”  

- “High altitude and asthma: beyond house dust mites...In this issue of the European Respiratory Journal, Rijssenbeek-Nouwens et al. [1] demonstrated that the benefit of a stay at high altitude was comparable in allergic and nonallergic adult asthmatic patients (allergy was defined on the basis of specific immunoglobulin (Ig)E to a panel of common aero-allergens). This benefit was substantial, exemplified by a discontinuation in oral steroids intake over the course of the stay in about 40% of both groups of asthmatic patients and an average reduction of 50% in the other patients.”

https://www.environmentalradiation.com

https://www.medicinenet.com/asthma_-_the_effects_of_climate_and_altitude/ask.htm

https://erj.ersjournals.com/content/40/6/1320
Altitude Diseases: Anemia Hazards

- “I noticed a positive effect when I suspected very high altitude anemia damage may be present and started to treat it with a 65 mg iron supplement daily in 2018.” Steven Magee CEng MIET - Q
- “Hypoxemia in Dogs. When the brain is deprived of oxygen, irreversible damage may be the result, even when the deprivation has been for a short period of time. Oxygen deficiency may also lead to anemia in the organs, which can progress to arrhythmia and heart failure. Hypoxemia occurs when arterial blood is not being oxygenated sufficiently. This is a serious condition and needs to be treated quickly.”
  https://www.petmd.com/dog/conditions/cardiovascular/c_multi_hypoxemia?page=show
- “High altitude anemia: validity of definition criteria...The effect of iron and folate supplementation on the hemoglobin response and iron status was studied in male and female equatorian medical students: 66 in Quito (2,800 m altitude) and 40 in Guayaquil (sea level). At the end of the supplementation, there was a nearly complete disappearance of biochemical evidence of iron deficiency in the two groups of students.”
- “Childhood Anemia at High Altitude: Risk Factors for Poor Outcomes in Severe Pneumonia...Children at high altitude present with more severe disease, and children with anemia at high altitude are at greater risk of poor outcome when being treated for severe pneumonia. Given the high global prevalence of anemia among young children, prevention and treatment of anemia should be a priority in children living at high altitude and could improve outcomes of pneumonia.”
  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3812558/
- “Two weeks in the mountains can change your blood for months...Peter Ratcliffe, a medical researcher at the University of Oxford in the United Kingdom who studies how cells react to low oxygen in cancer, heart disease, stroke, and anemia. Low oxygen is also a problem when trauma—from car accidents to gunshot wounds—causes blood loss. Finding ways to kick the blood’s oxygen-carrying capacity into high gear in such an emergency, D’Alessandro says, could save lives in both the civilian sector and on the battlefield.”
  http://www.sciencemag.org/news/2016/10/two-weeks-mountains-can-change-your-blood-months
- “The Effect of Altitude Change on Anemia Treatment Response in Hemodialysis Patients...Hemodialysis patients who live at high altitude use less exogenous erythropoietin but achieve higher hematocrit levels than those living at a lower altitude...These results support the hypothesis that altitude-induced hypoxia reduces erythropoietin requirements in hemodialysis patients with treatment-refractory anemia.”
  https://academic.oup.com/aje/article/173/7/768/102633
- “Iron Deficiency Anemia: Symptoms and Solutions...Iron deficiency is one of the most common deficiencies in the world. Although anemia can be caused by other deficiencies including folic acid, B12, B6 or copper, iron deficiency anemia is the most common type of anemia. Anemic people may not show any symptoms at first, then start to develop symptoms over time, including: dizziness or lightheadedness, fatigue, weakness, shortness of breath, or lack of endurance during exercise, headache, poor concentration and cognitive ability, desire to chew on ice, irritability, paleness, heart palpitations or rapid heart beat, intolerance to cold, loss of appetite, and/or reduced immunity...Anemia can dramatically compound the effects at
altitude, and can also increase the risks associated with altitude sickness; if left untreated, severe anemia may cause high-output heart failure, a life-threatening problem anywhere, but especially in the mountains far from emergency rescue services.”

http://www.bodyresults.com/e2anemia.asp

- “Vitamin A...Vitamin A deficiency often coexists with iron deficiency and may exacerbate iron deficiency anemia by altering iron metabolism (27). Vitamin A supplementation has beneficial effects on iron deficiency anemia and improves iron nutritional status among children and pregnant women (27, 28). The combination of supplemental vitamin A and iron seems to reduce anemia more effectively than either supplemental iron or vitamin A alone (31). Moreover, studies in rats have shown that iron deficiency alters plasma and liver levels of vitamin A (32, 33).”

https://lpi.oregonstate.edu/mic/vitamins/vitamin-A

- “The influence of high-altitude living on body iron...It is estimated that 20 to 30 million people worldwide live at altitudes above 3000 m commonly defined as high altitude; over half of these individuals live in the Andean region of Latin It is commonly assumed that the prevalence of iron deficiency is higher in vulnerable segments of these populations because of the added iron requirement imposed by expansion of the red cell mass.”

http://www.bloodjournal.org/content/bloodjournal/106/4/1441.full.pdf?sso-checked=true

- “Impact of Altitude-based Hemoglobin Modification on Pediatric Iron Deficiency Anemia Screening...Objective. To determine if additional children attending primary care clinics in moderate-altitude areas would screen positive for anemia if the hemoglobin cutoff were modified for altitude. Study design. This cross-sectional study evaluated children aged 11-19 months of age who had a screening hemoglobin conducted between January 2011 and December 2017 at 4 moderate-altitude (1726-2212 m) and 8 low-altitude (1-20 m) US military clinics. The primary outcome was anemia prevalence (hemoglobin <11 g/dL) in moderate-altitude and low-altitude groups, before and after applying the current World Health Organization model for altitude-based hemoglobin modification. Groups were compared with prevalence ORs adjusted for age, sex, weight-for-length percentile, and parental military rank, and the false-negative proportion was calculated for children with anemia at moderate altitude. Results. Before altitude modification, anemia prevalence was 4.4% in the moderate-altitude group (n = 1488) and 16.8% in the low-altitude group (n = 7090) (prevalence OR, 0.23; 95% CI, 0.17-0.29). After applying the World Health Organization model, anemia prevalence in the moderate-altitude group increased to 14.7% (prevalence OR, 0.82; 95% CI, 0.70-0.97). Nonapplication of the model at moderate altitude resulted in a false-negative proportion of 0.70 (95% CI, 0.63-0.76). Conclusions. Nonuse of the World Health Organization altitude-based modification model for hemoglobin may result in a large percentage of US children with anemia at moderate altitude screening falsely negative for anemia. Although ancestry disparities in altitude acclimatization may limit universal application of the current World Health Organization model, the existing standard of care may leave children at moderate altitude at risk for complications from iron deficiency anemia.”


- “Combination of anemia, high altitude challenge outcomes for children with pneumonia...Overall the study found that, while neither anemia nor high altitude alone increased the risk of treatment failure, the combination of both factors caused a fourfold increase in failure risk. Controlling for the two treatment regimens of the SPEAR study did not change the impact of altitude and anemia. Children living at high altitudes also were much more seriously ill when diagnosed -- with lower blood pressure and blood oxygen levels and an
increased respiratory rate -- and took much longer to recover normal blood oxygen levels after treatment. Since low blood oxygen significantly increases the risk of death, Moschovis notes, these findings highlight the importance of providing high-quality care to children in high-altitude environments who develop pneumonia.”

https://www.sciencedaily.com/releases/2013/10/131008123156.htm

“Anemia: Be Aware of This Cancer-Related Risk. Cancer and its treatments can cause a variety of side effects, and one that you might not know about is anemia. But if you develop this condition, treating it can make you feel better almost immediately—and help you get back to effectively fighting your cancer…Cancer itself can cause bleeding that leads to anemia. Cancer treatments can also bring on anemia. “Most chemotherapy can contribute to it,” Khanal said. Nutrition plays an essential role. According to Khanal, tumors secrete cytokines leading to cancer related anorexia, which may contribute to nutritional deficiency and anemia henceforth. Also, the body does not utilize iron, folate, and vitamin B12 when contending with cancer. “And that can lead to deficiencies that make cancer patients more susceptible to anemia,””

https://www.foxchase.org/blog/anemia-be-aware-cancer-related-risk
Altitude Diseases: Radiation Hazards

- “High altitude sites are also above most of atmosphere's water vapor, making them ideal for infrared astronomy and submillimeter astronomy as those wavelengths are strongly absorbed by water vapor...At the far end of the spectrum, for the extremely short wavelengths of x-ray and gamma ray astronomy, along with high-energy cosmic rays, high altitude observations once again offers significant advantages.”
- “Very high altitude workers that have sea level adapted genetics are radiation workers.” Steven Magee CEng MIET - Q
- "A few years after working on Mauna Kea, I discovered that I had radiation sickness." Steven Magee CEng MIET – Q http://amzn.com/1500896241
- “The closer you get to the Sun, the higher the levels of radiation become.” Steven Magee CEng MIET - Q
- “One of the nice features of working the astronomy night shift atop Mauna Kea was that I would get to watch the beautiful Hawaiian sunset daily. I was later to realize that watching sunsets at 13,796 feet was undesirable for the biological health of sea level adapted humans.” Steven Magee CEng MIET - Q
- “When I worked in high altitude astronomy, I was never screened annually by a doctor that was expert in low level radiation sickness (LLRS) and high altitude disease (HAD).” Steven Magee CEng MIET - Q
- "Ionizing radiation...Its most common impact is the stochastic induction of cancer with a latent period of years or decades after exposure. The mechanism by which this occurs is well understood, but quantitative models predicting the level of risk remain controversial. The most widely accepted model posits that the incidence of cancers due to ionizing radiation increases linearly with effective radiation dose at a rate of 5.5% per sievert. If this linear model is correct, then natural background radiation is the most hazardous source of radiation to general public health, followed by medical imaging as a close second. Other stochastic effects of ionizing radiation are teratogenesis, cognitive decline, and heart disease." https://en.wikipedia.org/wiki/Ionizing_radiation
- “Teratology is the study of abnormalities of physiological development. It is often thought of as the study of human congenital abnormalities, but it is broader than that, taking into account other non-birth developmental stages, including puberty; and other non-human life forms, including plants. The related term developmental toxicity includes all manifestations of abnormal development that are caused by environmental insult. These may include growth retardation, delayed mental development or other congenital disorders without any structural malformations.” https://en.wikipedia.org/wiki/Teratology
- "I was on the Big Island of Hawaii in 2015 and managed to characterize the ionizing radiation levels in the south of the island. Mauna Kea was the radiation hot zone with approximately a doubling of radiation levels at the Mauna Kea Visitors Center at 9,200 feet as compared to sea level. I did not venture to the summit due to the known biologically harmful environmental conditions to the sea level adapted human that exist at 13,796 feet." Steven Magee CEng MIET - Q http://www.environmentalradiation.com/hawaii_radiation_readings.pdf
“Ionizing Radiation Readings At Kitt Peak National Observatory (KPNO)”
https://youtu.be/cNNGSaBh63o

“workers who were exposed to radiation for a median of 10 years had: 2.8 times higher odds of having skin lesion: 7.1 times higher odds of having orthopedic (back/neck/knee) problems; and 6.3 times higher odds of having cataracts.”

“experimental evidence supported low-dose ionizing radiation exposure causes a significant long-term alterations in lipid metabolisms and endothelial function”
http://info.cfimedical.com/blog/hypertension-and-high-cholesterol-linked-to-radiation-exposure

“A mathematical model constructed by researchers at Imperial College London predicts the risk of cardiovascular disease (heart attacks, stroke) associated with low background levels of radiation. The model shows that the risk would vary almost in proportion with dose.”

“The effects of radiation on the long-term trends of the total serum cholesterol levels of the Hiroshima and Nagasaki atomic bomb survivors were examined using data collected in the Adult Health Study over a 28-year period (1958-1986)...We showed that the mean growth curve of cholesterol levels for the irradiated subjects were significantly higher than that for the unirradiated subjects, and that the increase was greater for women than for men...This increase may also partially explain the increased rate of coronary heart disease seen in the atomic bomb survivors.”

“At the age of 46 I was placed onto cholesterol lowering RX-Only prescription medication.”
Steven Magee CEng MIET - Q

“All the endocrine glands are susceptible to damage by radiation exposure; however, pituitary, thyroid and gonads are most likely to be affected. In addition to the endocrine effects, the rates of birth defects and carcinomas may also be increased in the population exposed to excessive radiation.”
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3125012/

“studies have associated chronic radiation exposure with poor long-term heart health.”
http://www.medicalnewstoday.com/articles/308881.php

“Very high altitude workers at astronomical observatories are well on their way into Space without the radiation protective pressurized Space suit.”
Steven Magee CEng MIET - Q

“Space suit”
https://en.wikipedia.org/wiki/Space_suit

“Scientists Find 'Radiation Clouds' In Upper Atmosphere...Researchers detected small pockets in our atmosphere with almost double the surrounding level of radiation.”

“Earth's Atmospheric Layers”

“Solar radiation reaching the Earth’s surface. At the top of the atmosphere most of the solar radiation is still present. By the time the radiation reaches the Earth’s (sea level) surface, radiation in most spectral regions has been removed by the Earth’s atmosphere.”
https://www.ucar.edu/communications/gcip/m7sssystem/m7pdfc3.pdf

“Distribution of 90Sr and 144Ce in the stratosphere has been investigated by analyzing high-altitude air filter samples collected in 1962 and 1963. The highest concentrations of 90Sr (5.4 dis/min/SCF) and 144Ce (122 dis/min/SCF) were observed in April 1963 at 64–70°N and at an altitude of 16.7 km. The 144Ce/90Sr ratio in the northern stratosphere was fairly constant (about 20, as of January 1963). The distribution patterns of 90Sr and 144Ce were quite different
“The only difference between a very high altitude worker and a radiation worker is that there is a government compensation program in place for sickened radiation workers.” Steven Magee CEng MIET - Q

“The Energy Employees Occupational Illness Compensation Program (EEOICP) was passed in 2000 and is designed to compensate individuals who worked in nuclear weapons production and as a result of occupational exposures contracted certain illnesses. The law was signed into law by President Bill Clinton on December 7, 2000.”

“By 14 August 2010, the (EEOICP) program had already identified 45,799 civilians who lost their health (including 18,942 who developed cancer) due to exposure to radiation and toxic substances while producing nuclear weapons for the United States.”

“Adverse radiation exposures are cumulative and the longer you receive them, the more likely it is to make you sick.” Steven Magee CEng MIET - Q

“Sea level adapted humans are radiation workers when working at very high altitudes.” Steven Magee CEng MIET - Q

“The very high altitude summit of Mauna Kea is a bad place to be during a solar radiation storm.” Steven Magee CEng MIET - Q
Altitude Diseases: Cosmic-Ray Hazards

- “Cosmic rays are high-energy radiation, mainly originating outside the Solar System[1] and even from distant galaxies.[2] Upon impact with the Earth's atmosphere, cosmic rays can produce showers of secondary particles that sometimes reach the surface. Composed primarily of high-energy protons and atomic nuclei, they are originated either from the sun or from outside of our solar system. Data from the Fermi Space Telescope (2013)[3] have been interpreted as evidence that a significant fraction of primary cosmic rays originate from the supernova explosions of stars.[4] Active galactic nuclei also appear to produce cosmic rays, based on observations of neutrinos and gamma rays from blazar TXS 0506+056 in 2018...Cosmic rays ionize the nitrogen and oxygen molecules in the atmosphere, which leads to a number of chemical reactions. Cosmic rays are also responsible for the continuous production of a number of unstable isotopes in the Earth's atmosphere, such as carbon-14...Cosmic rays kept the level of carbon-14[81] in the atmosphere roughly constant (70 tons) for at least the past 100,000 years,[citation needed] until the beginning of above-ground nuclear weapons testing in the early 1950s. This is an important fact used in radiocarbon dating used in archaeology.”
  https://en.wikipedia.org/wiki/Cosmic_ray
- “Cosmic rays are very hard to detect at sea level, you have to go to high altitudes to reliably observe them.” Steven Magee CEng MIET - Q
- “A cosmic-ray observatory is a scientific installation built to detect high-energy-particles coming from space called cosmic rays. This typically includes photons (high-energy light), electrons, protons, and some heavier nuclei, as well as antimatter particles. About 90% of cosmic rays are protons, 9% are alpha particles, and the remaining ~1% are other particles.”
  https://en.wikipedia.org/wiki/Cosmic-ray_observatory
- “Huge Chinese cosmic-ray observatory begins operation...One of the world’s largest and most sensitive cosmic-ray facilities has begun operation with its first set of detectors. Located about 4410 m above sea level”
  https://physicsworld.com/a/huge-chinese-cosmic-ray-observatory-begins-operation/
- “MAGIC (Major Atmospheric Gamma Imaging Cherenkov Telescopes) is a system of two Imaging Atmospheric Cherenkov telescopes situated at the Roque de los Muchachos Observatory on La Palma, one of the Canary Islands, at about 2200 m above sea level. MAGIC detects particle showers released by gamma rays, using the Cherenkov radiation, i.e., faint light radiated by the charged particles in the showers. With a diameter of 17 meters for the reflecting surface, it was the largest in the world before the construction of H.E.S.S. I”
- “High Energy Stereoscopic System (H.E.S.S.) is a system of Imaging Atmospheric Cherenkov Telescopes (IACT) for the investigation of cosmic gamma rays in the photon energy range of 0.03 to 100 TeV. The acronym was chosen in honour of Victor Hess, who was the first to observe cosmic rays....Altitude 1,800 m (5,900 ft)”
- “We would see the effects of cosmic rays in images from the telescope electronic camera’s.” Steven Magee CEng MIET - Q
Altitude Diseases: Diseases Associated With Ionizing Radiation Exposure

- “Diseases Associated with Ionizing Radiation Exposure...Cancers of the bile ducts, bone, brain, breast, colon, esophagus, gall bladder, liver (primary site, but not if cirrhosis or hepatitis B is indicated), lung (including bronchiolo-alveolar cancer), pancreas, pharynx, ovary, salivary gland, small intestine, stomach, thyroid, urinary tract (kidney/renal, pelvis, urinary bladder, and urethra). Leukemia (except chronic lymphocytic leukemia). Lymphomas (except Hodgkin’s disease). Multiple myeloma (cancer of plasma cells)...Other diseases associated with radiation exposure...All cancers. Non-malignant thyroid nodular disease. Parathyroid adenoma. Posterior subcapsular cataracts. Tumors of the brain and central nervous system.”

- “Nuclear Fallout: This story produced in partnership with ProPublica and the Santa Fe New Mexican.”

- “Spaceflight radiation carcinogenesis... The largest risks for adults who have been studied include several types of leukemia, including myeloid leukemia [8] and acute lymphatic lymphoma [8] as well as tumors of the lung, breast, stomach, colon, bladder and liver. Intergender variations are very likely due to the differences in the natural incidence of cancer in males and females. Another variable is the additional risk for cancer of the breast, ovaries and lungs in females.”

- “Central nervous system effects from radiation exposure during spaceflight...Acute and late CNS risks from space radiation are of concern for Exploration missions to the moon or Mars. Acute CNS risks include: altered cognitive function, reduced motor function, and behavioral changes, all of which may affect performance and human health. Late CNS risks are possible neurological disorders such as Alzheimer’s disease, dementia, or premature aging...CNS behavioral changes such as chronic fatigue and depression occur in patients who are undergoing irradiation for cancer therapy.[18] Neurocognitive effects, especially in children, are observed at lower radiation doses.[19][20] A recent review on intelligence and the academic achievement of children after treatment for brain tumors indicates that radiation exposure is related to a decline in intelligence and academic achievement, including low intelligence quotient (IQ) scores, verbal abilities, and performance IQ; academic achievement in reading, spelling, and mathematics; and attention functioning.[21] Mental retardation was observed in the children of the atomic-bomb survivors in Japan who were exposed to radiation prenatally at moderate doses (<2 Gy) at 8 to 15 weeks post-conception, but not at earlier or later prenatal times.[20] Radiotherapy for the treatment of several tumors with protons and other charged particle beams provides ancillary data for considering radiation effects for the CNS. NCRP Report No. 153 [4] notes charge particle usage “for treatment of pituitary tumors,[22][23] hormone-responsive metastatic mammmary carcinoma,[24] brain tumors,[25][26] and intracranial arteriovenous malformations and other cerebrovascular diseases.[27][28][29][30][31][32]” In these studies are found associations with neurological complications such as impairments in cognitive functioning, language acquisition, visual spatial ability, and memory and executive functioning, as well as changes in social behaviors. Similar effects did not appear in patients who were treated with chemotherapy. In all of these examples, the patients were treated with extremely high doses that were below the threshold for necrosis.[33][34] Since cognitive functioning and memory are closely associated with the cerebral white volume of the prefrontal/frontal lobe and
cingulate gyrus, defects in neurogenesis may play a critical role in neurocognitive problems in irradiated patients.[4]

Health threat from cosmic rays...The potential acute and chronic health effects of space radiation, as with other ionizing radiation exposures, involve both direct damage to DNA, indirect effects due to generation of reactive oxygen species, and changes to the biochemistry of cells and tissues, which can alter gene transcription and the tissue microenvironment along with producing DNA mutations. Acute (or early radiation) effects result from high radiation doses, and these are most likely to occur after solar particle events (SPEs).[24] Likely chronic effects of space radiation exposure include both stochastic events such as radiation carcinogenesis[25] and deterministic degenerative tissue effects...A review of CNS space radiobiology by Cucinotta, Alp, Sulzman, and Wang (Life Sciences in Space Research, 2014) summarizes research studies in small animals of changes to cognition and memory, neuro-inflammation, neuron morphology, and impaired neurogenesis in the hippocampus. Studies using simulated space radiation in small animals suggest temporary or long-term cognitive detriments could occur during a long-term space mission. Changes to neuron morphology in mouse hippocampus and pre-frontal cortex occur for heavy ions at low doses (<0.3 Gy). Studies in mice and rats of chronic neuro-inflammation and behavioral changes show variable results at low doses (~0.1 Gy or lower).

Cosmic radiation may leave astronauts with long-term cases of ‘space brain,’ study says...Scientists studying the effects of radiation in rodents say that astronauts exposed to galactic cosmic rays could face a host of cognitive problems, including chronic dementia...It's well-known that radiation can damage neural tissue and hurt cognitive function; cancer patients with brain tumors who need radiotherapy end up with what the study authors called "severe and progressive cognitive deficits."...The scientists found that even six months after radiation exposure, the rodents still were suffering from brain inflammation and neural damage. Neurons sported fewer dendrites and spines, which meant their neural networks were less interconnected than in a healthy brain.

“Unexpected Potential Problems” Predicted for Travelers to Mars and Beyond. One in five astronauts could experience "severe deficits."...Using a new “low-dose” radiation facility at Colorado State University, a team of scientists observed that when mice spent months exposed to radiation similar to that found in deep space, they started acting strangely. The mice in the study displayed “severe impairments” in learning and memory, and they became extremely anxious. These symptoms may sound unsurprising since the mice had just spent six months as part of an experiment, but the team also found physical changes in their brains that may explain the changes.

NASA Twin Study Shows Some Long-Term Changes in Astronaut Scott Kelly...Scott’s telomeres had gotten significantly longer during his time in space. Telomeres protect DNA from unraveling by capping the ends of chromosomes, and normally shrink with age. But while on board the International Space Station, Scott’s genes were also expressed differently. Like a volume knob, the information from his genes was turned up in some cases and down in others. This resulted in changes in proteins and metabolites that indicated oxygen deprivation stress in Scott’s body, as well as increased inflammation and variations in his nutrient levels.”
“Moon disease: Apollo astronauts more likely to die of heart problems...Worrying research from the US has found that astronauts who travelled into deep space on lunar missions were five times more likely to have died from cardiovascular disease than those who went into low orbit, or never left Earth...We know very little about the effects of deep space radiation on human health, particularly on the cardiovascular system....We know the immune system is compromised in space and that viruses and bacterial are more infectious.”

“Is radiation beneficial? Everything in moderation — even radioactivity...It may already have cost some astronauts their lives. Five of the original space pioneers have died of cancer. Alan Shepard publicly wondered if his Apollo radiation exposure had given him the leukemia that ultimately killed him. And studies show that radiation is particularly bad for the heart.”

“Mars Astronauts Will Face a Frighteningly High Risk of Cancer...researchers determined that exposure to the very high rates of ionization in the atoms that comprise cosmic rays damaged the cells in astronauts’ bodies, making them vulnerable to a range of health problems, including acute radiation syndromes, cancer, cataracts, central nervous system issues, and circulatory diseases.”

“Prolonged Spaceflight Could Weaken Astronauts’ Immune Systems. Astronauts who embarked on spaceflights lasting longer than six months experienced a decrease in the functionality of NK cells, which serve an important role in the immune system by killing cancerous cells and preventing viruses from reactivating.”

“Most of us have viruses sleeping inside us, and spaceflight wakes them up...A new study published last month in Frontiers in Microbiology reports that herpes viruses lying dormant inside the body become reactivated in more than half of all astronauts sent into space, potentially exacerbating what is already a high-risk environment. While we’ve yet to run into any kind of worrisome situation resulting from this phenomenon, those concerns loom larger as we set our sights on longer duration missions in orbit and seek to send astronauts back to the moon and on to Mars.”

“How Scott Kelly’s year in space changed his poop...relatively small but significant change in Scott Kelly’s gut microbiome. The gut microbiome is the community of bacteria, fungi and viruses that live inside an animal’s intestines and can be detected in their bodily waste. In the past decade or so, the human gut microbiome has been implicated in everything from the obvious — digestion and metabolism — to the unexpected — cancer, Parkinson’s disease and depression.”

“Pelvic radiation therapy: Between delight and disaster...In the last few decades radiotherapy was established as one of the best and most widely used treatment modalities for certain tumours. Unfortunately that came with a price. As more people with cancer survive longer an ever increasing number of patients are living with the complications of radiotherapy and have become, in certain cases, difficult to manage. Pelvic radiation disease (PRD) can result from ionising radiation-induced damage to surrounding non-cancerous tissues resulting in disruption
of normal physiological functions and symptoms such as diarrhoea, tenesmus, incontinence and rectal bleeding.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4663381/]

- “Pelvic Radiation Disease Association” [http://www.prda.org.uk/]
- “Adult Celiac Disease and Its Malignant Complications...A diagnosis of celiac disease is more readily established prior to lymphoma treatment (since chemotherapy or radiation may induce small intestinal changes). Concomitant recognition of underlying celiac disease may also have important nutritional implications” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2852736/]
- “Celiac Disease And Chemotherapy...My husband was diagnosed with lung cancer in Sept. 2007. He ended his chemo and radiation treatments in December 2007 and is now cancer free. In February he began to have celiac disease symptoms (bloating, vomiting, etc.) even though we had no idea what was causing these symptoms.” [https://www.celiac.com/forums/topic/45831-celiac-disease-and-chemotherapy/]
- “Tips for Managing Diarrhea after Radiation Therapy for Rectal Cancer...Chronic radiation enteritis is the technical term for the long-term damage that can result after radiation therapy for rectal cancer. It can lead to chronic diarrhea, incontinence, and bowel urgency. This can occur after treatment of other cancers that require radiation therapy to the abdominal area as well. These side effects can occur months, or even years, after therapy is completed.” [https://www.oncologynutrition.org/erfc/eating-well-when-unwell/tips-for-managing-diarrhea-after-radiation-therapy-for-rectal-cancer/]
- “Diet and late bowel effects...Sometimes radiotherapy to the pelvis can make you intolerant to certain foods. You may become lactose, fructose or gluten intolerant, which means you may feel bloated or have more wind after eating dairy, fruit or foods with wheat in them.” [https://www.macmillan.org.uk/information-and-support/coping/side-effects-and-symptoms/late-effects-pelvic-radiotherapy/diet-and-late-effects.html]
- “FOOD INTOLERANCE DEFINITION. A food intolerance, or a food sensitivity occurs when a person has difficulty digesting a particular food. This can lead to symptoms such as intestinal gas, abdominal pain or diarrhea. A food intolerance is sometimes confused with or mislabeled as a food allergy. Food intolerances involve the digestive system. Food allergies involve the immune system. With a food allergy, even a microscopic amount of the food has the potential to lead to a serious or life-threatening reaction called anaphylaxis.” [https://www.aaaai.org/conditions-and-treatments/conditions-dictionary/food-Intolerance]
- “Allergy might kill you, but intolerance kills you slowly...Allergy and intolerance are different, but they’re also very similar. Both are caused by an immune reaction, but the difference is in the timing. Allergy is immediate and intolerance is delayed, making it harder to pinpoint the
offending food. Allergic reactions release histamine, which is why they show up on skin-prick tests, while intolerances don’t. But the cause is similar – a food protein (allergy) or a food chemical (intolerance) and so are the symptoms – a rash, stomach complaints, breathing difficulties etc. However, allergy can be life-threatening, so I’m sure we all agree it cannot be ignored. Intolerance, on the other hand, may lead to life-long illness, so maybe it’s about time we paid it some more attention!”

“The Food Intolerance Institute of Australia...Food intolerance makes you sick: Symptoms of food sensitivity tend to be those we 'put up with' on a daily basis: itching skin, mild diarrhea, coughing, tiredness, mouth ulcers, stomach bloating, stiff joints or back ache and headache. By the time food sensitivity is properly diagnosed - the health can be compromised, with a much greater risk of serious disease. But with corrected diet symptoms evaporate and pre-disease conditions can heal.”

“Food sensitivities on rise...More people than ever are claiming to suffer from food sensitivities. We all have one: the friend who makes you cringe when they quiz cafe staff about the menu because of their wheat, dairy or gluten intolerance. Food intolerances, it seems, are on the rise. Allergy UK estimates that 45 per cent of people in the UK have food sensitivities.”

“2016 Why food allergies are on the rise: Are we too clean?...Nearly 15 million Americans have food allergies, with an estimated 1 in 13 children under the age of 18 affected by them, according to the Centers for Disease Control and Prevention. Some argue that the nearly 50 percent rise in food allergic kids between 1997 and 2011 is a problem caused by Americans being too clean. Others argue we’re weakening children’s immune systems by delaying foods linked to allergies when babies start eating. Unfortunately, the science really isn’t clear when it comes to the cause of food allergies — it could be a combination of genetics and the environment —but there are many things we do know.”

“Do You Have Celiac Disease?  Adults are less likely to have digestive symptoms, with only one-third experiencing diarrhea.  Adults are more likely to have: unexplained iron-deficiency anemia. Fatigue. bone or joint pain. Arthritis. osteoporosis or osteopenia (bone loss). liver and biliary tract disorders (transaminitis, fatty liver, primary sclerosing cholangitis, etc.). depression or anxiety. peripheral neuropathy ( tingling, numbness or pain in the hands and feet). seizures or migraines. missed menstrual periods. infertility or recurrent miscarriage. canker sores inside the mouth. dermatitis herpetiformis (itchy skin rash)”

“Coeliac disease...The classic symptoms of coeliac disease include pale, loose, and greasy stool (steatorrhoea) and weight loss or failure to gain weight. More common symptoms are subtle or primarily occur in organs other than the bowel itself.[34] It is also possible to have coeliac disease without any classic symptoms whatsoever.[19] This represents at least 43% of the cases in children.[35] Many adults with subtle disease only have fatigue or anaemia.[28] Many undiagnosed people considered asymptomatic actually are not, but have become accustomed to living with a chronic bad health status as if it were normal, and they are able to recognise that they actually had symptoms related to coeliac disease after starting the gluten-free diet and improvement is evident, in contrast to the situation prior to the diet...The changes in the bowel make it less able to absorb nutrients, minerals, and the fat-soluble vitamins A, D, E, and K.[19]
The inability to absorb carbohydrates and fats may cause weight loss (or failure to thrive/stunted growth in children) and fatigue or lack of energy. Anaemia may develop in several ways: iron malabsorption may cause iron deficiency anaemia, and folic acid and vitamin B12 malabsorption may give rise to megaloblastic anaemia. Calcium and vitamin D malabsorption (and compensatory secondary hyperparathyroidism) may cause osteopenia (decreased mineral content of the bone) or osteoporosis (bone weakening and risk of fragility fractures). Selenium malabsorption in coeliac disease, combined with low selenium content in many gluten-free foods, confers a risk of selenium deficiency.[42] Copper and zinc deficiencies have also been associated with coeliac disease.[42] A small proportion have abnormal coagulation due to vitamin K deficiency and are slightly at risk for abnormal bleeding…Coeliac disease is associated with a number of other medical conditions, many of which are autoimmune disorders: diabetes mellitus type 1, hypothyroidism, primary biliary cholangitis, microscopic colitis, gluten ataxia, psoriasis, vitiligo, autoimmune hepatitis, dermatitis herpetiformis, primary sclerosing cholangitis, and more. A more controversial area is a group of diseases in which antigliadin antibodies (an older and nonspecific test for coeliac disease) are sometimes detected but no small bowel disease can be demonstrated. Sometimes these conditions improve by removing gluten from the diet. This includes cerebellar ataxia, peripheral neuropathy, schizophrenia, and autism.”

“Complications of Celiac Disease...In adults, the digestive symptoms may be less common and the signs or symptoms of celiac disease may be related to the long-term effects of poor absorption. Some of the more common complications include: Malnutrition…Bone loss…Lactose intolerance…Irritability and depression…Lymphoma and bowel cancer…Low birth-weight babies….Dental defects.”

“The broad spectrum of celiac disease and gluten sensitive enteropathy...The classical symptoms include gastrointestinal-related symptoms such as diarrhea, steatorrhea and weight loss due to malabsorption. About 50% of CD patients present extra intestinal or atypical symptoms, such as anemia, osteoporosis, dermatitis herpetiformis, neurological problems and dental enamel hypoplasia.”

“Enamel Hypoplasia…Some of the signs of enamel hypoplasia are obvious, but others are more difficult to detect and may not be noticeable until they cause major dental problems. Having thin tooth enamel can lead to: pits, tiny groves, depressions, and fissures; white spots; yellowish-brown stains (where the underlying layer of dentin is exposed); sensitivity to heat and cold; lack of tooth contact, irregular wearing of teeth; susceptibility to acids in food and drink; retention of harmful bacteria; increased vulnerability to tooth decay and cavities.”

“Celiac disease is also known as coeliac disease, celiac sprue, non-tropical sprue, and gluten sensitive enteropathy.”

“What’s really behind ‘gluten sensitivity’?...The patients weren't crazy—Knut Lundin was sure of that. But their ailment was a mystery. They were convinced gluten was making them sick. Yet they didn't have celiac disease, an autoimmune reaction to that often-villainized tangle of proteins in wheat, barley, and rye. And they tested negative for a wheat allergy. They occupied a medical no man's land.”
“3 Reasons Gluten Intolerance May Be More Serious Than Celiac Disease...Recent news stories have downplayed the significance of non-celiac gluten sensitivity, even going as far as suggesting that it doesn’t exist. But a growing body of evidence has proven that gluten intolerance is not only real, but is potentially a much larger problem than celiac disease.” [chriskresser.com](https://chriskresser.com/3-reasons-gluten-intolerance-may-be-more-serious-than-celiac-disease/)


“Gluten intolerance: Dangerous gut-wrenching experience for some...Owing to these destructive responses of gluten, it may cause cancer or mutations. Sometimes, this protein can also lead to neurological disorders, epilepsy or schizophrenia...It can also lead to height shortening, affects normal growth of the body and overall cognition difficulties” [www.thehealthsite.com](http://www.thehealthsite.com/news/gluten-intolerance-dangerous-gut-wrenching-experience-for-some/)

“Gluten: The Whole Story...Gluten troubles were once thought to be a problem primarily for those with celiac disease. But recent research indicates that gluten-related disorders extend to a far broader population, and affect far more than the digestive system....In her 20s, she was plagued by debilitating headaches, joint pain and fatigue. “I could hardly get out of bed in the morning,” she says. “I was 25 but felt 85.”...Within two weeks of going gluten-free, her stomach stopped hurting after meals — a first. Within a few short months, her fatigue, joint pain and headaches all vanished. Testing confirmed her suspicion — gluten was the guilty party. But Stevens doesn’t have celiac disease; she has an intolerance to gluten, an increasingly common diagnosis.” [https://experiencelife.com/article/gluten-the-whole-story/](https://experiencelife.com/article/gluten-the-whole-story/)

“Gluten can devastate brain and nervous system...For most people the intolerance manifests in the skin, the joints, the thyroid, etc. In fact, the tissues most commonly affected by gluten are brain and nervous tissue. Studies have found associations between gluten sensitivity and disorders in every major part of the nervous system, including the brain, the spinal cord, and the nerves that extend into the arms and feet.” [brainhealthbook.com](http://brainhealthbook.com/gluten-can-devastate-brain-nervous-system/)

“Gluten affects brain development and function...If your brain is not working or if you have a neurological disease you must be properly tested for the entire spectrum of gluten sensitivity and not just for the limited markers for celiac disease.” [brainhealthbook.com](http://brainhealthbook.com/gluten-affects-brain-development-function/)

“Gluten Triggers Strange Delusions in Woman with Celiac Disease...The 37-year-old woman, whose case was described in the report, was studying for her Ph.D. when she started having delusions...celiac disease can manifest itself in many different ways in the brain and nervous system, Fasano said. Complications can range from mild problems, such as short-term memory loss, to severe consequences, such as seizures.” [https://www.livescience.com/55166-celiac-disease-gluten-psychosis.html](https://www.livescience.com/55166-celiac-disease-gluten-psychosis.html)

“So Sleepy After Eating Pizza........It very well could be a gluten reaction. Since you handle whole wheat tortillas fine then it could be blood sugar related or related to the dairy or nightshades in the pizza.” [www.celiac.com](https://www.celiac.com/forums/topic/80637-so-sleepy-after-eating-pizza/)

“After that cheat meal, I felt absolutely HORRIBLE. Lethargic, major brain fog, grumpy,
splitting headache. I woke up in the night with terrible diarrhea, and the next morning, I had what felt like a migraine. My head hurt so badly that I didn't want to move, and I was extremely sensitive to light. My stomach also felt turbulent, and I continued to have diarrhea throughout the day. I was so sick that I had to miss work that day. From that point on, I was committed to NOT let myself eat wheat anymore.”

- “3 Ways To Tell if You Have a Gluten Sensitivity...The symptoms of gluten sensitivity can show up basically anywhere in the body depending on your susceptibility...Researchers only recently (in 2011) named gluten sensitivity and have not yet determined a standard test for diagnosing it. It is not diagnosed with the same tests that are used to diagnose Celiac disease.”

- “Can Gluten Intolerance Cause Damage to Your Heart?...Allergic Reactions...can cause irreversible heart damage, and can starve your heart and other major organs of oxygen...Vitamin and Mineral Deficiencies... The nutritional deficiencies and the additional workload can cause heart damage and heart failure...Edema...If too much fluid builds up in your body and your heart isn't able to compensate, it's known as congestive heart failure.... diabetes increases your risk of heart disease and makes you more likely to have a heart attack or stroke. You're also more likely to develop thyroid function problems, which can cause heart palpitations and high blood pressure.”

- “Celiac disease is linked to pericardial arrhythmia in several ways. Because the villi in the small intestine are under attack, the body isn't absorbing all the vitamins and minerals it needs to maintain proper cardiac function. Damage to the intestine walls also makes it easier for infection-causing bacteria and fungi to pass from your stomach into the bloodstream, where they can reach the pericardium.”

- “Cardiac Issues Associated with Celiac Disease and Gluten Intolerance EP023...Given the choice between a heart transplant and a gluten-free diet, the vast majority – if not all – of us would quickly opt for the diet! Yet the medical community continues to ignore celiac disease as a potential cause of cardiac complications, despite documented connections between the two conditions.”

- “Wheat And Atrial Fibrillation? A Look At the Correlation...Why might wheat elimination yield a reduction in A Fib? As there are no formal explorations of this phenomenon, I can only speculate. Could it work through some reduction in inflammatory signals or reduction in glycation? Is it a consequence of blood-borne wheat germ agglutinin? Might gliadin-derived opiate peptides play a role?”

- “Raised Heart-Trouble Risk Seen in Celiac Patients...People with celiac disease have a nearly twofold increased risk of heart disease compared to those without the chronic digestive disorder, according to a new study.”

- “Cardiovascular involvement in celiac disease...Based on the published research, it can be concluded that many types of cardiovascular issues can occur in untreated CD patients, but that most tend to resolve on a GFD, often in conjunction with the healing of small intestinal villous atrophy. However, in some cases the alterations are irreversible, underscoring the need for CD
“Could Lung Inflammation Be Related To Celiac?...Gluten Sensitivity can definitely cause inflammation in the lungs. My husband suffered from Asthma since he was 8 years old (32 now) and after 6 months gluten free he can now run without dying. Very, very cool. Gluten causes inflammation as the body attacks itself. If it attacks the villi in the small intestine we call it Celiac. If it attacks the thyroid we call it Hypo/Hyperthyroidism. If it attacks the lungs we call it asthma or likely one of those other names previously mentioned. If it is inflamed there is a better than good chance gluten is your culprit. Try going gluten-free for a month and see how you feel. Better then any biopsy or blood test.”

“The Relationship Between the Respiratory System and Celiac Disease EP028...Today Nadine explores the relationship between the lungs and celiac disease, offering anecdotal evidence as well as explaining the way that inflammation can lead to a number of respiratory problems. Because 70-90% of your immune system is housed in your intestines, it is no surprise that a leaky gut could make you more vulnerable to respiratory tract infections.”

“Hungry for Air...I watched him struggle with air hunger many times on the court. He didn’t call it that. His camp attributed it to asthma...His on-court breathing problems disappeared, and he began winning major tournaments. Lots of them, and he quickly ascended to number one in the world. The following year he revealed that he’d learned he had a severe sensitivity to gluten, and that purging his body of the protein had a profound and positive effect on his breathing.”

“Anaemia can lead to oxygen ‘starvation’...Iron deficiency anaemia can also occur if there is insufficient dietary iron, which is more likely in vegetarians, or when the body cannot absorb iron in the food, such as in gluten allergy or after surgical removal of part or all of the stomach (gastrectomy).”

“Celiac Disease and Anemia... In people with celiac disease, vitamin B12 deficiency is usually due to damage to the lower part of the small intestine, which is one of the places vitamin B12 is absorbed...Symptoms you may experience: Fatigue, weakness, irritability, pale skin, headaches, brittle nails, decreased appetite, increased susceptibility to infections, and a decreased attention span in kids... It is important to give the gluten-free diet time to have its effect: it may take between 2-18 months until nutritional deficiencies are corrected.”

“Insomnia: 12 Reasons Why You May Not Be Sleeping at Night...REASON 8: Gluten and other food sensitivities. Sleep issues are common in patients with celiac disease as well as those with non-celiac gluten sensitivity, even if they are following a gluten-free diet. I find that many patients with multiple food sensitivities and with leaky gut tend not to sleep well, and that when they eliminate foods based on an IgG and IgA food panel, they report improved sleep. It may seem hard to believe that the gut and brain are so interconnected, but research is now proving the link referred to as the “gut-brain axis.””

“What role does a gluten-free or lactose-free diet play in reducing cancer risk?...A: For people who have celiac disease, closely following a gluten-free diet is vital. Gluten is a protein in...
wheat, rye and barley that poses no risk to most people, but for people with this condition, it damages the intestines and that could increase risk of cancer.”  [http://www.aicr.org/press/health-features/health-talk/2013/04apr2013/gluten-free-diet-cancer.html]

- “Celiac Disease and Cancer.  What Types of Cancer are Associated with Celiac Disease?  There are 3 types of cancer associated with celiac disease: enteropathy-associated T-cell lymphoma (EATL), non-Hodgkin’s lymphoma, and adenocarcinoma of the small intestine.”  [https://www.beyondceliac.org/celiac-disease/related-conditions/cancer/]

- “Nadine Grzeskowiak, RN, BSN, CEN began her nursing career in 1992 working in emergency, trauma and critical care at hospitals throughout Oregon. In 2006, she was diagnosed with celiac disease, a disease she had never heard of before, even as a nurse. At the time of diagnosis, at the age of 40, she expected to be dead within 6 months due to multi-system organ failure. Within two weeks of beginning a gluten free diet her health began to improve markedly which led to a life and career-changing shift. Nadine found three nursing businesses shortly thereafter: RN On Call, Inc. in February 2007, Gluten Free RN in March 2007 followed by Celiac Nurse Consulting.”  [http://a.co/hsOZFGN]

- “Is Celiac Disease On the Rise?...Celiac disease only started being diagnosed in the first years of this century, making it difficult to track long-term increases. Yet one Minnesota study compared blood samples taken from young adults in the Air Force in the fifties with a similar age group starting in 1995 and found an .8 percent increase, from .2 percent to the national average of 1 percent. It appears that rates are indeed increasing.”  [https://bigthink.com/21st-century-spirituality/is-celiac-disease-on-the-rise]

- “Doctor Horror Stories...You know what the average time is for a celiac diagnosis? 10 years...So over 16 years after me presenting with the very scary symptoms, and making plans to gradually leave work due to sickness (at the age of 34), I finally got diagnosed...It took 30 years to figure out what was wrong. In that time I saw 60-70 different doctors, got tested for a ton of stuff (can we say the majority of these were intrusive and uncomfortable, if not downright painful) and had more drugs thrown at me than you can shake a stick at.”  [https://glutendude.com/doctor-horror-stories/]

- “Is Being Gluten-Intolerant an American Problem?  One reader asks why gluten-intolerance is so prevalent in America, but not in Europe... A quick Google search turned up many similar stories of those in the United States who believed they were gluten-intolerant but had no trouble eating wheat in Europe.”  [https://www.motherearthnews.com/real-food/gluten-intolerant-zm0z13aszmar]

- “New study shows gluten and dairy cause brain autoimmunity...a significant portion of the US population not only reacts to gluten and dairy but also that this reaction causes the immune system to destroy brain and nervous tissue in a scenario called neurological autoimmunity (as evidenced by positive tissue antibodies). With the explosion of Alzheimer’s, Parkinson’s, autism, childhood development disorders, and other brain disorders happening today, these findings confirm what many clinicians have already seen in their practice: removing gluten and dairy from the diet has a profoundly positive impact on brain health in many people.”  [http://brainhealthbook.com/new-study-shows-gluten-dairy-cause-brain-autoimmunity/]


- “Symptoms and Treatment of fructose malabsorption...bloating.  Flatulence.  diarrhoea or soft
stool (often smelly) / constipation. Nausea. stomach ache. abdominal cramps....Dizziness. Reflux. Heartburn. Tiredness. Depressive moods. Headache (to the point of migraine)”

- “Fructose Malabsorption. Is it the cause of my tummy troubles?...The symptoms of celiac disease and non-celiac gluten sensitivity (NCGS) can be very similar to the symptoms of fructose malabsorption. Thus, the diagnoses’ may often be confused. Fructose malabsorption can also mimic lactose/milk intolerance- a common diagnosis amongst celiac and NCGS patients. Fructose malabsorption (FM) may also be seen with celiac disease or NCGS and should be considered in these patients who are already on a gluten free diet, yet have ongoing symptoms.”

- “10 Fructose Malabsorption Symptoms...1. Bloating. 2. Flatulence. 3. Reflux. 4. Stomach pain. 5. Nausea/Vomiting. 6. Diarrhea/Constipation. 7. Fatigue. 8. Mental depression. 9. Headaches/Brain Fog. 10. Mood changes...Fructose malabsorption will thus lead to many nutrient deficiencies, specifically of folic acid, iron, tryptophan, and zinc, and vitamins C, D, and E. All of these nutrients are vital for different operating systems in the body, and especially are related to healthy brain function.”

- “Fructose malabsorption...There is no known cure, but an appropriate diet and the enzyme xylose isomerase can help.[4] The ingestion of glucose simultaneously with fructose improves fructose absorption and may prevent the development of symptoms. For example, people may tolerate fruits such as grapefruits or bananas, which contain similar amounts of fructose and glucose, but apples are not tolerated because they contain high levels of fructose and lower levels of glucose.”

- “Fructose Malabsorption and Hypoglycemia...I have read somewhere but don't remember where, that Fructose Malabsorption might cause Reactive Hypoglycemia or at least exacerbate it. What I have noticed is that tend to reach more negatively to fruits than to starches, even if starches have an high GL and GI.”

- “Idiopathic postprandial syndrome. Idiopathic postprandial syndrome, colloquially but incorrectly known by some as hypoglycemia, describes a collection of clinical signs and symptoms similar to medical hypoglycemia but without the demonstrably low blood glucose levels which characterise said condition. People with this condition suffer from recurrent episodes of altered mood and cognitive efficiency, often accompanied by weakness and adrenergic symptoms such as shakiness. The episodes typically occur a few hours after a meal, rather than after many hours of fasting. The principal treatments recommended are extra small meals or snacks and avoidance of excessive simple sugars.”

- “Is There A Connection Between Hypoglycemia and Thyroid Conditions? Hypoglycemia is a common condition where the blood sugar levels are low. Reactive hypoglycemia is due to the excessive secretion of insulin, usually after someone eats a meal. On the other hand, spontaneous or functional hypoglycemia usually occurs in between meals, and both types of hypoglycemia can develop due to insulin resistance, hypothyroidism, weak adrenals, as well as other conditions.”
“Functional Hypoglycemia: Facts and Fancies. When blood glucose decreases below a given threshold, symptoms of cerebral dysfunction and/or adrenergic hyperactivity appear. If this occurs postprandially in otherwise normal subjects, a diagnosis of reactive or functional hypoglycemia may be proposed.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2153490/

“Reactive hypoglycemia, postprandial hypoglycemia, or sugar crash is a term describing recurrent episodes of symptomatic hypoglycemia occurring within four hours[1] after a high carbohydrate meal in people both with and without diabetes.[2] The term is not a diagnosis per se since it requires an evaluation to determine the cause of the hypoglycemia.[3] The condition is related to homeostatic systems utilised by the body to control the blood sugar level. It is described as a sense of tiredness, lethargy, irritation, or hangover, although the effects can be lessened if a lot of physical activity is undertaken in the first few hours after food consumption.” https://en.m.wikipedia.org/wiki/Reactive_hypoglycemia

“In 2018 I became aware through dietary changes that I was Gluten, Fructose and Lactose intolerant and was experiencing several hours of chronic fatigue after eating certain foods, which is consistent with Reactive or Functional Hypoglycemia.” Steven Magee CEng MIET - Q

“I can eat it. Taking a bite out of food allergies...Currently, about 8 percent of children in the United States and about 2 percent of adults have diagnosed food allergies. It’s a mysterious epidemic. The rate of food allergies has more than doubled over the past decade and appears to be rising, with the rate highest among preschoolers. (Many more people self-identify as food allergic, but they are actually suffering from food intolerances or sensitivities.)” https://stanmed.stanford.edu/2014fall/i-can-eat-it.html

“Intestinal permeability....The opening of intercellular tight junctions (increased intestinal permeability) can allow passage of microbes, microbial products, and foreign antigens into the mucosa and the body proper. This can result in activation of the immune system and secretion of inflammatory mediators.[12] Increased intestinal permeability is a factor in several diseases, such as Crohn's disease, celiac disease,[13] type 1 diabetes,[14] type 2 diabetes,[13] rheumatoid arthritis, spondyloarthopathies,[15] inflammatory bowel disease,[8][16] irritable bowel syndrome,[9] schizophrenia,[17][18] certain types of cancer,[8] obesity,[19] fatty liver,[20] atopy and allergic diseases,[14] among others. In the majority of cases, increased permeability develops prior to disease,[8] but the cause–effect relationship between increased intestinal permeability in most of these diseases is not clear.[16][21] A well studied model is celiac disease, in which increased intestinal permeability appears secondary to the abnormal immune reaction induced by gluten and allows fragments of gliadin protein to get past the intestinal epithelium, triggering an immune response at the intestinal submucosa level that leads to diverse gastrointestinal or extra-gastrointestinal symptoms.[22][23] Other environmental triggers may contribute to altered permeability in celiac disease, as intestinal infections and iron deficiency.[22] Once established, this increase of permeability might self-sustain the inflammatory immune responses and perpetuate a vicious circle.[22] Eliminating gluten from the diet leads to normalization of intestinal permeability and the autoimmune process shuts off. [24]” https://en.m.wikipedia.org/wiki/Intestinal_permeability#Clinical_significance

“Ionizing radiation is commonly used to treat a number of malignancies. Although highly effective and now more targeted, many patients suffer side effects. The number of cancer survivors has increased and so there are more patients presenting with symptoms that have arisen as a result of radiotherapy. Radiation damage to small bowel tissue can cause acute or chronic radiation enteritis producing symptoms such as pain, bloating, nausea, faecal urgency, diarrhoea and rectal bleeding which can have a significant impact on patient’s quality of life.
This review outlines the pathogenesis of radiation injury to the small bowel along with the prevention of radiation damage via radiotherapy techniques plus medications such as angiotensin-converting enzyme inhibitors, statins and probiotics. It also covers the treatment of both acute and chronic radiation enteritis via a variety of medical (including hyperbaric oxygen), dietetic, endoscopic and surgical therapies.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3871275/

- “If you know that you have had radiation sickness, then you should be suspecting that radiation induced food intolerance may be present.” Steven Magee CEng MIET - Q
- “If you damage your digestive tract, you may end up with food intolerance that lead to mineral and vitamin deficiencies that may have profound effects on your physical and mental health.” Steven Magee CEng MIET - Q
- “People with radiation intestinal damage should adopt a low FODMAP diet that is gluten free.” Steven Magee CEng MIET - Q
- “The Complete Low-FODMAP Diet: A Revolutionary Plan for Managing IBS and Other Digestive Disorders by Sue Shepherd PhD et al.” http://a.co/d/d0iQUy1
- “Radiation Therapy Side Effects...Many people who get radiation therapy have fatigue. Fatigue is feeling exhausted and worn out. It can happen all at once or come on slowly. People feel fatigue in different ways and you may feel more or less fatigue than someone else who is getting the same amount of radiation therapy to the same part of the body.”

https://www.cancer.gov/about-cancer/treatment/types/radiation-therapy/side-effects

- “Non-Hodgkin Lymphoma Risk Factors...Studies of survivors of atomic bombs and nuclear reactor accidents have shown they have an increased risk of developing several types of cancer, including NHL, leukemia,and thyroid cancer. Patients treated with radiation therapy for some other cancers, such as Hodgkin lymphoma, have a slightly increased risk of developing NHL later in life. This risk is greater for patients treated with both radiation therapy and chemotherapy.”


- “Radiation Exposure in Pregnancy...Fetal overexposure to radiation could result in an increased risk of childhood leukemia and cancer.”


- “Commercial for Asthma Medication Features Unsafe Use of Technology. Respiratory Health Is Affected by Cell Phone and WiFi Radiation and Electrical Pollution (Electrosmog).”


- “Do You Have Respiratory Issues? Exposure to Cell Phone Radiation, “Dirty Electricity”, WiFi and Other Sources of Electrosmog Can Make It Worse...Besides also boosting possible cancer risk, research has confirmed that exposure to cell phone and WiFi radiation and/or Electrosmog has a cumulative toxic effect when combined with other toxins. Research has confirmed that exposure can increase pre-existing conditions even if it didn’t cause them.”


- “ALLERGIES & RADIATION REPORT. The discovery that radiation, coupled with other elements, produces allergies is new with this report and my upcoming book. The pieces have been there, independently found by others, but never put together. Using this new information,

- “After living an allergy free life, I developed seasonal allergies after having a CT X-Ray radiation scan of my lungs.” Steven Magee CEng MIET - Q
- “Radiation Exposure...If you are exposed to small amounts of radiation over a long time, it raises your risk of cancer. It can also cause mutations in your genes, which you could pass on to any children you have after the exposure.” [https://medlineplus.gov/radiationexposure.html](https://medlineplus.gov/radiationexposure.html)
Altitude Diseases: Radiation Damage

- “AIRCREW SAFETY & HEALTH. Cosmic Ionizing Radiation. What you need to know. Aircrew and passengers are exposed to cosmic ionizing radiation on every flight. Here you can learn more about cosmic ionizing radiation, how you can be exposed, exposure levels, and possible health effects...Are there any known health effects from cosmic ionizing radiation? The World Health Organization (WHO) International Agency for Research on Cancer (IARC) states that ionizing radiation causes cancer in humans. Ionizing radiation is also known to cause reproductive problems. We are looking more specifically at whether cosmic ionizing radiation is linked to cancer and reproductive problems. Most studies of radiation health effects have looked at groups with much higher radiation doses from different kinds of radiation (atomic bomb survivors; patients who received radiation therapy).”[12](https://www.cdc.gov/niosh/topics/aircrew/cosmicionizingradiation.html)
- “Air travel exposes you to radiation – how much health risk comes with it?...You might guess that a frequent flyer’s radiation dose is coming from the airport security checkpoints, with their whole-body scanners and baggage x-ray machines, but you’d be wrong. The radiation doses to passengers from these security procedures are trivial. The major source of radiation exposure from air travel comes from the flight itself. This is because at high altitude the air gets thinner. The farther you go from the Earth’s surface, the fewer molecules of gas there are per volume of space. Thinner air thus means fewer molecules to deflect incoming cosmic rays – radiation from outer space. With less atmospheric shielding, there is more exposure to radiation.”[13](http://theconversation.com/air-travel-exposes-you-to-radiation-how-much-health-risk-comes-with-it-78790)
- “What's to know about radiation sickness?...Living at a higher altitude, for example, in the plateau of New Mexico and Colorado, increase exposure, as does traveling in an airplane. Radon gas in homes also contributes...The many activities that can expose people to sources of radiation include: watching television, flying in an airplane, passing through a security scanner, using a microwave or cell phone”[14](https://www.medicalnewstoday.com/articles/219615.php)
- “Backgrounder on Biological Effects of Radiation...This natural radiation that is always present is known as ”background” radiation. Background levels can vary greatly from one location to the next. For example, Colorado, because of its altitude, has more cosmic radiation than the East or West Coast. It also has more terrestrial radiation from soils rich in naturally-occurring uranium. So people living in Colorado are exposed to more background radiation than residents of the coasts.”[15](https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/bio-effects-radiation.html)
- “Radiation in Everyday Life...The term ”radiation” is very broad, and includes such things as light and radio waves. In our context it refers to ”ionizing” radiation, which means that because such radiation passes through matter, it can cause it to become electrically charged or ionized. In living tissues, the electrical ions produced by radiation can affect normal biological processes...The radiation exposure due to cosmic rays is very dependent on altitude, and slightly on latitude: people who travel by air, thereby, increase their exposure to radiation.”[16](https://www.iaea.org/Publications/Factsheets/English/radlife)
- “How harmful is low-level radiation?...radiation is cumulative. Most scientists agree there’s no such thing as a harmless dose...What comes from medical X-rays, airport scanners, leaking nuclear plants and similar sources is ionizing radiation — the dangerous kind, capable of...
causing cancer, increasingly so as time and dosage increase...Studies of the body’s reaction to low levels of radiation have shown that as exposure increases, it causes the same cancers as very high doses although in far smaller numbers. Thyroid cancer and leukemia can follow after years of chronic overexposure. Later, in 10 or 15 years, come lung cancer, skin cancer, multiple myeloma and cancers of the breast and stomach.”


- “Do x-rays and gamma rays cause any other health problems?...Doses of radiation such as those given in radiation therapy also cause side effects. Short-term side effects depend on the area being treated but often include skin changes (ranging from mild reddening to something like a severe burn), nausea, vomiting, diarrhea, and low blood cell counts. There is also a risk of long-term side effects, which again vary depending on the area being treated. For example, radiation to the head and neck area can lead to problems with dry mouth and trouble swallowing. Radiation can weaken bones, so that they are more likely to break later on. Radiation to the bone marrow can lead to long-term problems with blood cell counts and even a disease called aplastic anemia. Radiation can also lead to infertility (problems getting pregnant or fathering children)” https://www.cancer.org/cancer/cancer-causes/radiation-exposure/x-rays-gamma-rays/other-health-problems.html

- “What does radiation from a nuclear disaster actually do to our bodies?...The combination of how much radiation you are exposed to, what type, and how often will determine the effect on your cells and tissues. Low doses of nuclear radiation are more likely to change cells by modifying DNA, while high doses tend to kill cells. So long-term exposure to low doses of radiation increase the odds of getting cancer, while a single high dose will quickly cause immediate damage to cells and tissues — a process used effectively to kill tumour cells in radiation therapy.” https://www.abc.net.au/news/science/2016-04-22/what-nuclear-radiation-does-to-your-body/7346324

- “Long Term Effects of Low Level Radiation- and How to Prevent Them...ABC, CBS, CNN, Pres. Obama- they're all saying radiation levels are low in the US and of no concern to Americans. If you're reading this site, we doubt you're one of the Sheeple believing this garbage. But its not enough to know we're being poisoned, what can we practically do to prevent negative long term effects from the radiation spewing from Fukushima?” http://silverdoctors.blogspot.com/2011/04/long-term-effects-of-low-level.html

- “Radiation-induced cognitive decline describes the possible correlation between radiation therapy and mild cognitive impairment. Radiation therapy is used mainly in the treatment of cancer. Radiation therapy can be used to cure care or shrink tumors that are interfering with quality of life. Sometimes radiation therapy is used alone; other times it is used in conjunction with chemotherapy and surgery. For people with brain tumors, radiation can be an effective treatment because chemotherapy is often less effective due to the blood–brain barrier.[citation needed] Unfortunately for some patients, as time passes, people who received radiation therapy may begin experiencing deficits in their learning, memory, and spatial information processing abilities. The learning, memory, and spatial information processing abilities are dependent on proper hippocampus functionality. Therefore, any hippocampus dysfunction will result in deficits in learning, memory, and spatial information processing ability.” https://en.wikipedia.org/wiki/Radiation-induced_cognitive_decline

- “Radiation Therapy Side Effects on the Immune System...The immune system is responsible for keeping your body healthy and safe from attack by bacteria, viral and fungal infections. The immune system also helps the body heal wounds and damage to the skin or internal organs.
Protecting you from germs, the immune system is made up of networks of organs, cells and tissues that are biologically programmed to destroy foreign organisms that may harm you. A compromised immune system can't work efficiently to protect the body, leaving you open to illness or disease. Individuals undergoing radiation therapy may experience some damage to the body's immune system.”

- “Possible Side Effects of Radiation Treatment for Brain Tumors...Fatigue is very common with radiation treatment and tends to begin a few weeks into therapy. Fatigue typically resolves slowly over the weeks and months following treatment. Hair loss may occur where you received radiation. Hair typically starts to regrow a month or so after treatment. However, your hair might not grow back exactly as it was before treatment and for some, the hair loss becomes permanent. Muffled hearing: Your hearing may become muffled during treatment. This typically resolves in 2-4 weeks after finishing treatment. Skin irritation: The skin in the treatment area may become red, irritated, dry, or sensitive. This may start to look like a sunburn. Treat the skin gently to avoid further irritation, and bathe carefully, using only warm water and mild soap. Avoid perfumed or scented lotions or soaps, as these may cause more irritation. Avoid sun exposure, which can worsen the irritation. Some short-term memory loss and difficulty thinking can occur if you are treated with whole-brain radiation therapy. Brain tissue swelling can develop during treatment. You may get a headache or feel pressure in your head if this occurs. The health care team watches for signs of this problem and may prescribe medications to decrease swelling. Let the team know if you experience these symptoms...you should be aware of these possible long-term effects: There is a low risk of developing a second cancer in or near the radiation field. These are called secondary cancers, and they develop as a result of the exposure of healthy tissue to radiation. Modern radiation techniques are designed to limit this exposure, but it is not always possible to prevent all exposure and still achieve the desired outcomes. Radiation necrosis: Rarely, a mass of dead (necrotic) tissue forms at the site of the tumor. If this occurs, it usually develops months to years after radiation is given. Surgery may be needed to remove the necrotic tissue. Damage to healthy brain tissue: Although rare, this side effect can cause headaches, seizures, or even death. Harm to the pituitary gland and other areas of the brain can happen, which can affect hormone levels in the body, including thyroid and sex hormones. Damage to the pituitary gland can affect future fertility for women and cause sexuality concerns for men. Your provider may prescribe synthetic hormones to manage these changes. Loss of some brain function can occur if large areas of the brain receive radiation. There may also be other symptoms that develop as a result of damage to healthy brain tissue. These symptoms depend on what the treated area of the brain controls and how much radiation was given. These risks must be weighed against the risks of not using radiation and having less impact on the tumor.”

- “Radiation enteropathy is a syndrome that may develop following abdominal or pelvic radiation therapy for cancer.[1][2] Many affected people are cancer survivors who had treatment for cervical cancer or prostate cancer; it has also been termed pelvic radiation disease with radiation proctitis being one of the principal features...People who have been treated with radiotherapy for pelvic and other abdominal cancers frequently develop gastrointestinal symptoms.[2][3] These include: rectal bleeding, diarrhea and steatorrhea, other defecation disorders including fecal urgency and incontinence, nutritional deficiencies and weight loss, abdominal pain and
bloating, nausea, vomiting and fatigue. Gastrointestinal symptoms are often found together with those in other systems including genitourinary disorders and sexual dysfunction. The burden of symptoms substantially impairs the patients’ quality of life. Nausea, vomiting, fatigue and diarrhea may happen early during the course of radiotherapy. Radiation enteropathy represents the longer-term, chronic effects which may be found after a latent period most commonly of 6 months to 3 years after the end of treatment. In some cases, it does not become a problem for 20–30 years after successful curative therapy.”


- "What will astronauts need to survive the dangerous journey to Mars?...“The biggest and most promising field for countermeasure development is antioxidants,” Guida says. High-energy charged particles can cause damage by splintering water molecules in the body into toxic compounds called reactive oxygen species. Priming the body with antioxidants could help neutralize some of those reactive oxygen species and curb their effects. Options include vitamins A and E, as well as selenomethionine, an ingredient found in some dietary supplements. “All these have shown at various levels to decrease the negative effects of radiation,” he says."  

https://www.sciencenews.org/article/astronauts-mars-space-health-survival
Altitude Diseases: Magee’s Radiation Induced Colon Cleansing

- “After several extreme very high altitude night shifts, returning to sea level and exposure to increased oxygen and bright sunlight would bring on intestinal pains and diarrhea after eating the first large meal.” Steven Magee CEng MIET – Q
- “I call sunlight induced diarrhea “Magee’s Radiation Induced Colon Cleansing”.
- “Does short sun exposure cause diarrhea even without stomach cramping?...This morning I was sitting indoors with the windows closed but in the sun, just getting warm. I must have sat in the sun for 1 and a half hours and it felt really good, no skin burn or anything, but about 1 hour later I had really watery diarrhea. I know it was nothing I ate because all I had was oatmeal, which is what I usually have in the morning. I didn't have a stomach ache, so where is the diarrhea coming from?” https://www.medhelp.org/posts/Undiagnosed-Symptoms/Does-short-sun-exposure-cause-diarrhea-even-without-stomach-cramping/show/1468892
- “sun and diarrhea...Just wondering if anyone here is affected by the sun shining brightly. Every time I'm in bright sunlight I need the bathroom two minutes later. I was wondering if this had to do with the crohns...I did read something about the sun having an effect on the digestive system in some people.” https://www.healingwell.com/community/default.aspx?f=17&m=1534222
Altitude Diseases: Effect of radiation on the human reproductive system

- "Effect of radiation on the human reproductive system...Irradiation may have a profound effect on reproductive function. The schedule of the delivered irradiation (total dose, number of fractions, and duration) is an important determinant of the radiobiological effect on the tissues involved and varies among different tissues and organs. Irradiation to the central nervous system may affect the timing of the onset of puberty, result in hyperprolactinemia, or cause gonadotropin deficiency if the hypothalamic-pituitary axis is involved in the radiation field. Direct irradiation to the testis will, in lower doses, affect the germinal epithelium: doses of irradiation greater than 0.35 Gy cause aspermia, which may be reversible. The time taken for recovery increases with larger doses; however, with doses in excess of 2 Gy aspermia may be permanent. At higher radiation doses (> 15 Gy), Leydig cell function will also be affected. In addition to radiation dose, the vulnerability of the testis is dependent on the age at irradiation and the pubertal status of the male. In the female, the response of the ovary to the effects of irradiation varies with age as well as dose, and separation of ovarian dysfunction into hormonal and fertility effects is not clearcut. An ovarian dose of 4 Gy may cause a 30% incidence of sterility in young women, but 100% sterility in women over 40 years of age. Pelvic irradiation may also have a profound effect on the uterus, with arrested growth in the prepubertal girl, and failure of uterine expansion during pregnancy with subsequent miscarriages and premature labor." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1519954/]
Altitude Diseases: Light & Biological Effects (Daytime)

- "Simple Overview of Osha Lighting Requirements for the Workplace...OSHA standard 1926.56 established minimum lighting requirements in foot-candles ((ftc.) which is the amount of illumination produced by a candle from 1 foot distance) for a variety of work environments which include offices, hallways and exit ways. OSHA requires that a workspace environment be specifically organized to reduce glare and excessive lighting, which can result in eye strain and headaches." [https://www.makegreatlight.com/about-us/blog/simple-overview-osha-lighting-requirements-workplace](https://www.makegreatlight.com/about-us/blog/simple-overview-osha-lighting-requirements-workplace)


- "OSHA Lighting Standards for General Industries...General Lighting Requirements. As a rule, generalized lighting should be evenly distributed through the workplace, without gaps, so that workers can comfortably see and move throughout the workplace without straining their eyes. OSHA provides candle-feet breakdowns for various types of work as follows: First-aid stations, offices, and infirmaries: 30 foot-candles. General construction plants and shops: 10 foot-candles. General construction area: 5 foot-candles. Warehouses, walkways, corridors, exits, and other indoor spaces: 5 foot-candles. General underground work areas, including shafts and tunnels: 5 foot-candles. Concrete placement, waste areas, loading platforms, active storage areas, field maintenance areas, refueling areas, and excavation sites: 3 foot-candles." [https://www.ehsinsight.com/blog/osha-lighting-standards-for-general-industries](https://www.ehsinsight.com/blog/osha-lighting-standards-for-general-industries)

- "Exposure to Natural Light Improves Workplace Performance. Study links light exposure in the workplace to improved sleep and vitality...Compared to workers in offices without windows, those with windows in the workplace received 173 percent more white light exposure during work hours and slept an average of 46 minutes more per night. Workers without windows reported lower scores than their counterparts on quality of life measures related to physical problems and vitality. They also had poorer outcomes in measures of overall sleep quality, sleep efficiency, sleep disturbances and daytime dysfunction....Light is the main cue influencing circadian rhythms. Exposure to light turns the genes that control an organism’s internal clocks "on" and "off." Circadian rhythms dictate: sleep-wake cycles, hormone release, body temperature and other important bodily functions. Disruptions of circadian rhythms is directly linked to sleep disorders. Abnormal circadian rhythms have also been associated with obesity, diabetes, depression, bipolar disorder and seasonal affective disorder (SAD)." [https://www.psychologytoday.com/us/blog/the-athletes-way/201306/exposure-natural-light-improves-workplace-performance](https://www.psychologytoday.com/us/blog/the-athletes-way/201306/exposure-natural-light-improves-workplace-performance)

- "High altitude astronomical observatories tend to be windowless environments illuminated by florescent light." Steven Magee CEng MIET - Q

- "How Fluorescent Lights Affect You and Your Health...There were hundreds of studies done during the late 20th century that showed causal links between elongated exposure to fluorescent lights and various negative effects...humans usually awoke at sunrise and worked outdoors or, later in our history, by windows....There are a number of negative health effects that have been linked to working under fluorescent lights that are theorized to be caused by this disturbance to our circadian rhythms and the accompanying body chemistry mechanisms. These negative health effects may include: Migraines. Eye strain. Problems sleeping, due to melatonin suppression. Symptoms of Seasonal Affective Disorder or depression. Endocrine disruption"
and poor immune systems. Female hormonal/menstrual cycle disruption. Increases in breast cancer rates and tumor formation. Stress/Anxiety, due to cortisol suppression. Sexual development/maturation disruption. Obesity. Agoraphobia (anxiety disorder)"

https://www.thoughtco.com/how-fluorescent-lights-affect-you-1206641

- "Natural light actually provides measurable health benefits...most of us would prefer to live out our lives under the warmth of the sun rather than under the buzz and glare of fluorescent bulbs...Since mental health and sleep often go hand in hand, it’s not surprising that natural light affects both...for some people, exposure to fluorescent light appears to elicit an elevated stress response. With CFLs (compact florescent light bulbs) as your main light source day in and day out, this could increase your risk for migraines and eye strain. (P.S. Broken CFL bulbs can also emit dangerous amounts of mercury, so if you’ve got adventurous kids, keep these out of reach!)

https://www.healthline.com/health/natural-light-benefits#advocate-for-more-light

- "Visible light affects mitochondrial function and induces neuronal death in retinal cell cultures...The aim of this investigation was to provide support for the idea that when retinal neurons exist in a compromised energetic state, as is thought to occur for ganglion cells in glaucoma, then light as entering the eye can increase the likelihood of their demise (Osborne et al., 2006). In the present study we used primary rat retinal cultures where the neurons, as opposed to glia, are in an energetically compromised state reflected by the fact that they survive for no longer than 20 days (Wood et al., 2005). We found that light (400–760 nm) could induce neuronal death in these cultures and that this process is exacerbated when the energetic state is further compromised by serum deprivation. Moreover, the vitamin E derivative, trolox a known antioxidant significantly blunted the negative influence of light. These data provide strong support for the idea that light can act as a risk factor to already affected neurons, in situ (see Osborne et al., 2006)."


- "Low-Energy Lighting and Chronic Fatigue Syndrome (CFS/ME)...I have, over many years, been struck by the consistency with which a proportion of CFS/ME patients report adverse experiences in settings lit with fluorescent lights. This is especially, but not exclusively, amongst those in whom general light sensitivity is present; this tends to affect those with more severe disability, but can be present in less severely affected people...The effect of fluorescent lighting is immediate, and it generally means that the patient has to leave the environment (eg a store) or get the lights switched off (eg in clinics). The symptoms evoked vary from headaches and visual distortion, to more general increases in their wide-ranging CFS/ME symptoms, the latter being most common. In many cases, such exposures can trigger relapses that may last for days; I am aware of severe instances that have lasted for months.


- "5 Ways Lighting Can Make You Feel Tired at Work...Many people who spend their days under the harsh glare of artificial lights feel as if their bodies and brains are slowly shutting down. If your job requires you to spend a substantial amount of time indoors, consider the following five ways workplace lighting can make you feel tired...#1 Workplace Lighting Can Disrupt Your Circadian Rhythms...#2 Fluorescent Light Can Send Chaotic Visual Signals to Your Brain...#3 Overhead Lights Can Compound the Effects of Computers Screens...#4 Fluorescent Light Can Cause Fatigue-Inducing Glare...#5 Artificial Light is Shown to Impair Energy Production."

https://www.makegreatlight.com/about-us/blog/can-lighting-make-you-tired

- "Fluorescent lamps and health...This flickering can cause problems for some individuals with light sensitivity[1] and are associated with headaches and eyestrain. Such lamps are listed as
problematic for some individuals with autism, epilepsy,[2] lupus,[3] chronic fatigue syndrome, Lyme disease,[4] and vertigo.[5] Newer fluorescent lights without magnetic ballasts have essentially eliminated flicker:[6][7] Individuals with high flicker fusion threshold are particularly affected by these obsolete, electromagnetic ballasts: their EEG alpha waves are markedly attenuated and they perform office tasks with greater speed and decreased accuracy.[8] Ordinary people have better reading performance using frequency (50–60 Hz) electromagnetic ballasts than electronic ballasts, although the effect was large only for the case of luminance contrast.[9]... Ultraviolet radiation emitted by fluorescent lighting can increase an individual's exposure to carcinogenic radiation by 10 to 30 per cent per year, with an associated increased probability of contracting squamous cell carcinoma by 4 percent...The constituent high-energy visible light (some blue light) of CFLs can aggravate retinal diseases in susceptible people, but it is unlikely to occur...The inner-ear condition Ménière's disease can be aggravated by flicker. Sufferers of vertigo are recommended to not use fluorescent lights...Polymorphous light eruption is a condition affecting the skin thought to be caused by an adverse reaction to ultraviolet light. Its prevalence across Europe is 10-20% of the population. Artificial light sources may provoke the condition, and CFLs have been shown to produce an eruption...Chronic actinic dermatitis is a condition where a subject's skin becomes inflamed due to a reaction to sunlight or artificial light. Its prevalence in Scotland is 16.5 per 100,000 population. There is evidence that CFLs worsen the condition...The autoimmune disease lupus is exacerbated by CFLs...There is evidence that actinic prurigo is worsened by CFLs. This disease affects 3.3% of the general population...3.1% of the population suffer solar urticaria, a skin disorder affected by ultraviolet light. Some patients are directly affected by CFLs...Phytophotodermatitis may be aggravated by the additional levels of ultraviolet light emitted by CFLs...Patients undergoing photodynamic therapy are at additional risk of adverse photosensitive reactions caused by CFLs...Self-reporting suggests that 21% of chronic fatigue syndrome patients experience sensitivity to light but there have been no studies into the association between chronic fatigue syndrome and CFLs...One cause of cataracts is exposure to ultraviolet light. Provided the level of UV emission from lamps is within safe limits, and the lamp a sufficient distance away from the individual, there should be no increased risk of developing cataracts...There is evidence that flicker can cause seizures in patients with photosensitive epilepsy, but there has yet to be any evidence to date attributing seizures to compact fluorescent lamps...Self-reporting suggests fluorescent lamps aggravate dyslexia, but tests show that dyslexic patients are unable to detect flicker emanating from light sources. This opinion was updated by SCENIHR in 2012, with no significant changes from the opinion of 2008.[16]...Early studies suspected a relationship between the flickering of fluorescent lamps with electromagnetic ballasts and repetitive movement in autistic children.[10] However, these studies had interpretive problems[11] and have not been replicated...Fluorescent bulbs contain mercury, a toxic substance. The United States Environmental Protection Agency (EPA) provide safety guidelines for how to clean up a broken fluorescent bulb. Mercury can be harmful to children and developing fetuses, so children and pregnant women should avoid being in the area whilst a broken bulb is cleaned up.[17] Bulbs which have reached the end of their life should not be disposed of in normal trash, as this may release the mercury into the environment if the bulb is damaged...in rare cases individuals with solar urticaria (allergy to sunlight) can get a rash from fluorescent lighting, although this is true of any source of light.[24] Very photosensitive individuals with systemic lupus erythematosus may experience disease activity under artificial light. Standard acrylic diffusers over the fluorescent lamps absorb nearly all the
UV-B radiation and appear to protect against this.[25] One paper suggested that in rare cases, fluorescent lighting can also induce depersonalization and derealization; subsequently, it can worsen depersonalization disorder symptoms.[26] The charity Migraine Action Association reported concerns from members that CFL bulbs can cause migraines,[27] and there are many anecdotal reports of such occurrences."

https://en.wikipedia.org/wiki/Fluorescent_lamps_and_health

- "Depersonalization can consist of a detachment within the self, regarding one's mind or body, or being a detached observer of oneself.[1] Subjects feel they have changed and that the world has become vague, dreamlike, less real, lacking in significance or being outside reality while looking in.[not verified in body] Chronic depersonalization refers to depersonalization/derealization disorder, which is classified by the DSM-5 as a dissociative disorder,[2] based on the findings that depersonalization and derealization are prevalent in other dissociative disorders including dissociative identity disorder.[3] Though degrees of depersonalization and derealization can happen to anyone who is subject to temporary anxiety or stress, chronic depersonalization is more related to individuals who have experienced a severe trauma or prolonged stress/anxiety. Depersonalization-derealization is the single most important symptom in the spectrum of dissociative disorders, including dissociative identity disorder and "dissociative disorder not otherwise specified" (DD-NOS). It is also a prominent symptom in some other non-dissociative disorders, such as anxiety disorders, clinical depression, bipolar disorder, schizophrenia,[4] schizoid personality disorder, hypothyroidism or endocrine disorders,[5] schizotypal personality disorder, borderline personality disorder, obsessive–compulsive disorder, migraines, and sleep deprivation; it can also be a symptom of some types of neurological seizure. In social psychology, and in particular self-categorization theory, the term depersonalization has a different meaning and refers to "the stereotypical perception of the self as an example of some defining social category"."  

https://en.wikipedia.org/wiki/Depersonalization

- "Derealization is an alteration in the perception or experience of the external world so that it seems unreal. Other symptoms include feeling as though one's environment is lacking in spontaneity, emotional coloring, and depth.[1] It is a dissociative symptom that may appear in moments of severe stress.[2] Derealization is a subjective experience of unreality of the outside world, while depersonalization is sense of unreality in one's personal self, although most authors currently do not regard derealization (surroundings) and depersonalization (self) as separate constructs. Chronic derealization may be caused by occipital–temporal dysfunction.[3] These symptoms are common in the population, with a lifetime prevalence of up to 5% and 31–66% at the time of a traumatic event.[4]"  


- "Depersonalization disorder (DPD), also known as depersonalization/derealization disorder (DPDR),[3] is a mental disorder in which the person has persistent or recurrent feelings of depersonalization or derealization. Depersonalization is described as feeling disconnected or detached from one's self. Individuals experiencing depersonalization may report feeling as if they are an outside observer of their own thoughts or body, and often report feeling a loss of control over their thoughts or actions.[4] In some cases, individuals may be unable to accept their reflection as their own, or they may have out-of-body experiences.[5] Derealization is described as detachment from one's surroundings. Individuals experiencing derealization may report perceiving the world around them as foggy, dreamlike/surreal, or visually distorted.[4] In addition to these depersonalization-derealization disorder symptoms, the inner turmoil created by the disorder can result in depression,[6] self-harm, low self-esteem, phobias, panic attacks,
and suicide. It can also cause a variety of physical symptoms, including chest pain, blurry vision, visual snow, nausea, and the sensation of pins and needles in one's arms or legs.[citation needed] Depersonalization-derealization disorder is thought to be caused largely by interpersonal trauma such as childhood abuse.[7] Triggers may include significant stress, panic attacks, and drug use.[7] Studies suggest a uniform syndrome for chronic depersonalization/derealization regardless of whether drugs or an anxiety disorder is the precipitant.[8] It is unclear whether genetics plays a role; however, there are many neurochemical and hormonal changes in individuals with depersonalization disorder.[7] The disorder is typically associated with cognitive disruptions in early perceptual and attentional processes.[9] Diagnostic criteria for depersonalization-derealization disorder include persistent or recurrent feelings of detachment from one's mental or bodily processes or from one's surroundings.[10] A diagnosis is made when the dissociation is persistent and interferes with the social or occupational functions of daily life. However, accurate descriptions of the symptoms are hard to provide due to the subjective nature of depersonalization and derealization and persons' ambiguous use of language when describing these episodes. In the DSM-5, it was combined with derealization disorder and renamed "depersonalization/derealization disorder" ("DDPD").[3] In the DSM-5, it remains classified as a dissociative disorder, while the ICD-10 calls it "depersonalization-derealization syndrome" and classifies it as a neurotic disorder.[11] Although the disorder is an alteration in the subjective experience of reality, it is not a form of psychosis, as the person is able to distinguish between their own internal experiences and the objective reality of the outside world. During episodic and continuous depersonalization, the person can distinguish between reality and fantasy and the grasp on reality remains stable at all times.[12] While depersonalization-derealization disorder was once considered rare, lifetime experiences with it occur in about 1–2% of the general population. The chronic form of the disorder has a reported prevalence of 0.8 to 1.9%.[13][14] While brief episodes of depersonalization or derealization can be common in the general population, the disorder is only diagnosed when these symptoms cause substantial distress or impair social, occupational, or other important areas of functioning."

- "Is Blue Light Bad For Your Health?...Light is by far the most important synchronizer of human circadian rhythms, or body clocks, Czeisler says. Specialized cells in the retina are finely tuned to respond to the short-wavelength light that comes from a cloudless blue sky. As light rays hit those cells, they tell the brain to stop pumping out drowsiness-inducing melatonin and start making hormones like cortisol and ghrelin that wake us up and make us hungry...At the office, put your desk near a window. Invest in a bright light -- one that delivers 1,000 lux (a measure of light intensity) or more of blue-hued light at eye level -- to put on your desk at work. Studies show that most office environments are too dim to stimulate the positive, alerting effects of light by day. One 2014 study by Northwestern University researchers found that people who got most of their bright light exposure before noon were about 1.4 pounds leaner on average than those exposed to most bright light in the evening." [https://www.webmd.com/sleep-disorders/news/20170619/is-blue-light-bad-for-your-health](https://www.webmd.com/sleep-disorders/news/20170619/is-blue-light-bad-for-your-health)

- "Lighting...Common health effects associated with poor lighting include: Headache and eyestrain. Neck, back, and shoulder strain (when straining to see items because of poor lighting). Falling, tripping, slipping. Dropping materials or tools. Depression (in the case of insufficient or gloomy lighting)...The main causes of lighting problems are: Insufficient light - not enough light for the need. Glare - too much light for the need. Improper contrast. Poor distribution, and Flicker." [https://www.ccohs.ca//teach_tools/phys_hazards/lighting.html](https://www.ccohs.ca//teach_tools/phys_hazards/lighting.html)
"Lighting Ergonomics - Light Flicker...What kind of things can cause light flicker or dimming? Voltage changes can be caused by dimmer switches or when electrical equipment drawing heavy currents are turned on or when being used (e.g., resistance welding machines; motors in refrigerators, air conditioners; arc furnaces; medical imaging machines (x-ray, CAT scan, MRI); motors subject to variable loads; large capacity photocopiers). Resistance welding machines that repeats welding at a rate of one or more per second can cause repetitive voltage fluctuations and may result in a noticeable light flicker. Usually voltage fluctuations are small and do not have adverse effects on electrical equipment. However, in offices, for example, voltage fluctuations of just a few tenths of one percent can produce very annoying flickers in the lighting, especially if they are regular and repetitive in the 5-15 Hz range....What kind of lighting is likely to cause a flicker problem? Flicker is usually a potential problem only with lighting that requires the use of ballasts, like fluorescent lights. Incandescent lights usually do not cause a flicker problem since the light filaments generally do not cool quickly enough (and make the light dimmer) during the "off" time as the voltage changes in the AC power line. The type of ballast, which controls the electrical supply to fluorescent lights, affects the amount of flicker. Magnetic ballasts change the voltage supplied to the fluorescent lamps but do not alter the frequency – the power line frequency of 60 Hz. The ultraviolet (UV) light produced inside the fluorescent light tube also fluctuates 120 times per second. The phosphorescence (the fluorescent light) resulting from the UV shining on the phosphor coatings inside the light tube is sufficiently stable (i.e., lasts long enough) to even out the variations in the fluorescent light output."  

"LED lights damage eyes and disturb sleep, European health authority warns...Janet Sparrow, a professor of ophthalmic sciences at Columbia University, wrote in an email that "blue light is thought to help individuals to maintain the daily rhythms that allow sleep."  

"How Does Lighting Affect Mental Health In The Workplace...Poor lighting often gets overlooked in the workplace, as we talk about mental health and well-being, and the focus is firmly on creating happier and healthier workplaces. But bad lighting is associated with a range of ill-health effects, both physical and mental, such as eye strain, headaches, fatigue and also stress and anxiety in more high-pressured work environments. As we spend much of the day in artificial lighting, there is evidence that the lack of natural sunlight has an adverse effect on the body and the mind, and can result in conditions such as seasonal affective disorder (SAD)...40% of office workers are struggling to work in poor lighting every day...There are no statutory workplace lighting levels in the UK. Regulation 8 of the Workplace Health, Safety and Welfare (WHSW) simply requires that lighting at work is "suitable and sufficient" and that, where possible workplaces are lit by natural light...Some lighting designers have recommended an emphasis on cooler, daylight temperatures, for example by adding more blue to the mix. A trial by the University of Surrey's sleep research center suggests that certain wavelengths of blue light suppress the sleep hormone that regulates sleep/wake cycles. The trial compared alertness levels among staff working in the blue-enriched light with those on a control floor. It found that first thing in the morning and at lunchtime, alertness levels were the same on both floors. But another measure just before staff left for home found significantly higher alertness on the trial floor. Staff also reported improved sleep patterns, and although not scientifically validated, indicated that visual acuity was better with the blue light, and after four weeks, 92% of people on the floor said they preferred it over the old lighting."
"Properties of LED light can boost poultry production and profits...Incandescent light (Fig. 2a) effectively simulates sunlight at sunset, producing a continuous spectrum rich in reds with diminished greens and very little blue. However, this spectrum does not simulate midday sunlight, which is rich in blues and greens with diminished red...Compact fluorescent lamps (CFLs) have good efficiency and produce white light, but again, CFL light output is tailored to human vision. The white light is achieved by producing and combining narrow bands of red, green, and blue. As a result, there are large gaps in the spectrum between the red, blue, and green spikes, and many of the red, blue, and green wavelengths present in sunlight are lost (Fig. 2b). Blue light is exceptionally weak, and most of the deeper reds are lost. Overall, CFLs do a terrible job of mimicking natural sunlight. They are also hard to clean (because of their curly shape), contain small amounts of toxic mercury, require an enclosure to be wet rated, and do not dim well — plus their lifetime is shortened significantly when dimmed...High-pressure sodium (HPS) bulbs offer excellent efficiency and high light output, with a color spectrum that is strongest in the reds and yellows, thus giving the bulbs their distinctive orange-yellow or amber hue. As with CFLs, however, much of the color spectrum is missing, especially the greens and blues. HPS lamps are also very difficult to dim, are slow to warm up, require a ballast for operation, have high upfront costs, and may contain sodium and/or mercury...LEDs are the most efficient and environmentally friendly of the agricultural lighting options, producing white light by combining a blue LED with red and green phosphors. The spectrum is near continuous (Fig. 3) with especially strong blues, but also ample green and red. While not exactly daylight, the LED spectrum provides a close approximation of daylight from a human’s point of view, without the spectral gaps of other technologies...LED-based technologies can lower luminaire cost, increase musculoskeletal development and weight gain, induce earlier maturity in layer chickens destined to produce eggs, improve feed conversion, alter melatonin production, increase egg output and quality, regulate reproductive cycles, and increase length of reproductive life...Each color has a distinct effect on fowl physiology. Green light, for example, significantly increases growth rate at an early age by enhancing proliferation of skeletal muscle satellite cells. Blue light increases growth at a later age by elevating plasma androgens. Narrow-band blue light reduces locomotion. It also reduces cannibalism rate at late age (especially in broiler chickens raised for human consumption). Together, green and blue light promote myofiber growth due to more effective stimulation of testosterone secretion. Overall, blue light has been shown to improve feed conversion by up to 4%, thereby reducing the cost per pound by up to 3% and increasing overall live weight by up to 5%. Red light stimulates and promotes sexual activity and increases growth rates for chickens and turkeys at the beginning of the rearing period. It also increases locomotion, thereby minimizing leg disorders at the end of the rearing period. Red light also reduces the amount of feed consumption per egg laid with no differences in egg size, shell weight, shell thickness, or yolk and albumin weights. Overall, red light has been shown to lengthen the peak production period and increase egg production by up to 38 eggs per hen, while potentially decreasing food consumption by up to 20%."
brain (hypothalamus) four to 50 times more efficiently than blue, green and yellow-orange light. The hypothalamus is important in regulating the production of hormones important for egg production. Chickens are affected by the duration, intensity and spectrum of light. Light can be utilized as a management tool to help optimize pullet growth, age of sexual maturity, egg weight and egg production in laying hens in a variety of environments.

Duration – As a general rule, decreasing light duration is utilized for growing pullets and increasing light duration is used to stimulate layers. Light stimulation (usually an increase of as little as one hour) has an immediate effect on the production of reproductive hormones. The standard level of light for maximum production is 16 hours. It is ideal to reach 16 hours of light by 30–35 weeks to help prolong peak production. Research on layer pullets has shown that blue and green LED lights enhance growth. Research on layer pullets indicates that LED lights with a greater portion of blue and green spectra result in better body weights and uniformity compared to incandescent bulbs. Pullets may be reared with warm or cool lights, but laying hens should have lights with a sufficient red spectrum (2700K–3000K).

Intensity – Light intensity, measured in lux, clux or foot candles, is also important for poultry production. In general, light intensity below 5 lux is too dark to stimulate proper growth and production, while higher light intensity (above 50 lux) may cause nervousness and aberrant behaviour. The standard recommendation for growing pullets is to brood for 2 to 3 weeks at 30–50 lux, and then dim to 10–15 lux until 14 weeks. Two weeks prior to the transfer, gradually increase the light intensity to match the levels in the layer house. Laying hens should be kept at an average of 30 lux at the level of the feed trough.

The importance of lighting in poultry production... On a typical sunny day we can see as much as 150,000 lux of light intensity, which means that chickens with access to the outdoors are exposed to a very high level of light intensity. As the sky gets cloudy, a little bit of the daylight’s red spectrum is obscured and it becomes dominated by the blue spectrum. When the sun sets or rises, we see the opposite. We see an increase in the red spectrum and a decrease in the blue spectrum. Rubinoff believes that installing LED lighting in free-range and aviary systems provides more consistency than fluorescent light can provide. “There’s greater compatibility between the full spectrum of an LED or incandescent versus the spikes of a fluorescent bulb,” he said. “In some internal research, we have noticed that when you move birds from an LED environment into a fluorescent environment there is a scare response in those birds,” he continued. “They really are frightened by the difference and change in that light environment, so consistency is key.”

The 5 Major Benefits of Poultry LED Lighting. Chickens raised using a poultry LED lighting system have been found to produce higher quality and quantity of eggs, develop into maturity at a faster rate and enjoy an improved standard of health as compared to chickens raised under traditional light sources. Using an LED system could tremendously help your broiler or layer farm. Dim – to – Red light fixtures have proven to decrease the time to peak production by stimulating ovulation via the release of reproduction stimulating hormones. Sunrise/Sunset simulation eliminates the stress inputs of switching lights on and off abruptly which can lower mortality and support immune response. The red spectrum helps maintain circadian rhythms and promotes sexual maturity. ONCE’s AgriShift® MLM – Red light fixture was built to help regulate reproduction cycles and generate faster maturity for the poultry.

Are You Doing Your Poultry Lighting Right?... Lighting is very important in broiler farming...
because it helps in feeding, behavior, and growth. Basically, if the chicken coop isn’t well lit three things can happen to your broilers: Your poultry may start exhibiting fear and aggression. This aggressive behavior may lead to fights that not only drain their energy but also can be fatal. It may affect how they feed. Which may lead to a deterioration of their health. Lastly, poor lighting can affect how your broilers feed. Feeding problems can also affect your poultry’s growth...An increase in daylight leads to an increase in egg production. Why? It’s mainly because a well light environment encourages the release of FSH (Follicle Stimulating Hormone) that’s responsible for the growth of eggs. Thereafter, there will be an increase in LH (Luteinizing Hormone) that prompts the release of mature eggs from the ovary. That’s why experts recommend at least 16 hours of light for laying poultry to maximize egg production. This means that you can use LED poultry lighting to provide artificial lighting for a few extra hours in the morning or evening or even both times.

- "Impact of Light on Poultry"

- "Effect of lighting on rabbits and its role in rabbit production: A review...Life is based on sunlight. Light is important for the crepuscular or nocturnal animal species such as wild or domesticated rabbits. They are able to see well at night; however their colour vision is limited. Rabbits are exposed to a periodic light and dark environment which generates a 24 h (circadian) rhythm of almost every function of the body. When rabbits lived in continuous light or dark the daily rhythms were a little longer or shorter than 24 h, respectively. The daily activity of European wild rabbits (Oryctolagus cuniculus) depends on the season (the time of sunrise and sunset), and that of farmed rabbits on the times that the lights are switched off and on. Strong seasonal effects can be found in reproduction and molting. In farms, the seasonal effects are limited when 16 h lighting is applied year around. Change of 8 h light to 16 h light eight days before insemination is effective to increase the receptivity and kindling rate. Maturation of Rex rabbit fur can be accelerated and its quality can be improved changing the photoperiod from a long to a short daily lighting period. The wool production of Angora rabbits can be increased by shortening the light period or by melatonin treatment. Light schedules are applied for different purposes on rabbit farms. Further research on the effects of light intensity, colour and LED lighting are needed."
Altitude Diseases: Light & Biological Effects (Nighttime)

- "Effects of artificial light at night on human health: A literature review of observational and experimental studies applied to exposure assessment...It has frequently been reported that exposure to artificial light at night (ALAN) may cause negative health effects, such as breast cancer, circadian phase disruption and sleep disorders. Here, we reviewed the literature assessing the effects of human exposure to ALAN in order to list the health effects of various aspects of ALAN. Several electronic databases were searched for articles, published through August 2014, related to assessing the effects of exposure to ALAN on human health; these also included the details of experiments on such exposure. A total of 85 articles were included in the review. Several observational studies showed that outdoor ALAN levels are a risk factor for breast cancer and reported that indoor light intensity and individual lighting habits were relevant to this risk. Exposure to artificial bright light during the nighttime suppresses melatonin secretion, increases sleep onset latency (SOL) and increases alertness. Circadian misalignment caused by chronic ALAN exposure may have negative effects on the psychological, cardiovascular and/or metabolic functions. ALAN also causes circadian phase disruption, which increases with longer duration of exposure and with exposure later in the evening. It has also been reported that shorter wavelengths of light preferentially disturb melatonin secretion and cause circadian phase shifts, even if the light is not bright. This literature review may be helpful to understand the health effects of ALAN exposure and suggests that it is necessary to consider various characteristics of artificial light, beyond mere intensity."

- "Human Health...Exposure to Artificial Light at Night Can Harm Your Health...Humans evolved to the rhythms of the natural light-dark cycle of day and night. The spread of artificial lighting means most of us no longer experience truly dark nights. Research suggests that artificial light at night can negatively affect human health, increasing risks for obesity, depression, sleep disorders, diabetes, breast cancer and more. Our bodies produce the hormone melatonin in response to circadian rhythm. Melatonin helps keep us healthy. It has antioxidant properties, induces sleep, boosts the immune system, lowers cholesterol, and helps the functioning of the thyroid, pancreas, ovaries, testes and adrenal glands. Nighttime exposure to artificial light suppresses melatonin production...Exposure to blue light at night is particularly harmful. Unfortunately, most LEDs used for outdoor lighting — as well as computer screens, TVs, and other electronic displays — create abundant blue light."

- "Are LED-lights a Hazard to Human Health?...For LEDs, the vulnerable populations are children and the elderly who may exhibit higher sensitivity to blue light due to glare, flicker or phantom-array effects. There is insufficient research on the health effects of LED lighting, and many topics should be investigated further, particularly the effects of flicker. Since the use of LED technology is still evolving, the SCHEER would like to see continued monitoring of the risk of adverse health effects from long-term LED use by the general population."

- "Is Blue Light Bad For Your Health?..."The more research we do, the more evidence we have that excess artificial light at night can have a profound, deleterious effect on many aspects of..."
human health,” says Czeisler, who is also director of sleep medicine at Harvard Medical School. “It is a growing public health concern.” Czeisler is among a growing number of physicians, researchers, and health policy makers sounding the alarm that dark nights -- like a healthy diet, regular exercise, and good sleep habits -- are a key, endangered ingredient for long-term health. Last year, the U.S. National Toxicology Program convened a 2-day workshop to explore mounting research linking exposure to artificial light at night not just to sleep problems, but also to weight gain, depression, cancer, and heart disease. In October, NASA went so far as to change all the lights on the International Space Station to ones that, as night falls, dim and change to longer-wavelength light, which has been shown to have less impact on human physiology than “blue light.”

- "LED lights damage eyes and disturb sleep, European health authority warns...The blue light in LED lighting that is increasingly used in our homes can damage the eye's retina while disturbing our biological and sleep rhythms, a French health authority warned in a new report....LED lights damage eyes and disturb sleep, European health authority warns...ANSES differentiates types of blue light in its report. For example, "warm white" domestic LED lighting has weak phototoxicity risks, similar to traditional lighting, according to ANSES. However, other LED lighting sources, including the newest flashlights, car headlights and some toys, produce a whiter and "colder" blue light that is more harmful." 

- "Light and human health: LED risks highlighted. Issues relating to the effects on health and well-being of artificial light are discussed in three recent publications; including one that says the blue-light component in white LEDs causes toxic stress to the retina..."The issues of most concern identified by the Agency concern the eye due to the toxic effect of blue light and the risk of glare," says the report, adding that the blue light necessary to obtain white LEDs causes "toxic stress" to the retina...Manufacturers and integrators of lighting systems using LEDs are encouraged to use optics or diffusers, for example, so that the beams of light emitted by the LEDs cannot be seen directly, to avoid glare. Manufacturers should also take account of the progressive wear of layers of phosphor in white LEDs, which in time could lead to devices being moved from one photobiological risk group to a higher one, according to ANSES." 

- "Orange light as a potential mental health treatment...The question arises what people should do who have just replaced their old light bulbs with LED bulbs. We know LED lights are beneficial for the environment, but can they mess up our circadian rhythm? Kallestad confirms that yes, LEDs may potentially have a harmful effect on our circadian rhythm. LEDs produce more blue light than old-fashioned light bulbs do. When it comes to tablets and smartphones, many of them have a nighttime setting or app that filters out blue light that you can turn on in the evening. Or you can turn off the lights completely and light a candle instead." 

- "Light Pollution Is Getting Worse Every Year. That's Bad For Your Health...But nature is paying a price. One 2017 study found that artificial lighting near waterways draws insects up from the water surface and toward the lighting source, disrupting food chains and weakening the local ecosystem. Another study this year found an equally direct cause and effect between increased lighting over beach areas and a dramatic decline in sea turtle populations, as hatchlings are lured away from the water and toward the light, where they are snapped up by predators."
Migrating birds, which navigate partly by light from the moon and the stars, can be thrown off course when light pollution washes out the sky. Vegetation is affected, too. A 2016 study showed that trees are increasingly blooming out of season, as lighting coaxes their buds to burst too soon, leaving them vulnerable to damage by cold temperatures before the true onset of spring. That could affect fruit orchards and crops as well. Finally, of course, there is the effect on us. The American Medical Association warns that nighttime lighting, especially the blue-white LED variety, “is associated with reduced sleep times, dissatisfaction with sleep quality, excessive sleepiness, impaired daytime functioning and obesity.” Alarmingly, a Harvard study showed that artificial lighting may actually be linked to increased breast cancer rates, probably as a result of decreased levels of the hormone melatonin, which influences circadian rhythms. For now, that connection has been found only in premenopausal women who are current or former smokers, but the link is troubling nonetheless." https://time.com/5033099/light-pollution-health/
Altitude Diseases: Light & Biological Effects (Brain)

- “LED Office Lighting: the Best Color Temperature to Increase Productivity...Studies have even been performed on soldiers in the US Army to see how different lighting affects their productivity—soldiers show slower response times on cognitive tasks measuring spatial and verbal memory with fluorescent lighting instead of LED lighting...To give the perception of daylight, Superior Lighting suggests offices use light sources with color temperatures of 5000K or higher. As you might imagine, the amount of blue light in the spectrum of light sources increases with increasing color temperature. Higher color temperatures have a greater impact on mental activity, alertness, and the central nervous system...Researchers have found that exposure to short wavelength or blue light during the day directly improves alertness and performance. Blue-enriched white light stimulates the brain, improves alertness, performance, and sleep quality. The intensity and color temperature of artificial lighting affects physiological processes in the human body, including: blood pressure, heart rate variability, and core temperature...people who work in the evenings under fluorescent lights then go straight to bed may have difficulty sleeping, due to their lack of melatonin. Additionally, some studies have shown that fluorescent lighting can make people tired and sleepy during the day...It can’t be denied that natural and artificial light affects peoples’ health.”

- “6 Ways to Block Fluorescent Lights at Work – and 1 Way Not To...Does fluorescent lighting make you feel a little...uncomfortable?...You might find yourself blinking excessively or squinting to try to filter out some of that light. Maybe your eyes begin to tear up. You may even get a headache or feel sick to your stomach. Whatever your symptoms, they can be uncomfortable, annoying, and inconvenient, affecting your ability to do your job...33% reported having severe limitations functioning under fluorescent lights. 56% responded that bright lights provoke a headache “often” or “very often”. 73% responded that bright light is very unpleasant during a headache. 85% wears sunglasses to decrease headaches...Much different from sunglasses or even computer glasses, light sensitivity glasses are made specifically for people with photophobia, and can help you block fluorescent lights at work and anywhere else they are found. But instead of blocking all types of light the way sunglasses do, these lenses block only the types of light most commonly associated with photophobia symptoms...“I was getting dizzy and headaches at work on a daily basis. I work at a hospital with all fluorescent lighting and white walls. After realizing that it was the lighting that was causing me a headache, I did some research online after becoming pretty desperate for some relief. I ordered a pair and since then they have worked great. I haven’t had any dizzy spells or nearly as many headaches if any. Highly recommended.””
  https://www.axonoptics.com/6-ways-to-block-fluorescent-lights-at-work-and-1-way-not-to/
Altitude Diseases: Light & Biological Effects (Too Bright)

- “Sungazing...Sungazing is the act of looking directly into the sun during dawn and dusk. It is sometimes done as part of a spiritual or religious practice.[1] The human eye is very sensitive, and prolonged exposure to direct sunlight can lead to solar retinopathy, pterygium,[2] cataracts,[3] and often blindness.[4][5][6] Studies have shown that even when viewing a solar eclipse the eye can still be exposed to harmful levels of ultraviolet radiation.” [https://en.wikipedia.org/wiki/Sungazing](https://en.wikipedia.org/wiki/Sungazing)

- “Photic retinopathy is damage to the eye's retina, particularly the macula, from prolonged exposure to solar radiation or other bright light, e.g., lasers or arc welders. The term includes solar, laser, and welder's retinopathy and is synonymous with retinal phototoxicity.[1] It usually occurs due to staring at the Sun, watching a solar eclipse, or viewing an ultraviolet, Illuminant D65, or other bright light.” [https://en.wikipedia.org/wiki/Photic_retinopathy](https://en.wikipedia.org/wiki/Photic_retinopathy)

- “Pterygium (conjunctiva)...A pterygium is a pinkish, triangular tissue growth on the cornea of the eye.[2] It typically starts on the cornea near the nose.[3] It may slowly grow but rarely grows so large that it covers the pupil and impairs vision.[2] Often both eyes are involved.[5] The cause is unclear.[2] It appears to be partly related to long term exposure to UV light and dust.[2][3] Genetic factors also appear to be involved.[4] It is a benign growth.[6] Other conditions that can look similar include a pinguecula, tumor, or Terrien's marginal corneal degeneration.[5] Prevention may include wearing sunglasses and a hat if in an area with strong sunlight.[2] Among those with the condition, an eye lubricant can help with symptoms.[2] Surgical removal is typically only recommended if the ability to see is affected.[2] Following surgery a pterygium may recur in around half of cases.[2][6] The frequency of the condition varies from 1% to 33% in various regions of the world.[7] It occurs more commonly among males than females and in people who live closer to the equator.[7] The condition becomes more common with age.[7] The condition has been described since at least 1000 BC.[8]” [https://en.wikipedia.org/wiki/Pterygium_(conjunctiva)](https://en.wikipedia.org/wiki/Pterygium_(conjunctiva))

- “Cataract...A cataract is an opacification of the lens of the eye which leads to a decrease in vision.[1] Cataracts often develop slowly and can affect one or both eyes.[1] Symptoms may include faded colors, blurry or double vision, halos around light, trouble with bright lights, and trouble seeing at night.[1] This may result in trouble driving, reading, or recognizing faces.[7] Poor vision caused by cataracts may also result in an increased risk of falling and depression.[2] Cataracts cause half of all cases of blindness and 33% of visual impairment worldwide.[3][8] Cataracts are most commonly due to aging but may also occur due to trauma or radiation exposure, be present from birth, or occur following eye surgery for other problems.[1][4] Risk factors include diabetes, smoking tobacco, prolonged exposure to sunlight, and alcohol.[1] The underlying mechanism involves accumulation of clumps of protein or yellow-brown pigment in the lens that reduces transmission of light to the retina at the back of the eye.[1] Diagnosis is by an eye examination.[1] Prevention includes wearing sunglasses, a wide brimmed hat, eating leafy vegetables and fruits, and avoiding smoking.[1][9] Early on the symptoms may be improved with glasses.[1] If this does not help, surgery to remove the cloudy lens and replace it with an artificial lens is the only effective treatment.[1] Cataract surgery is not readily available in many countries, and surgery is needed only if the cataracts are causing problems and generally results in an improved quality of life.[1][10][4][11] About 20 million people are blind due to cataracts.[4] It is the cause of approximately 5% of blindness in the United States and
nearly 60% of blindness in parts of Africa and South America.[11] Blindness from cataracts occurs in about 10 to 40 per 100,000 children in the developing world, and 1 to 4 per 100,000 children in the developed world.[12] Cataracts become more common with age.[1] In the United States, cataracts occur in 68% of those over the age of 80 years.[13] Additionally they are more common in women, and less common in Hispanic and Black people.[13]"

https://en.wikipedia.org/wiki/Cataract

- “We would routinely be exposed to the sunset as we were waiting to open up the telescopes for nighttime viewing atop the very high altitude Mauna Kea mountain in Hawaii, USA. That would be followed by exposure to bright industrial laser light during the night. It was around this time that I started suffering with chronic fatigue and mental confusion. I had these exposures in my mid thirties and by my mid forties I was seeing rainbow halos around bright nighttime lights.” Steven Magee CEng MIET - Q

- “LASER spotters were employed to visually monitor air traffic in the vicinity of the high powered LASER beam. The were typically young students and aged people that would take these temporary very high altitude jobs for some extra money. Some would become irritable as the night progressed. As far as I know, there has never been any long term monitoring of these people for health issues stemming from nighttime industrial LASER light exposure at very high altitudes.” Steven Magee CEng MIET - Q

- “Can office lighting be too bright?...Office lighting that is too bright, or too dim, does not create a workspace that is conducive to doing your best work. Poor office lighting can cause eyestrain, fatigue and headaches that keep us from focusing on our work. This results in lower productivity, absenteeism, and a recent study by the HSE has shown it also has an adverse effect on our daily moods. Light That is Too Bright. Light that is too bright is especially bothersome in areas with computer screens, video monitors, tablets and smartphones. With excessive glare on these devices they can be hard to view and the quality of their visuals is lost due to bright light. In this situation it is important to remove or change the lighting to ensure the light levels in these areas is where it needs to be. Flickering office lights also distract workers, create additional eyestrain and negatively affect productivity. That’s why it is important to repair flickering fluorescent lights in a timely manner….Recommended light levels in offices is 300 – 500 lumens.” https://culturelighting.com/news/bright-office-lighting/

- “IS IT TOO BRIGHT IN HERE?...Our aim is to find factors that most impact our cognitive performance, so individual organisations can adopt the best practices to get everyone’s brain in peak condition...Studies have shown that insufficient light exposure can disrupt human rhythms that can result in adverse consequences for cognitive performance...Studies have proven that humans depend on light to reset the timing of their circadian pacemaker (your biological clock), as well as improving alertness and other physiological responses. Our biological clock rhythms are kept in sync by a variety of cues, a main one being light. High frequency and intense lighting promotes alertness, without this stimulus, the body can think it’s time to conserve energy and continue to rest...While light, and exposure to natural light is known to be essential to our physical and emotional wellbeing (according to medical experts and researchers), excessive brightness like glare, can be problematic. Uneven levels of brightness can cause tired eyes and discomfort. The issue is that there is less contrast for the retina to detect, which causes strain. Glare can be present in many parts of the office, depending upon the direction of the sun and the amount of solar management within the building design...There is evidence that daylight keeps us more alert and accurate, whereas artificial light increases our levels of fatigue and sleepiness. So the more windows exposing natural sunlight into the office, the better at
keeping employees alert and accurate. Lower quantities of cortisol (stress hormone) are produced when a person spends more time under artificial lighting... If you then work in artificial light all day, there are signals to increase melatonin production, leading to drowsiness...Finally, it’s best to always remember, light levels are key to our sleep patterns and circadian rhythms.”

“The Healthy Workplace - Office Lighting...Poor lighting (which includes light being too bright or creating glare) can cause us to lose our ability to focus through eyestrain, fatigue and headaches. This can result in lower productivity; absenteeism and a recent study by the HSE has shown it also has an adverse effect on our daily moods. If you imagine sitting in an intensely lit room all day, squinting at another bright light; you can start to visualise how it might begin to affect you. Another condition associated with prolonged exposure to computer light is computer vision syndrome (CVS) or visual display unit (VDU) glare, affecting between 64% and 90% of the UK office population. While this hasn’t been found to have any long term complications, it can cause all the problems previously mentioned as well as dry eyes and temporary myopia (difficulty in seeing distant objects). Overhead lighting is generally fixed in the early phases of office development at an overly bright 500 lux, often over areas that do not need the light. After all, it’s surely better to have too much light than not enough?”
Altitude Diseases: Light Deprivation

- "WHAT IS LIGHT DEPRIVATION & HOW DOES IT AFFECT US?...Light is essential - we need it to live, and yet, many of us don’t get the amount of daylight we need to function well. Light deprivation typically happens when a person is completely deprived of any daylight. However, while many in modern society do experience decreased exposure to daylight, total deprivation is pretty rare - we call this relative daylight deprivation...WHAT HAPPENS WHEN WE ARE DEPRIVED OF THE LIGHT WE NEED? Neuroscientists at the University of Pennsylvania conducted a 6 week study in which they kept rats in the dark for 6 weeks. During this period, they not only observed mood behaviors but brain damage in areas that are under-active in humans during mood swings. The neurons responsible for producing norepinephrine, dopamine, and serotonin were dying. Another study published in Scientific Reports examined light deprivation in two research stations in Antarctica. These environments were unique in that they provided a winter and summer season with absolute darkness and absolute light, respectively. The researchers found that low light exposure during the day sensitizes the body for light exposure at night (evidenced by melatonin suppression). Bright light at inappropriate times (as experienced by the subjects in the Antarctica experiment) resulted in shorter sleep cycles. WHAT’S THAT MEAN? Getting the right amount of natural light is just as important as getting it at the right time. If we don’t get light during the day (because we are spending our time indoors), and get it in the evening (e.g. from bright artificial light or electronic devices), we are cause an unhealthy shift in our circadian rhythm and negatively affect our sleep patterns. That can happen for a variety of reasons - spending a lot of time indoors, working variable hours (such as shift workers, airline staff, etc.), or winter in a location that has reduced daylight hours during that period of the year." [https://verilux.com/blogs/light-reading/what-is-light-deprivation-how-does-it-affect-us]

- "What happens if a human is deprived of exposure to light?...If nothing else changes, then a human deprived of light will eventually die...The most notable benefit of exposure to sunlight is its ability to boost your body's vitamin D supply. Vitamin D is produced by the skin's response to UV radiation primarily through sun exposure. Several studies on men indicate low levels of vitamin D increases one's risk of heart disease. Some medical studies indicate too little sunlight may contribute to certain onsets of cancer (breast, colorectal), just as too much may trigger other forms (melanoma). Lack of sunlight will alter one's mood, especially in northern latitudes. Also, sunlight triggers melatonin production leading to melanin formation, or skin color. People deprived of sunlight have lighter to pasty skin tones...Osteoporosis for one thing, since sunlight is needed to activate vitamin D to allow the body to absorb calcium." [https://www.quora.com/What-happens-if-a-human-is-deprived-of-exposure-to-light]

- "9 Ways a Lack of Sun is Killing You...We all know that too much sun can cause cancer, but even a lack of sunlight has been linked to certain cancers. Vitamin D deficiencies can lead to the development of prostate and breast cancer, memory loss, and an increased risk for developing dementia and schizophrenia...a lack of sunlight can actually lead to a form of clinical depression...Pulling excessive all-nighters or working the night shift? Your health begs you to reconsider. Those who spend an extended time at night exposed to artificial lights have shown an inclination to the development of breast and prostate cancer, diabetes, heart disease, and obesity." [https://www.sunsprite.com/blog/9-ways-a-lack-of-sun-is-killing-you]

- "Vitamin D and Depression: Where is all the Sunshine?...Recently, Lakhan and Vieria (2008)
reported on proposed nutritional deficiencies and treatments for persons with major depression, bipolar disorder, schizophrenia, and obsessive compulsive disorder (Table 1). Others have reported on the association between depression and inadequate intakes of some selected nutrients such as folate (Murakami et al., 2008; Payne et al., 2008), vitamin B12 (Sanchez-Villegas et al., 2009), as well as selenium, iron, and zinc (Bodnar & Wisner, 2005). In addition, intake of certain fatty acids suggests a possible beneficial effect on some mental disorders (Sanchez-Villegas et al., 2007), and for treatment of depressive symptoms in middle-aged women (Lucas, Asselin, Merette, Poulin & Dodin, 2009). Although vitamin D has recently gained widespread interest, little information relative to its impact on mental disorders is available....Although places closer to the equator have greater sun exposure (Hawaii, Arizona, Florida), recently it has been reported that in even in these areas vitamin D insufficiency persists (Binkley et al., 2007; Jacobs et al., 2008; Levis et al., 2005)."

"How Light Deprivation Causes Depression. Neuronal death may be the mechanism underlying seasonal affective disorder (SAD)...The association between darkness and depression is well established. Now a March 25 study in the Proceedings of the National Academy of Sciences reveals for the first time the profound changes that light deprivation causes in the brain...The researchers observed neurons that produce norepinephrine, dopamine and serotonin—common neurotransmitters involved in emotion, pleasure and cognition—in the process of dying...Principal investigator Gary Aston-Jones, now at the Medical University of South Carolina, speculates that the dark-induced effects stem from a disruption of the body’s clock. “When the circadian system is not receiving normal light, that in turn might lead to changes in brain systems that regulate mood,” he says." 

"Seasonal Affective Disorder...Seasonal Affective Disorder (SAD) is a type of depression that comes and goes with the seasons, typically starting in the late fall and early winter and going away during the spring and summer. Depressive episodes linked to the summer can occur, but are much less common than winter episodes of SAD....Symptoms of Major Depression: Feeling depressed most of the day, nearly every day. Feeling hopeless or worthless. Having low energy. Losing interest in activities you once enjoyed. Having problems with sleep. Experiencing changes in your appetite or weight. Feeling sluggish or agitated. Having difficulty concentrating. Having frequent thoughts of death or suicide. Symptoms of the Winter Pattern of SAD include: Having low energy. Hypersomnia. Overeating. Weight gain. Craving for carbohydrates. Social withdrawal (feel like “hibernating”). Symptoms of the less frequently occurring summer seasonal affective disorder include: Poor appetite with associated weight loss. Insomnia. Agitation. Restlessness. Anxiety. Episodes of violent behavior." 

"Light deprivation damages monoamine neurons and produces a depressive behavioral phenotype in rats...Light is an important environmental factor for regulation of mood. There is a high frequency of seasonal affective disorder in high latitudes where light exposure is limited, and bright light therapy is a successful antidepressant treatment. We recently showed that rats kept for 6 weeks in constant darkness (DD) have anatomical and behavioral features similar to depressed patients, including dysregulation of circadian sleep–waking rhythms and impairment of the noradrenergic (NA)-locus coeruleus (LC) system. Here, we analyzed the cell viability of neural systems related to the pathophysiology of depression after DD, including NA-LC, serotonergic-raphe nuclei and dopaminergic-ventral tegmental area neurons, and evaluated the
depressive behavioral profile of light-deprived rats. We found increased apoptosis in the three aminergic systems analyzed when compared with animals maintained for 6 weeks in 12:12 light-dark conditions. The most apoptosis was observed in NA-LC neurons, associated with a significant decrease in the number of cortical NA boutons. Behaviorally, DD induced a depression-like condition as measured by increased immobility in a forced swim test (FST). DD did not appear to be stressful (no effect on adrenal or body weights) but may have sensitized responses to subsequent stressors (increased fecal number during the FST). We also found that the antidepressant desipramine decreases these neural and behavioral effects of light deprivation. These findings indicate that DD induces neural damage in monoamine brain systems and this damage is associated with a depressive behavioral phenotype. Our results suggest a mechanism whereby prolonged limited light intensity could negatively impact mood. Depression is associated with decreased function in the noradrenergic (NA) locus coeruleus (LC), serotonergic (5-HT) dorsal raphe (DR) and median raphe (MnR), and dopaminergic (DA) ventral tegmental area (VTA) systems (1–4). Behaviorally, depression is characterized by lethargy, feelings of helplessness, and profound alterations of sleep–wake rhythms (5). In at least some cases, depression is associated with decreased light availability (e.g., seasonal affective disorder) and a blunted amplitude and phase delay of circadian rhythms (5). Also, degeneration of NA fibers from LC has been associated with stress-induced depression in rats (6, 7). Recently, we showed that, as compared with animals on a 12:12 light-dark (LD) schedule, rats kept for 6 weeks in constant darkness (DD) exhibit decreased NA-LC fibers and boutons in the frontal cortex, a delayed onset of active/rest periods, and a decreased circadian amplitude of the sleep–waking rhythm (8). These results raise the possibility that the absence of light could contribute to depression, perhaps in part through effects on monoamine systems. Here, we evaluated the integrity of brain NA, 5-HT, and DA neurons, and depressive behavioral profiles, of animals kept in long-term DD to test the hypothesis that decreased function in one or more of these neural systems promotes depression after limited light exposure. The present data demonstrate that the absence of light not only damages monoamine systems, but also induces depression-like behavioral symptoms, indicating the involvement of a light-dependent mechanism in the etiology of depression. We show the effect of light deprivation on depression-associated behaviors in animals and on neural systems involved in the pathophysiology of depression."  
https://www.pnas.org/content/105/12/4898

- "The Dangers of Winter Darkness: Weak Bones, Depression and Heart Trouble. Long periods without sunshine can play a role in a surprising variety of physical and mental disorders...scientists are discovering that prolonged darkness can play a role in disorders from depression to diabetes. The consensus seems to be that sunlight is essential to humans, provided we can get the right dose on a regular basis...“The most interesting recent development to me is the [number of] probable other beneficial effects of a bit of sun exposure or time outdoors,” says epidemiologist Robyn Lucas at the Australian National University. Lucas was lead author of a World Health Organization study about the global health burden due to UV exposure. “There are recent studies showing beneficial effects on blood pressure, development of obesity and modulation of immune function to be less autoreactive, so lower incidence of autoimmune disorders like multiple sclerosis.”...“We evolved getting a bit of sun exposure,” says Lucas, and the evidence is suggesting that we all need some rays to stay healthy."  
- "Impact of long-term daylight deprivation on retinal light sensitivity, circadian rhythms and
sleep during the Antarctic winter...Long-term daylight deprivation such as during the Antarctic winter has been shown to lead to delayed sleep timing and sleep fragmentation. We aimed at testing whether retinal sensitivity, sleep and circadian rest-activity will change during long-term daylight deprivation on two Antarctic bases (Concordia and Halley VI) in a total of 25 healthy crew members (mean age: 34 ± 11y; 7f). The pupil responses to different light stimuli were used to assess retinal sensitivity changes. Rest-activity cycles were continuously monitored by activity watches. Overall, our data showed increased pupil responses under scotopic (mainly rod-dependent), photopic (mainly L-/M-cone dependent) as well as bright-blue light (mainly melanopsin-dependent) conditions during the time without direct sunlight. Circadian rhythm analysis revealed a significant decay of intra-daily stability, indicating more fragmented rest-activity rhythms during the dark period. Sleep and wake times (as assessed from rest-activity recordings) were significantly delayed after the first month without sunlight (p < 0.05). Our results suggest that during long-term daylight deprivation, retinal sensitivity to blue light increases, whereas circadian rhythm stability decreases and sleep-wake timing is delayed.”

![Image](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6212492/)

- "What happens when humans spend too much time in the dark...Our aversion to darkness is rooted in our eyes. We are diurnal—day-active—creatures, meaning our ancestors, down to the finest physiological points, were adapted to forage, navigate, and seek shelter while the sun was up...When the results came in, though, he was stunned: the subjects’ disorientation was far more extreme than he’d imagined. One volunteer, upon completing the study, drove out of the laboratory parking lot and crashed his car. On several occasions, when subjects took a break to relieve themselves, they got lost in the bathroom, and had to call a researcher to help them find the way out...Most startling were the hallucinations. After just a few hours in isolation, nearly all the subjects saw and felt things that weren’t there. First they would see pulsing dots and simple geometric patterns; these grew into complex isolated images floating about the room, which then evolved into elaborate, integrated scenes playing out before the subjects’ eyes — “dreaming when awake,” as one participant described it. One participant reported seeing a parade of squirrels marching “purposefully” across a snowy field, wearing snowshoes and backpacks, while another saw a bathtub being steered by an old man in a metal helmet. In a particularly extreme case, a subject encountered a second version of himself in the room: he and his apparition began to blend together, until he was unable to discern which was which...Despite the total absence of visual input, Schwarz’s visual cortex lit up like a lantern, exactly as it would if she weren’t blindfolded. That is, in the world of her brain, the hallucinations were as true and real as anything she could touch or taste or smell." [https://www.popsci.com/sensory-deprivation-effects-darkness/](https://www.popsci.com/sensory-deprivation-effects-darkness/)

- "Isolation in the Dark Drives Humans to Brink of Insanity, Studies Find...You could sleep for days and think it was a nap...So what happens when our body is deprived of light? Very strange things, indeed...When it comes down to it, our body’s natural cycle and circadian rhythm rely on natural light, and without it, our physiology goes wonky. The same goes for living in complete isolation — being deprived of interaction of any sort can make us lose our minds. Exhibit A: Tom Hanks making friends with a volleyball in Cast Away...Bottom line: humans need light and interaction to stay sane. Without light, we lose our sense of time, and without interaction, we become consumed with loneliness and boredom. With this sensory deprivation comes the strangest, most unimaginable psychological effects." [http://thescienceexplorer.com/brain-and-body/isolation-dark-drives-humans-brink-insanity-studies-find](http://thescienceexplorer.com/brain-and-body/isolation-dark-drives-humans-brink-insanity-studies-find)
"Humans Can Sleep For Days When Living Alone Underground, Experiments Show...Whenever we've tried to test the effects that living in isolation without sunlight have on the body, a common thread has emerged: much longer sleep cycles...and suffering some fairly acute mental stresses along the way too...I can tell you though that it became very difficult toward the end and I felt terribly worn out... At the start of my stay I read, and then I lost the desire...Other similar experiments have found loneliness and mental tiredness to be the biggest problems when people are left with no one but themselves for company for months at a time (if you've ever seen Cast Away, you'll remember Tom Hanks making friends with a volleyball)."

https://www.sciencealert.com/experiments-show-that-humans-can-sleep-for-days-when-living-alone-underground

"How extreme isolation warps the mind...A similar pattern of ‘slowing time’ was reported by Maurizio Montalbini, a sociologist and caving enthusiast. In 1993, Montalbini spent 366 days in an underground cavern near Pesaro in Italy that had been designed with Nasa to simulate space missions, breaking his own world record for time spent underground. When he emerged, he was convinced only 219 days had passed. His sleep-wake cycles had almost doubled in length. Since then, researchers have found that in darkness most people eventually adjust to a 48-hour cycle: 36 hours of activity followed by 12 hours of sleep. The reasons are still unclear."

Altitude Diseases: Circadian Rhythm Disorders

- "Chronobiology...Chronobiology is a field of biology that examines periodic (cyclic) phenomena in living organisms and their adaptation to solar- and lunar-related rhythms.[1] These cycles are known as biological rhythms. Chronobiology comes from the ancient Greek χρόνος (chrónos, meaning "time"), and biology, which pertains to the study, or science, of life. The related terms chronomics and chronome have been used in some cases to describe either the molecular mechanisms involved in chronobiological phenomena or the more quantitative aspects of chronobiology, particularly where comparison of cycles between organisms is required. Chronobiological studies include but are not limited to comparative anatomy, physiology, genetics, molecular biology and behavior of organisms within biological rhythms mechanics.[1] Other aspects include epigenetics, development, reproduction, ecology and evolution." [https://en.wikipedia.org/wiki/Chronobiology](https://en.wikipedia.org/wiki/Chronobiology)

- "Circadian rhythm....A circadian rhythm is a natural, internal process that regulates the sleep-wake cycle and repeats roughly every 24 hours.[1] It can refer to any biological process that displays an endogenous, entrainable oscillation of about 24 hours. These 24-hour rhythms are driven by a circadian clock, and they have been widely observed in plants, animals, fungi, and cyanobacteria.[2] The term circadian comes from the Latin circa, meaning "around" (or "approximately"), and diēm, meaning "day". The formal study of biological temporal rhythms, such as daily, tidal, weekly, seasonal, and annual rhythms, is called chronobiology. Processes with 24-hour oscillations are more generally called diurnal rhythms; strictly speaking, they should not be called circadian rhythms unless their endogenous nature is confirmed.[3] Although circadian rhythms are endogenous ("built-in", self-sustained), they are adjusted (entrained) to the local environment by external cues called zeitgebers (from German, "time giver"), which include light, temperature and redox cycles. In medical science, an abnormal circadian rhythm in humans is known as circadian rhythm disorder.[4] In 2017, the Nobel Prize in Physiology or Medicine was awarded to Jeffrey C. Hall, Michael Rosbash and Michael W. Young "for their discoveries of molecular mechanisms controlling the circadian rhythm" in fruit flies.[5] Effect of circadian disruption. Mutations or deletions of clock gene in mice have demonstrated the importance of body clocks to ensure the proper timing of cellular/metabolic events; clock-mutant mice are hyperphagic and obese, and have altered glucose metabolism.[44] In mice, deletion of the Rev-ErbA alpha clock gene facilitates diet-induced obesity and changes the balance between glucose and lipid utilization predisposing to diabetes.[45] However, it is not clear whether there is a strong association between clock gene polymorphisms in humans and the susceptibility to develop the metabolic syndrome...Obesity and diabetes are associated with lifestyle and genetic factors. Among those factors, disruption of the circadian clockwork and/or misalignment of the circadian timing system with the external environment (e.g., light–dark cycle) might play a role in the development of metabolic disorders.[112] Shift work or chronic jet lag have profound consequences for circadian and metabolic events in the body. Animals that are forced to eat during their resting period show increased body mass and altered expression of clock and metabolic genes.[119][medical citation needed] In humans, shift work that favors irregular eating times is associated with altered insulin sensitivity and higher body mass. Shift work also leads to increased metabolic risks for cardio-metabolic syndrome, hypertension, and inflammation." [https://en.wikipedia.org/wiki/Circadian_rhythm](https://en.wikipedia.org/wiki/Circadian_rhythm)
"Circadian Rhythm Disorders. Also known as Sleep-Wake Cycle Disorders. Circadian rhythm disorders are problems that occur when your sleep-wake cycle is not properly aligned with your environment and interferes with your daily activities. You have a biological clock that controls the timing of several activities and functions of your body, including when you go to sleep and wake up. This internal mechanism is called the circadian clock. The circadian clock cycles about every 24 hours. These repeating 24-hour cycles are called the circadian rhythm. The control of your circadian rhythm is a function of certain genes in the DNA called circadian clock genes. Your body tries to align your sleep-wake cycle to cues from the environment, for example, when it gets light or dark outside, when you eat, and when you are physically active. When your sleep-wake cycle is out of sync with your environment, you may have difficulty sleeping, and the quality of your sleep may be poor. Disruptions of your sleep-wake cycle that interfere with daily activities may mean that you have a circadian rhythm disorder. Disruptions in your sleep patterns can be temporary and caused by external factors such as your sleep habits, job, or travel. Or a circadian rhythm disorder can be long-term and caused by internal factors such as your age, your genes, or a medical condition. Symptoms may include extreme daytime sleepiness, insomnia, tiredness, decreased alertness, and problems with memory and decision-making. To diagnose a circadian rhythm disorder, your doctor may ask about your sleep habits, suggest sleep tests, a diary to track when and how long you sleep, and test the levels of certain hormones in your blood or saliva. Your treatment plan will depend on the type and cause of your circadian rhythm disorder. Treatment may include light therapy, medicines to help you fall asleep or stay awake, or healthy lifestyle changes including steps to improve your sleep habits. If left untreated, circadian rhythm disorders may increase the risk of certain health problems or lead to workplace and road accidents."

https://www.nhlbi.nih.gov/health-topics/circadian-rhythm-disorders#:~:text=Circadian,rhythm%20disorders%20are%20problems,to%20sleep%20and%20wake%20up.

"Circadian rhythm sleep disorder...The International Classification of Sleep Disorders classifies Circadian Rhythm Sleep Disorder as a type of sleep dyssomnia...Currently, the International Classification of Sleep Disorders (ICSD-3) lists 6 disorders under the category of circadian rhythm sleep disorders. CRSDs can be categorized into two groups based on their underlying mechanisms: The first category is composed of disorders where the endogenous oscillator has been altered, known as intrinsic type disorders. This category will be referred to as the intrinsic disorder type. The second category consists of disorders in which the external environment and the endogenous circadian clock are misaligned, called extrinsic type CRSDs. Intrinsic. Delayed sleep phase disorder (DSPD): Individuals who have been diagnosed with delayed sleep phase disorder have sleep-wake times which are delayed when compared to normal functioning individuals. People with DSPD typically have very long periods of sleep latency when they attempt to go to sleep during conventional sleeping times. Similarly, they also have trouble waking up at conventional times. Advanced sleep phase disorder (ASPD): People with advanced sleep phase disorder exhibit characteristics opposite to those with delayed sleep phase disorder. These individuals have advanced sleep wake times, so they tend to go to bed and wake up much earlier as compared to normal individuals. ASPD is less common than DSPD, and is most prevalent within older populations. Familial Advanced Sleep Phase Syndrome (FASPS) is linked to an autosomal dominant mode of inheritance. It is associated with a missense mutation in human PER2 that replaces Serine for a Glycine at position 662 (S662G).[11] Families that have this mutation in PER2 experience extreme phase advances in sleep, waking up around 2 AM and going to bed around 7 PM. Irregular sleep–wake rhythm disorder (ISWRD) is
characterized by a normal 24-hr sleeping period. However, individuals with this disorder experience fragmented and highly disorganized sleep that can manifest in the form of waking frequently during the night and taking naps during the day, yet still maintaining sufficient total time asleep. People with ISWRD often experience a range of symptoms from insomnia to excessive daytime sleepiness. Most common in individuals that are blind and unable to detect light, Non-24-hour sleep–wake disorder (N24SWD) is characterized by chronic patterns of sleep/wake cycles which are not entrained to the 24-hr light-dark environmental cycle. As a result of this, individuals with this disorder will usually experience a gradual yet predictable delay of sleep onset and waking times. Patients with DSPD may develop this disorder if their condition is untreated. Extrinsic. Shift work sleep disorder (SWSD): Approximately 9% of Americans who work night or irregular work shifts are believed to experience Shift work sleep disorder.[12] Night shift work directly opposes the environmental cues that entrain our biological clock, so this disorder arises when an individual's clock is unable to adjust to the socially imposed work schedule. Shift work sleep disorder can lead to severe cases of insomnia as well as excessive daytime sleepiness. Jet lag: Jet lag is best characterized by difficulty falling asleep or staying asleep as a result of misalignment between one's internal circadian system and external, or environmental cues. It is typically associated with rapid travel across multiple time zones. https://en.wikipedia.org/wiki/Circadian_rhythm_sleep_disorder

- "Dyssomnia...Dyssomnias are a broad classification of sleeping disorders involving difficulty getting to sleep, remaining asleep, or of excessive sleepiness. Dyssomnias are primary disorders of initiating or maintaining sleep or of excessive sleepiness and are characterized by a disturbance in the amount, quality, or timing of sleep. Patients may complain of difficulty getting to sleep or staying asleep, intermittent wakefulness during the night, early morning awakening, or combinations of any of these. Transient episodes are usually of little significance. Stress, caffeine, physical discomfort, daytime napping, and early bedtimes are common factors." https://en.wikipedia.org/wiki/Dyssomnia

- "Circadian Rhythm Abnormalities...Purpose: This article reviews the recent advances in understanding of the fundamental properties of circadian rhythms and discusses the clinical features, diagnosis, and treatment of circadian rhythm sleep disorders (CRSDs). Recent Findings: Recent evidence strongly points to the ubiquitous influence of circadian timing in nearly all physiologic functions. Thus, in addition to the prominent sleep and wake disturbances, circadian rhythm disorders are associated with cognitive impairment, mood disturbances, and increased risk of cardiometabolic disorders. The recent availability of biomarkers of circadian timing in clinical practice has improved our ability to identify and treat these CRSDs. Summary: Circadian rhythms are endogenous rhythms with a periodicity of approximately 24 hours. These rhythms are synchronized to the physical environment by social and work schedules by various photic and nonphotic stimuli. CRSDs result from a misalignment between the timing of the circadian rhythm and the external environment (eg, jet lag and shift work) or a dysfunction of the circadian clock or its afferent and efferent pathways (eg, delayed sleep-phase, advanced sleep-phase, non–24-hour, and irregular sleep-wake rhythm disorders). The most common symptoms of these disorders are difficulties with sleep onset and/or sleep maintenance and excessive sleepiness that are associated with impaired social and occupational functioning. Effective treatment for most of the CRSDs requires a multimodal approach to accelerate circadian realignment with timed exposure to light, avoidance of bright light at inappropriate times, and adherence to scheduled sleep and wake times. In addition, pharmacologic agents are recommended for some of the CRSDs. For delayed sleep-phase, non–
24-hour, and shift work disorders, timed low-dose melatonin can help advance or entrain circadian rhythms; and for shift work disorder, wake-enhancing agents such as caffeine, modafinil, and armodafinil are options for the management of excessive sleepiness."

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3654533/

• "Chapter Ten - Health Consequences of Circadian Disruption in Humans and Animal Models...Daily rhythms in behavior and physiology are programmed by a hierarchical collection of biological clocks located throughout the brain and body, known as the circadian system. Mounting evidence indicates that disruption of circadian regulation is associated with a wide variety of adverse health consequences, including increased risk for premature death, cancer, metabolic syndrome, cardiovascular dysfunction, immune dysregulation, reproductive problems, mood disorders, and learning deficits. Here we review the evidence for the pervasive effects of circadian disruption in humans and animal models, drawing from both environmental and genetic studies, and identify questions for future research."


• "What Are Some Circadian Rhythm Sleep Disorders?...Delayed Phase Sleep Phase Disorder. Called DSP for short, this type of circadian rhythm is what’s experienced by “night owls” or those who tend to stay up until 1:00am or later. It’s most common in younger people or teenagers. Unfortunately, if your school or work schedule doesn’t allow you to sleep late enough to log enough zzz’s, this disorder is likely to leave you feeling as if you haven’t had enough sleep during the day. Advanced Sleep Phase Disorder. The opposite of DSP, ASP is what’s experienced by extreme “early birds” who wake up between 2:00am and 5:00am. Going to bed early enough to get the right amount of sleep can help if you have this disorder, which becomes more common with age. Jet Lag... Anyone can experience this type of temporary sleep disorder simply by traveling across two or more time zones. The more time zones you cross—especially if you’re going east—the more likely you are to have trouble sleeping. Shift Work Disorder. This type of circadian rhythm disorder is common in people who work when they would naturally be sleeping—either late at night or very early in the morning. While you may not be able to change your work schedule, using props like eye masks and blackout blinds to block out light when it’s time to sleep and exposing yourself to bright light when it’s time to be awake can help you adjust your body’s clock. Irregular Sleep-Wake Rhythm... People with this issue have sleep that is fragmented into naps that are spread over a 24-hour period rather than consolidated all at once at night. Symptoms can include chronic insomnia as well as sleepiness." https://www.sleep.org/what-are-some-circadian-rhythm-sleep-disorders/

• "I lost my circadian rhythm during extreme night shift work at atop the very high altitude mountain of Mauna Kea in Hawaii. Waking up in the morning, staying awake during the daytime and sleeping has been problematic ever since." Steven Magee CEng MIET - Q

• "In August 2020, I had restored my daytime circadian rhythm using continous light therapy. I was waking up at sunrise with the with the birds, no alarm clock needed." Steven Magee CEng MIET – Q

• "Light therapy...Light therapy—or phototherapy, classically referred to as heliotherapy—consists either of A.) exposure to daylight or some equivalent form of light as a treatment for seasonal affective disorder (SAD) or B.) exposure of the skin to specific wavelengths of light using polychromatic polarised light to treat a skin condition. It is used as a treatment for
wintertime seasonal affective disorder and in circadian rhythm disorders, such as delayed sleep phase disorder.[1] There is tentative evidence to support its use to treat non-seasonal psychiatric disorders, in particular major depression and depression in bipolar disorder.[2][3][4] As a treatment for disorders of the skin, the second kind of light therapy is meant to correct psoriasis, acne vulgaris, eczema and neonatal jaundice.[5][6]...Light therapy has also been suggested in the treatment of non-seasonal depression and other psychiatric mood disturbances, including major depressive disorder,[32][33] bipolar disorder and postpartum depression.[34][35] A meta-analysis by the Cochrane Collaboration concluded that "for patients suffering from non-seasonal depression, light therapy offers modest though promising antidepressive efficacy."[36] A 2008 systematic review concluded that "overall, bright light therapy is an excellent candidate for inclusion into the therapeutic inventory available for the treatment of nonseasonal depression today, as adjuvant therapy to antidepressant medication, or eventually as stand-alone treatment for specific subgroups of depressed patients."...A 1995 study showed that green light therapy at doses of 350 lux produces melatonin suppression and phase shifts equivalent to 10,000 lux white light therapy” https://en.wikipedia.org/wiki/Light_therapy

- "If you are not naturally waking up at sunrise, then it is likely that you have some form of Circadian Rhythm Disorder." Steven Magee CEng MIET – Q
- "Circadian rhythm disruption and mental health...Circadian rhythms are internal manifestations of the solar day that permit adaptations to predictable environmental temporal changes. These ~24-h rhythms are controlled by molecular clockworks within the brain that are reset daily to precisely 24 h by exposure to the light–dark cycle. Information from the master clock in the mammalian hypothalamus conveys temporal information to the entire body via humoral and neural communication. A bidirectional relationship exists between mood disorders and circadian rhythms. Mood disorders are often associated with disrupted circadian clock-controlled responses, such as sleep and cortisol secretion, whereas disruption of circadian rhythms via jet lag, night-shift work, or exposure to artificial light at night, can precipitate or exacerbate affective symptoms in susceptible individuals. Evidence suggests strong associations between circadian rhythms and mental health, but only recently have studies begun to discover the direct interactions between the circadian system and mood regulation. This review provides an overview of disrupted circadian rhythms and the relationship to behavioral health and psychiatry. The focus of this review is delineating the role of disruption of circadian rhythms on mood disorders using human night shift studies, as well as jet lag studies to identify links. We also review animal models of disrupted circadian rhythms on affective responses. Lastly, we propose low-cost behavioral and lifestyle changes to improve circadian rhythms and presumably behavioral health." https://www.nature.com/articles/s41398-020-0694-0
- "Orange light as a potential mental health treatment...Currently, the view from space shows that large parts of the Earth are illuminated at night. And that's pretty much fine – we can read longer, work longer and stay out longer. But we may also be paying a price for all the artificial light. And it may affect some people more strongly than others. Too much light at the wrong time of day can damage the body's circadian rhythm – basically your body's own internal clock. A disrupted circadian rhythm can make us physically and mentally ill." https://medicalxpress.com/news/2017-12-orange-potential-mental-health-treatment.html
- "What’s The Deal With Fancy Red Light Devices? Your Go-To Guide On How To Use Red Light To Enhance Testosterone, Skin, Recovery, Cognition, Sleep & Beyond!...Most photomedicine researchers point to something called the “therapeutic window,” which is a range of wavelengths between about 600 to 1,200 nanometers. Red and near-infrared light—
especially between 600-950 nm—has been studied extensively and its positive effects have been well documented in clinical trials. But even within that window, for the purposes of light therapy, you want to only use devices that deliver red light in the mid-600 nm range and near infrared in the mid-800 nm range. Those are the clinical sweet spots, and pretty much all the research about light therapy is specific to these ranges of red and near-infrared light.

https://bengreenfieldfitness.com/article/biohacking-articles/red-light-therapy-benefits/

- "Support Sleep with Healthy Light...What is Red Light Therapy? Red light therapy, also known as photobiomodulation (PBM) or low level laser therapy (LLLT), is a simple, non-invasive treatment that uses LEDs to deliver wavelengths of red and near infrared (NIR) light directly to the skin and cells. This enhances cellular function by supplying the mitochondria with the light needed to make the ATP energy that powers your body."
  https://joovv.com/blogs/joovv-blog/how-red-light-helps-you-sleep-better#

- "Red Light and the Sleep Quality and Endurance Performance of Chinese Female Basketball Players...Our study confirmed the effectiveness of body irradiation with red light in improving the quality of sleep of elite female basketball players and offered a nonpharmacologic and noninvasive therapy to prevent sleep disorders after training."

- “In October 2020 I had improved my sleeping circadian rhythm with red and infrared light exposures.” Steven Magee CEng MIET - Q
Altitude Diseases: Industrial High Powered LASER Hazards

- “Working the night shift exposed me to very high powered 20 watt industrial sodium LASER light. We were told that it was harmless to the naked eye if we did not look directly into the LASER beam. Walking into the observatory dome being illuminated by the bright scattered orange laser light was a common occurrence.” Steven Magee CEng MIET - Q
- “I do wonder what being illuminated by scattered high powered industrial LASER light does to the human.” Steven Magee CEng MIET - Q
- “A Darker View: LASER” http://darkerview.com/wordpress/?tag=laser
- “The average power output of the Keck I and II lasers are generally 15-20 W and 20 W, respectively.” https://www2.keck.hawaii.edu/optics/lgsao/lgsbasics.html
- “Class IV: High power lasers (cw: 500 mW, pulsed: 10 J/cm² or the diffuse reflection limit) are hazardous to view under any condition (directly or diffusely scattered) and are a potential fire hazard and a skin hazard. Significant controls are required of Class IV laser facilities.” https://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_6.html
- “You need laser safety glasses in any situation where it is possible that your eyes could be exposed to direct, reflected, or scattered laser radiation. In other words, if there’s even a remote chance that your eyes could be exposed to even a scattered reflection of the beam, you need to be wearing laser safety glasses.” http://blog.phillips-safety.com/when-do-you-need-laser-safety-glasses/
- “Keck Laser Engineer Robert Lafon volunteers his hand to demonstrate the intensity (and safety) of the Keck LGS laser. Photo Courtesy of W.M. Keck Observatory.” http://www.gemini.edu/node/128
- “I enjoyed working with Keck Laser Engineer Robert Lafon during my night shifts. If I saw him today, I would ask him this question: Do you have any health conditions that you associate with working with 20 watt high powered LASER's and very high altitude work?” Steven Magee CEng MIET - Q
- “The long term effects of exposure to high powered 20 watt sodium LASER guide stars are unlikely to be fully understood for a few more decades, as it is such a new technology and only a relatively small group of people have been exposed to it. LASER radiation safety standards appear to be where X-Ray radiation safety standards were in the 1900's.” Steven Magee CEng MIET - Q
- "Bright Light Adaptation Disease (BLAD) should be suspected in anyone that has worked with industrial high powered LASER's." Steven Magee CEng MIET – Q
- “Early X-ray machines needed to be set and repeatedly adjusted. To achieve this, radiographers would place their hands between the actively radiating tube and the film plate to check if the apparatus was functioning and that it was well focused on the film. By practicing this for 12 years, Dr. Kells was the first victim of dental X-ray radiation with numerous cancerous tumors on his fingers.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4319329/
- “She was a dental technician in the Navy and also worked for years in pediatric dental offices and orthodontics as an assistant, calming nervous children, helping them to have good dental experiences, and when she was exposing radiographs, sometimes she admits that she would make it easier on everyone if she would stay with the child while the x-rays were beaming through her hand...Even though the tumor was benign, because of the damage done, the
possibility of regrowth and other factors, the decision was made for my friend to have her ring finger amputated.” [http://www.dentalbuzz.com/2013/03/15/fingers-in-the-picture/]

- “Laser safety is the safe design, use and implementation of lasers to minimize the risk of laser accidents, especially those involving eye injuries. Since even relatively small amounts of laser light can lead to permanent eye injuries, the sale and usage of lasers is typically subject to government regulations.” [https://en.wikipedia.org/wiki/Laser_safety]
- “The Laser Institute of America (LIA) is the international society for laser applications and safety. Our mission is to foster lasers, laser applications, and laser safety worldwide.” [https://www.lia.org/index.php]
- “Industrial very high powered sodium LASER systems in action” [https://youtu.be/o1xEQ212iyY]
- “If a streetlight can make you sick, one can only wonder what exposure to a very high powered industrial LASER can do to you.” Steven Magee CEng MIET - Q
- “The most serious health problems that I exhibited during my night shifts at the very high altitude summit of Mauna Kea occurred after I started routinely working with the high powered sodium LASER guide star system.” Steven Magee CEng MIET - Q
- “Light causes biological damage through both temperature effects due to absorbed energy and through photochemical reactions. The chief mode of damage depends on the wavelength of the light and on the tissue being exposed. For control of hazards from lasers, the damage is believed to be due principally to temperature effects, and the critical organs are the eye and the skin.” [http://oregonstate.edu/ehs/laser/training/laser-biological-hazards-eyes]
- “The retina represents a paradox, in that, while light and oxygen are essential for vision, these conditions also favour the formation of reactive oxygen species leading to photochemical damage to the retina. Such light damage seems to be multi-factorial and is dependent on the photoreactivity of a variety of chromophores (e.g., vitamin A metabolites, lipofuscin, melanin, flavins, porphyrins, carotenoids) endogenous to the retina.” [https://www.ncbi.nlm.nih.gov/pubmed/11744401]
- “The outer retina [photoreceptors and retinal pigment epithelium (RPE)], is immediately adjacent to the choroidal blood supply and thus highly oxygenated. Therefore, these are potentially favourable conditions for photodynamic damage to occur. The strong dependence of susceptibility of the retina to photodamage on oxygen concentration suggests that light-induced damage to the retina is indeed photodynamic in nature” [http://photobiology.info/Rozanowska.html]
- “At the age of 46 I was starting to see the appearance of rainbow halos and starbursts around
bright nighttime lights, problems reading small print, blurred focusing with my eyes, and image recognition issues. I had been exposed to medical oxygen, industrial gasses, solvents and bright high powered 20 watt scattered sodium LASER light a decade earlier in very high altitude astronomy.”  Steven Magee CEng MIET - Q

- “Seeing rainbows or halos around light indicates a problem with how light is filtering into the eye. Light is made up of different colours but the rays are normally focused on a single point so you can't distinguish them. These symptoms indicate that scattering of light is occurring on the cornea or lens” http://www.dailymail.co.uk/health/article-2567022/Seeing-rainbows-Its-time-eyes-checked.html
Altitude Diseases: High Energy Visible Light (HEV) Dangers

- "Biological effects of high-energy visible light...High-energy visible light (HEV light) is high-frequency, high-energy light in the violet/blue band from 400 to 450 nm in the visible spectrum, [1] which has a number of biological effects, including those on the eye. Despite a lack of any concurring scientific evidence, HEV light has sometimes been claimed to be a cause of age-related macular degeneration.[2][3] Some sunglasses and beauty creams specifically block HEV, for added marketing value.[1] Currently The French Agency for Food, Environmental and Occupational Health & Safety (ANSES) report from 2019 supports the 2010 result on the toxicity of blue LED light (400-450nm spike) to the eye, which can lead to impaired vision. It highlights short term effects on the retina linked to intense exposure to blue LED light, and long term effects linked to the onset of age-related macular degeneration. [4] Harvard Health Publishing additionally asserts that exposure to blue light (especially blue LED light, but also broad-spectrum blue light), at night, has a stronger negative effect on sleep.[5][6] This is also supported by the American Medical Association in a June 14, 2016 press release, which concludes that there are negative health impacts from the unrestrained use of LED street lighting in general.[7]...Blue-light hazard is the potential for photochemically-induced retinal injury resulting from electromagnetic radiation-exposure at wavelengths primarily between 400 and 450 nm. Researchers have not studied the phenomenon in humans, but only (and inconclusively) in some rodent, primate, and in vitro studies.[12] Photochemically-induced retinal injury is caused by the absorption of light by photoreceptors in the eye. Under normal conditions, when light hits a photoreceptor, the cell bleaches and becomes useless until it has recovered through a metabolic process called the visual cycle.[13][14]. Absorption of blue light, however, has been shown in rats and in a susceptible strain of mice to cause a problem in the process so that cells become unbleached and responsive again to light before they are ready. At wavelengths of blue light below 430 nm this greatly increases the potential for oxidative damage.[15] For blue-light circadian therapy, harm is minimized by employing blue light at the near-green end of the blue spectrum. "1-2 min of 408 nm and 25 minutes of 430 nm are sufficient to cause irreversible death of photoreceptors and lesions of the retinal pigment epithelium. [...] The action spectrum of light-sensitive retinal ganglion cells was found to peak at approximately 450 nm, a range with lower damage potential, yet not completely outside the damaging range."[16] A 2014 study found that LEDs cause retinal damage even in settings where they are used indirectly, such as in household light-bulbs.[17]. An unpublished and non peer-reviewed 2013 in vitro study, financed by skin-care company Lipo Chemicals, used shorter blue-band spectrum LED lights and claimed that prolonged exposure may permanently damage the pigment epithelial cells of the retina.[18] However, according to a specialist, the test conditions were the equivalent of staring at a blue light equivalent to a 100 watt incandescent source from 20 cm (8 in) for 12 hours, which is not deemed to be a realistic light exposure.[19][20]. One study has given more insight into the blue-light hazard: permanent damage to the eye cells, as reported by a research-team from Toledo University[21] especially for children, who are big users of LED backlit LCD and OLED screens (smartphones, tablets...)[citation needed]. The CIE published its position on the low risk of blue-light hazard resulting from the use LED technology in general lighting bulbs in April 2019 [22]. Concerns regarding blue LEDs are related to the difference between the photopic luminous flux and radiometric radiance. Photometry is concerned with the study of human perception of visible light, while radiometry
is concerned with the measurement of energy. At the outer edges of the range of light perception, the amount of energy as light required to register as a perception increases. The perception of the brightness of different frequencies of light is defined according to the CIE luminosity function \( V(\lambda) \). The peak efficiency of light perception is defined at 555 nm, having a value of \( V(\lambda)=1 \). Blue LEDs, particularly those used in white LEDs, operate at around 450 nm, where \( V(\lambda)=0.038 \).[23][24] This means that blue light at 450 nm requires more than 26 times the radiometric energy for one to perceive the same luminous flux as green light at 555 nm. For comparison, UV-A at 380 nm (\( V(\lambda)=0.000\,039 \)) requires 25,641 times the amount of radiometric energy to be perceived at the same intensity as green, three orders of magnitude greater than blue LEDs.[25][26] Studies often compare animal trials using identical luminous flux rather than radiance meaning comparative levels of perceived light at different frequencies rather than total emitted energy.[27][28] As interest in LED backlighting has increased, so has the technology developed. Studies often select low-quality generic LEDs from little-known brands with a high proportion of blue light, especially selecting low CRI LEDs which are not suitable for either lighting or backlight technologies. LCD screens and LED lighting generally use much higher CRI LEDs as consumers demand accurate color reproduction.[29][30][23] White LEDs are designed to emulate natural sunlight as closely as is economically and technologically possible. Natural sunlight has a relatively high spectral density of blue light making exposure to relatively high levels of blue light not a new or unique phenomenon despite the relatively recent emergence of LED display technologies. IOLs (Intraocular lenses) are the ideal test model in-vivo on human models. They cannot be removed and are persistently active 24/7 owing to the fact that they are permanently implanted into the eye. A Cochrane Review found no evidence of any effect in 51 trials with yellow tinted intraocular implants. None of the studies reviewed provided any reliable statistical evidence to suggest any effect regarding contrast sensitivity, macular degeneration, vision, color-discrimination or sleep disturbances. [31] A particular study claimed a large difference in observed fluorescein angiography examinations concluding they observed markedly less "progression of abnormal fundus autofluorescence" [32] however the authors failed to discuss the fact that the excitation beam is filtered light between 465-490 nm,[33] is largely blocked by blue light filtering IOLs[34] but not clear IOLs present in the control patients."

https://en.wikipedia.org/wiki/Biological_effects_of_high-energy_visible_light

- “High-Energy Visible (HEV) Light and Skin Damage. As if exposure to UV rays from sunlight wasn’t bad enough, skin has another enemy trying to steal away its youth and health: high-energy visible (HEV) light. Also referred to as blue light, HEV light is primarily from the sun, but it’s also emitted by your smartphone, tablet and computer screen. By any name and from any source, a growing amount of research is proving how destructive HEV light is for your skin...The HEV light (blue light) emitting from the sun and your electronic devices ranges from 380 nm to 500 nm, a bit longer than, but overlapping with, the range of UVA light. Interestingly, the range of blue light varies depending on whose research you’re reading, with some scientists putting it more strongly in the range of 400-450 nm in terms of its damage to skin. Regardless of exact numbers, for certain it’s no exaggeration to say that the progressive damage unprotected exposure to UVA and UVB light does to skin is ultraviolet. As it turns out, damage from HEV light isn’t far behind....Routine exposure to blue light, preferably from daylight, helps regulate our body’s sleep-wake cycle, improves our mood, keeps us alert and can even enhance memory.” https://www.paulaschoice.com/expert-advice/skincare-advice/sun-care/high-energy-visible-hev-light-and-skin-damage.html
“What is high-energy visible light – And why do we need to protect skin from it?...Both UVA rays and HEVIS Light can cause skin to age prematurely (photoage)....UVA, UVB and HEVIS Light can induce hyperpigmentation and may contribute to conditions such as sun spots (also known as age spots), melasma and post-inflammatory hyperpigmentation...Like UVA rays, HEVIS Light generates free radicals (also known as ROS – Reactive Oxygen Species). These free radicals cause skin cells to produce enzymes that break down the collagen and elastin that give skin its plump, youthful appearance. This process is often called oxidative stress and it's what causes skin to photoage (age prematurely as a result of sun exposure). Aging is, of course, an entirely natural process, but when skin ages prematurely it may start to sag and develop deep wrinkles before its time...UVA, UVB and HEVIS Light rays all contribute to sun spots. Alongside UVA and UVB, HEVIS Light can induce uneven skin pigmentation (often referred to as hyperpigmentation) and may contribute to conditions such as age spots (also known as sun spots), melasma and post-inflammatory hyperpigmentation.”

“Blue Light/High-Energy Visible (HEV) Light and Your Eyes...Research is still being done to determine the long-term effects of blue light or high-energy visible (HEV) light emission, however it is known that blue light is a cause of computer vision syndrome (CVS) and sleep disruptions. Eye Strain. The high energy and shorter wavelengths of blue or HEV light emit a less consistent flow of light, creating a glare or flickering that can cause eye strain. Because sharpness and visual contrast are affected by this, the eyes have to work harder to see clearly. After extended periods of time this can result in headaches, blurred vision, dry eyes, and mental and physical fatigue. Sleep Disruptions. Natural blue light in the atmosphere is known to help regulate the body’s circadian rhythm (which controls your sleep cycles), to boost your mood and level of alertness and to improve memory and cognitive function. However, prolonged exposure to artificial sources of blue light has been shown to reverse these positive effects, causing disruptions in the circadian rhythm which affects sleep, as well as an increased risk of depression. Studies show that using a digital device before bedtime can negatively impact your amount and quality of your sleep. Macular Degeneration. Researchers at Harvard University have shown that over time, prolonged exposure to blue light can cause damage to the retina at the back of your eye, which may lead to age-related macular degeneration (AMD) and possibly other serious health and vision problems. AMD is a leading cause of vision loss and low vision.”

“BLUE LIGHT/HIGH-ENERGY VISIBLE (HEV) LIGHT AND YOUR EYES...About a decade or two ago, eye doctors would ask their patients if they ever used a computer. The reality today is not if a computer is being used, but rather, how many hours per day. Many eye doctors are discovering that their patients are using 2 to 4 screens at a time! Computer screens, cell phones and tablets all use Light Emitting Diodes (LED) to deliver a bright and sharp image to the viewer. LED light is comprised of a very high concentration of light on the “Blue” wavelength...This extremely short and powerful wavelength is proven to be very harmful to the sensitive tissue inside the eye. Beyond damage to the health of the eye, blue light has many more harmful effects to your overall health and quality of life....Studies from both Harvard University and the Paris Vision Institute have concluded that there is a direct relation of blue light exposure and retinal cell death. You read this correctly, staring at a computer screen literally increases the rate at which the cells inside your eyeball will die. This drastically increases the risk for Macular Degeneration (America’s leading cause of blindness)....night
time exposure of HEV light disrupts your body’s natural production of Melatonin. This naturally occurring chemical in your body is triggered when the sun goes down to make you tired and facilitate deep REM sleep. Do you use a computer at night? How about reading a tablet or phone in bed? There is a strong feeling amongst leading scientists that modern society is not getting enough restorative sleep due to a Melatonin cycle impairment from computer usage. There is also a new phenomenon in the last decade known as digital eye strain. Sometimes called computer vision syndrome, it is characterized by dull aches and ocular pain. Other symptoms include eyelids that twitch, headaches, and even blurry night vision. These symptoms are often attributed to the habitual exposure to electronic devices.”

Visible Light Hazards and the Glassworker...While the hazards of UV radiation (UVR) to the eye are well known by most individuals, the issue of High Energy Visible (HEV) light and High Intensity Visible (HIV) light are not. Since most of the work that glass workers perform does not generate UVR, the main discussion points of this article will focus on the HEV and HIV hazards...For the purposes of this article, HIV is defined as luminescence in excess of 10,000 lumens. 1 lumen is the luminescence of 1 candle. A 100 watt light bulb emits approximately 120 lumens. Sunlight on a white sand beach can range from 8,000 to 10,000 lumens. Fresh snow on a sunny day can have a luminescence as high as 30,000 lumens...Prolonged unfiltered exposure to HIV increases the time cycle of visual purple replenishment and can affect an individual’s ability to adapt to low light levels. Individuals who spend long periods of time exposed to HIV are particularly susceptible to longer adaptation times when moving to relative dark conditions...Discomfort glare commonly results from one of two conditions – excessive amounts of illumination and/or reflections in the visual field. Excessive lighting causes actual pain and discomfort. Surroundings such as sand, water or polished surfaces can also produce discomfort glare...Age-related Macular Degeneration (AMD) is the result of photochemical damage affecting the macula, the central vision portion of the retina. It is the leading cause of blindness in people over the age of 50. The visual effect of AMD can be described as looking at a clock and being able to see the numbers but not the hands. One person in six, by age 55, will develop AMD. Extended exposure to HEV and HIV may increase the development of AMD. UVR, HEV and HIV have been shown to have a major impact on photoreceptor and retinal pigment epithelium (RPE) cell function, inducing photochemical damage and cell death in the rods and cones. This may lead to early onset of AMD."
Altitude Diseases: Infrared Hazards

- "Infrared astronomy is the branch of astronomy and astrophysics that studies astronomical objects visible in infrared (IR) radiation. The wavelength of infrared light ranges from 0.75 to 300 micrometers. Infrared falls in between visible radiation, which ranges from 380 to 750 nanometers, and submillimeter waves. Infrared astronomy began in the 1830s, a few decades after the discovery of infrared light by William Herschel in 1800. Early progress was limited, and it was not until the early 20th century that conclusive detections of astronomical objects other than the Sun and Moon were made in infrared light. After a number of discoveries were made in the 1950s and 1960s in radio astronomy, astronomers realized the information available outside the visible wavelength range, and modern infrared astronomy was established. Infrared and optical astronomy are often practiced using the same telescopes, as the same mirrors or lenses are usually effective over a wavelength range that includes both visible and infrared light. Both fields also use solid state detectors, though the specific type of solid state photodetectors used are different. Infrared light is absorbed at many wavelengths by water vapor in the Earth's atmosphere, so most infrared telescopes are at high elevations in dry places, above as much of the atmosphere as possible. There are also infrared observatories in space, including the Spitzer Space Telescope and the Herschel Space Observatory. The principal limitation on infrared sensitivity from ground-based telescopes is the Earth's atmosphere. Water vapor absorbs a significant amount of infrared radiation, and the atmosphere itself emits at infrared wavelengths. For this reason, most infrared telescopes are built in very dry places at high altitude, so that they are above most of the water vapor in the atmosphere. Suitable locations on Earth include Mauna Kea Observatory at 4205 meters above sea level, the Paranal Observatory at 2635 meters in Chile and regions of high altitude ice-desert such as Dome C in Antarctic. Even at high altitudes, the transparency of the Earth's atmosphere is limited except in infrared windows, or wavelengths where the Earth's atmosphere is transparent." [https://en.wikipedia.org/wiki/Infrared_astronomy](https://en.wikipedia.org/wiki/Infrared_astronomy)

- "List of highest astronomical observatories...Prior to the late 19th century, almost all astronomical observatories throughout history were located at modest elevations, often close to cities and educational institutions for the simple reason of convenience.[1] As air pollution from industrialization and light pollution from artificial lighting increased during the Industrial Revolution, astronomers sought observatory sites in remote locations with clear and dark skies, naturally drawing them towards the mountains. The first permanent mountaintop astronomical observatory was the Lick Observatory constructed from 1876 to 1887, at the modest elevation of 1,283 m (4,209 ft) atop Mount Hamilton in California.[2] The first high altitude observatory was constructed atop the 2,877 m (9,439 ft) Pic du Midi de Bigorre in the French Pyrenees starting in 1878, with its first telescope and dome installed in 1904.[3] Astronomical observations were also made from Mont Blanc in the late 1800s....Since the mid-20th century, an increasing number of high altitude observatory sites have been developed at locations around the world, including numerous sites in Arizona, Hawaii, Chile, and the Canary Islands.[6][7] The initial wave of high-altitude sites were mostly in the 2,000–2,500 m (6,600–8,200 ft) range, but astronomers soon sought even higher sites above 3,000 m (9,800 ft). Among the largest, best developed, and most renowned of these high altitude sites is the Mauna Kea Observatory located near the summit of a 4,205 m (13,796 ft) volcano in Hawaii, which has grown to include over a dozen major telescopes during the four decades since it was founded. In the first decade
of the 21st century, there has been a new wave of observatory construction at very high altitudes above 4,500 m (14,800 ft), with such observatories constructed in India, Mexico, and most notably the Atacama Desert in northern Chile, now the site of several of the world's highest observatories. The scientific benefits of these sites outweigh the numerous logistical and physiological challenges which must be overcome during the construction and operation of observatories in remote mountain locations, even in desert, polar, and tropical island sites which magnify the challenges but confer additional observational advantages...High altitude sites are also above most of atmosphere's water vapor, making them ideal for infrared astronomy and submillimeter astronomy as those wavelengths are strongly absorbed by water vapor. On the other hand, high altitude does not offer as significant an advantage for radio astronomy at longer wavelengths, so relatively few radio telescopes are located at such sites. At the far end of the spectrum, for the extremely short wavelengths of x-ray and gamma ray astronomy, along with high-energy cosmic rays, high altitude observations once again offers significant advantages, enough that many experiments at these wavelengths have been conducted by balloon-borne or even by space telescopes, although a number of high-altitude ground-based sites have also been used. These include the Chacaltaya Astrophysical Observatory in Bolivia, which at 5,230 m (17,160 ft) was the world's highest permanent astronomical observatory[9] from the time of its construction during the 1940s until surpassed in 2009 by the new University of Tokyo Atacama Observatory,[10] an optical-infrared telescope on a remote 5,640 m (18,500 ft) mountaintop in Chile."

"Does infrared or ultraviolet light damage the lens?...In daylight, the human eye is exposed to long wavelength ultraviolet radiation (UVR), visible radiation and short wavelength infrared radiation (IRR). Almost all the UVR and a fraction of the IRR waveband, respectively, left over after attenuation in the cornea, is absorbed in the lens. The time delay between exposure and onset of biological response in the lens varies from immediate-to-short-to-late. After exposure to sunlight or artificial sources, generating irradiances of the same order of magnitude or slightly higher, biological damage may occur photochemically or thermally. Epidemiological studies suggest a dose-dependent association between short wavelength UVR and cortical cataract. Experimental data infer that repeated daily in vivo exposures to short wavelength UVR generate photochemically induced damage in the lens, and that short delay onset cataract after UVR exposure is photochemically induced. Epidemiology suggests that daily high-intensity short wavelength IRR exposure of workers, is associated with a higher prevalence of age-related cataract. It cannot be excluded that this effect is owing to a thermally induced higher denaturation rate. Recent experimental data rule out a photochemical effect of 1090 nm in the lens but other wavelengths in the near IRR should be investigated."

"Light and Infrared Radiation...Visible light is generally defined as the portion of the electromagnetic spectrum between 380–400 nanometers (nm) and approximately 760 nm. Within the visible light spectrum, blue light (400–500 nm) is of particular importance. Man-made sources of broad-spectrum intense visible light include arc welding or cutting, arc lamps, spotlights, gas and vapor discharge tubes, flash lamps, open flames, and explosions. The majority of infrared (IR) radiation is emitted from the sun, but man-made devices also contribute to its proliferation. It is estimated that more than half (54%) of the sun’s radiation is infrared, whereas 39% is the visible rays and the remaining 7% is the ultraviolet rays. We experience IR radiation every day in the form of heat because IR waves are thermal. Man-made
sources of IR radiation include heated metals, molten glass, home electrical appliances, incandescent bulbs, radiant heaters, furnaces, welding arcs, and plasma torches. Glassblowing and working in glass and steel plants are considered potentially hazardous due to excessive IR radiation...visible light can be harmful—for example, when it is presented suddenly, as in a flash or explosion, or when equipment is first turned on. If the intensity is high enough to cause damage in <0.25 second, the body’s natural protective mechanisms will be insufficient. It is also possible to create a hazardous situation by suppressing the aversion response and staring directly at a high-intensity light source such as the sun (solar maculopathy or eclipse photoretinitis) or a welding arc (welding-arc photoretinitis). The eyes and skin are the organs most susceptible to damage by optical radiation. The type of effect, injury thresholds, and damage mechanisms vary significantly with wavelength. The effects may overlap and must be evaluated independently. Different types (and degrees) of damage to the eye can occur, as follows: Thermal damage of the cornea, approximately 1,400 nm—1 mm. Thermal damage of the iris, approximately 380–1,400 nm. Near-infrared thermal damage of the crystalline lens, approximately 800–3,000 nm. Thermal damage of the retina 380–1,400 nm. “Blue-light” photochemical damage of the retina, principally 380–550 nm (300–550 nm for the aphakic eye). Photochemical damage of the eye from chronic exposure to bright light. Photochemical injury dominates with exposure of the eye to wavelengths of visible light between 400 and 500 nm (blue light), which has an impact on the crystalline lens...The most common eye disease associated with near-infrared radiation is cataracts. Prolonged exposure to IR radiation causes a gradual but irreversible opacity of the lens. Other forms of damage to the eye from IR exposure include scotoma, which is a loss of vision due to the damage to the retina. Even low-level IR absorption can cause symptoms such as redness of the eye, swelling, or hemorrhaging...IR thermal injury may have significant biological effects on the human skin. The IR-A rays induce free radicals in the dermis and diminish the skin’s antioxidant capacity, the main cause of premature skin aging. Both the skin and the cornea are opaque to wavelengths >1,400 nm. Exposure to IR radiation in this region causes injury through thermal mechanisms, with absorbed radiation being converted to heat."
the first in a series of three, discusses how the heating effect of the sun through infrared rays can be hazardous to ocular tissue, and describes the mechanisms of cataractogenesis resulting from occupational exposure... shown to produce a solar retinopathy, first described by Agarwal and Malik (1959)1. Eclipse blindness, as described by Penner and McNair (1966)2, is a similar condition, and will be discussed more fully in the next article in this series. While a number of valuable recent studies on infrared have attempted to establish threshold energy levels and exposure times for damage to the eye, these have mainly been in relation to animal experiments, including those on the monkey eye. The occupational levels typically encountered have only been documented in the past decade and their effects and consequences are still far from being fully understood."

- "Infrared radiation: the old unknown enemy of the human eye...Infrared light (IR) is an electromagnetic radiation whose wavelength spans between 780 nm and 1 mm, and it represents the less energetic, although the most abundant part (~54%) of the solar radiation spectrum that reaches the Earth’s ground (Fig. 1). It is an invisible radiation, and its main effect on human beings is the nice warmth sensation which most of us appreciate. However, since the beginning of the industrial revolution, in the 18th century, it is known that IR radiation can also produce dangerous consequences for the human eye: as the technological innovation was continuously providing new and stronger artificial sources of infrared light, studies were published associating the occupational exposure to IR with several kinds of eye injures, like retinal burns for welders, or cataracts, detected for the first time in glass blowers and metal workers already in 1739 [1]. The exposure to IR light has been related to several eye pathologies, mainly in association with thermal effects, acting on almost every part of the ocular anatomy [2] (Fig. 2); however, a particular care has to be taken when considering the contribution of IR radiation to the couple of diseases that most frequently are associated with aging: cataracts and Age-Related Macular Degeneration (ARMD). These two classes of injuries take place in different parts of the eye, respectively the lens and the retina. In both cases, the most relevant contribution to the formation of the damages is produced by IR-A, the energetically stronger part of IR, with wavelength spanning between 780 and 1400 nm....epidemiology data [13] at global scale evidenced how the highest percentages of visual impairment due to cataracts are found in the north African and south Asian regions: although the main reason has to be seen in the lack of accessibility to health care and limited financial resources for patients, it is interesting to observe how these areas are positioned at the equatorial latitude, where sun radiation is more intense. Nowadays, it is commonly accepted that the main effect of IR radiation on the ocular lens is an accelerated aging [14], which produces cataracts. It is known that the aging process, involving oxidation events, is deeply affected by temperature and heat transfers. As a matter of fact, people who develop cataracts as a result of chronic or excessive exposure to IR radiation anticipate an opacification which was probably destined to appear in their old age years [15]...The effect of IR exposure of the retina and the choroid is a temperature increase through the absorption of near-infrared energy by melanin (and, to a lesser extent, hemoglobin, see Fig. 3), which denatures enzymes. Generally speaking, temperatures only 10 ºC higher than the human body value could induce permanent thermal damages...Recently, Dadoukis et al. [17] were able to find a relationship between an increased activity of MMP-2, and consequently of ARMD, and chronic or severe exposure to IR radiation."
therapeutic application to the human eye. Aim: The present study was designed to investigate the effect of IR radiation on rabbit’s crystalline lens and lens membrane. Materials and Methods: Fifteen New Zealand rabbits were used in the present work. The rabbits were classified into three groups; one of them served as control. The other two groups were exposed to IR radiation for 5 or 10 minutes. Animals from these two irradiated groups were subdivided into two subgroups; one of them was decapitated directly after IR exposure, while the other subgroup was decapitated 1 hour post exposure. IR was delivered from a General Electric Lamp model 250R 50/10, placed 20 cm from the rabbit and aimed at each eye. The activity of Na+-K+ ATPase was measured in the lens membrane. Soluble lens proteins were extracted and the following measurements were carried out: estimation of total soluble protein, sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) and Fourier transform infrared (FTIR) spectroscopy. For comparison between multiple groups, analysis of variance was used with significance level set at P < 0.001. Results: The results indicated a change in the molecular weight of different lens crystalline accompanied with changes in protein backbone structure. These changes increased for the groups exposed to IR for 10 minutes. Moreover, the activity of Na+-K+ ATPase significantly decreased for all groups. Conclusions: The protein of eye lens is very sensitive to IR radiation which is hazardous and may lead to cataract.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3116568/

- "Glassblowers' ocular health and safety: optical radiation hazards and eye protection assessment...The aims of this study were to investigate the levels of optical radiation exposure in glassblowing and to determine type(s) of protective eyewear commonly used. Radiometric measurements of radiant emissions from different molten glass materials and heating systems were carried out in six installations. Spectral transmittance curves of available protective lenses used at the locations were obtained. Significant variation (P = 0.0001) in ocular irradiation was obtained. All operations produced irradiances higher than the threshold limit values (TLVs) for the visible spectrum (400 to 700 nm). In craft glassblowing which employs furnace systems, irradiances levels exceeding the TLVs for near infrared (760 to 1100nm) were obtained. Molten soda-lime and quartz glasses emitted substantial subthreshold near UV radiation. This study shows that variation exists in glassblowing ocular radiation exposure due to different glass materials and heating systems, therefore selection of appropriate eye protector should be on an individual basis." https://www.sciencedirect.com/science/article/abs/pii/S0275540896000877

- "Glassblower's cataract...Glassblower's cataracts are a form of cataract due to an occupational exposure. They are formed by many years or decades of exposure to infrared radiation while working in the occupation of glass blowing, or working close to hot or molten metals such with metal foundry workers[1] or blacksmiths. Glassblower's cataracts are due to chronic exposure to infrared radiation emitted due to the extreme heating of glass or molten metal. The infrared radiation is absorbed by the iris and lens of the eye. This causes cataracts after decades of exposure. [2] This condition may be prevented by wearing protective glasses while practicing these occupations...Glassblowers tend to work with very high-temperature objects and equipment, which emit a great deal of infrared radiation through black-body radiation. The ocular lens, like all matter, has the capacity to store incident photon energy by resonance absorption. Absorption of infrared photons increases vibration of molecules, which is observed as increased temperature. Large important biomolecules such as proteins tend to lose their space structure when vibrating, known as denaturation. The rate of protein denaturation is temperature dependent as described by the Arrhenius equation. Damage to biological tissue owing to the high rate of vibration damage is called thermal damage.[3] Prior to recent research, it was
theorized that one possible mechanism was the large intake of fluid due to excessive sweating on the job. Within this theory, it was suggested that the evaporation of the sweat within the cornea "could lead to increased concentration of the aqueous humour," this increase could therefore induce the cataract. [4] This however has not been proven to be true and instead it is generally accepted that the infrared photons as mentioned above are the primary cause of glassblower's cataracts... common risk factors unrelated to occupation are smoking, excessive alcohol consumption, deficiency in vitamin E, B1, and B2, and increased exposure of sunlight to the eyes. Risk factors that are not modifiable include previous eye injury, family history, diabetes, the use of corticosteroids, and previous eye surgery. To lessen the risk of developing cataracts it is best to limit alcohol consumption, not use or stop the use of tobacco, get adequate amounts of vitamins E, B1, and B2, and wear sunglasses and/or a wide brim hat while outside. Even if you are taking all of these steps it is still recommended that patients have eye exams every other year, or every year if over 60...symptoms typically have a gradual onset. Initially, people generally are unaware they have cataracts. Blurry vision is one of the first symptoms to appear which gradually worsens as the cataracts develop further. Colors may eventually become more and more faded, eyes will become more sensitive to light, and sometimes people will have trouble seeing at nighttime. Double vision can occur and the need to change prescriptions often are also common symptoms. Over time, vision loss can occur in people who have well developed, untreated cataracts."

"Denaturation is a process in which proteins or nucleic acids lose the quaternary structure, tertiary structure, and secondary structure which is present in their native state, by application of some external stress or compound such as a strong acid or base, a concentrated inorganic salt, an organic solvent (e.g., alcohol or chloroform), radiation or heat.[3] If proteins in a living cell are denatured, this results in disruption of cell activity and possibly cell death. Protein denaturation is also a consequence of cell death.[4][5] Denatured proteins can exhibit a wide range of characteristics, from conformational change and loss of solubility to aggregation due to the exposure of hydrophobic groups. Denatured proteins lose their 3D structure and therefore cannot function. Protein folding is key to whether a globular or membrane protein can do its job correctly; it must be folded into the right shape to function. However, hydrogen bonds, which play a big part in folding, are rather weak and thus easily affected by heat, acidity, varying salt concentrations, and other stressors which can denature the protein. This is one reason why homeostasis is physiologically necessary in many life forms. This concept is unrelated to denatured alcohol, which is alcohol that has been mixed with additives to make it unsuitable for human consumption." 

"New light shed on damaging impact of infrared and visible rays on skin..."It is important to consider that visible and infrared light may also be contributing to the damage our skin receives from the sun, and that it could be beneficial to protect our skin against these as well when UV is present. "In addition we found that our skin cells are sensitive not only to the single UV, visible and infrared wavelengths but also to their interaction within sunlight. This means on their own each is fine but when combined the effect is enhanced, like in boxing -- the first blow, the UV, does the major damage and then the smaller jabs, punches two and three, represented by visible and infrared topple the boxer to the floor. "Visible and infrared on their own have a small effect on skin damage but their potency is increased dramatically when UV is present."...cells from the dermal layer deeper in the skin (fibroblasts) were damaged by UV as expected, but had greater
damage from the complete solar light. These cells were more damaged by the inclusion of the visible and infrared light, which left the keratinocytes unaffected...Further research will be done by Newcastle University scientists to understand the mechanism of the synergistic effect of combined UV, visible and infrared light. In addition, they will look at why the deeper dermal fibroblasts are more sensitive than the top-layer epidermal keratinocytes."

https://www.sciencedaily.com/releases/2020/01/200123095834.htm

- "Infrared and skin: Friend or foe...In the last decade, it has been proposed that the sun's IR-A wavelengths might be deleterious to human skin and that sunscreens, in addition to their desired effect to protect against UV-B and UV-A, should also protect against IR-A (and perhaps even visible light). Several studies showed that NIR may damage skin collagen content via an increase in MMP-1 activity in the same manner as is known for UVR. Unfortunately, the artificial NIR light sources used in such studies were not representative of the solar irradiance. Yet, little has been said about the other side of the coin. This article will focus on key information suggesting that IR-A may be more beneficial than deleterious when the skin is exposed to the appropriate irradiance/dose of IR-A radiation similar to daily sun exposure received by people in real life. IR-A might even precondition the skin – a process called photoprevention – from an evolutionary standpoint since exposure to early morning IR-A wavelengths in sunlight may ready the skin for the coming mid-day deleterious UVR. Consequently IR-A appears to be the solution, not the problem. It does more good than bad for the skin. It is essentially a question of intensity and how we can learn from the sun."


- "Infrared Therapy: Health Benefits and Risks...What are the Risks Linked to Infrared Therapy? Each day, humans are immersed in infrared radiation from the sun in the form of heat. In fact, infrared saunas are in-demand today, but experts warn of possible health risks. Thermal or heat injuries can happen, depending on the wavelength of the infrared light. Thermal injury can occur even without pain. Also, pregnant women, people with heart diseases, and those who are sick should never undergo infrared therapy. Moreover, experts warn against using infrared therapy to treat chronic diseases while neglecting the use of medications and recommended treatment procedures. Though infrared therapy promises many health benefits, its study is far from complete. At present, therefore, it should be considered an adjunct to medical treatment, and other regimens should be continued as prescribed."


- "Are there any harmful side effects of regular infrared sauna use?...The International Commission on Non-Ionizing Radiation Protection (ICNIRP) released a statement on Far Infrared Exposure in 2006. The ICNIRP statement on the biological effects of infrared radiation (IR) indicates that thermal injury (heat) is the dominant risk. Thermal (heat) injuries will depend on the wavelength (or color, if it could be seen) of the IR lights. IR light may cause thermal injury even if you do not feel pain for certain types of IR light exposure. Hyperpigmentation, scaling, and telangiectasias (erythema ab igne) may occur from repeated IR exposures of elevated temperatures, even if the skin is not burned. Skin cancer is not expected from exposure to IR. However, increased skin temperature can reduce DNA repair efficiency, and promote skin cancer that is initiated by other agents. Skin thickness may also increase due to repeated IR exposures. Ultraviolet light is associated with photo aging of skin, and it is not specifically reported in association with IR light. If the IR light is >1,500 nm, it is unlikely there will be any effects on the retina but damage to the cornea due to thermal heating could occur. The lens of the eye could possibly accrue damage due to elevated temperatures, leading
to cataracts. Additionally, one must be careful to not overcome the thermoregulatory mechanism of your body. It is possible to cause serious injury to a person by overheating when exposed to IR. The ICNIRP does not address “IR saunas” but does address IR cabins. They note that there have been no reported cases of erythema ab igne from typical use, but cautions that there have been no controlled studies of saunas or IR cabins. Overall, if the facility complies with ICNIRP limits, one would expect that no injuries would occur. The ICNIRP recommendations are rather complex to those unfamiliar with nonionizing radiation, and a person with expertise in this field should be consulted for compliance. Thomas E. Johnson, Associate Professor. Colorado State University. Reference: International Commission on Non-Ionizing Radiation Protection. ICNIRP statement on far infrared radiation exposure. Health Phys Journal 91(6):630-645; 2006." https://hps.org/publicinformation/ate/q10677.html
Altitude Diseases: Solar Retinopathy

- "The dark side of the sun...the damage from solar retinopathy can occur without any feeling of pain and the visual effects are not noticed for several hours after the damage has been done. After a few hours you may notice the following symptoms: Eyes begin to water and feel sore. Discomfort looking at bright lights. Difficulty discerning shapes, especially detailed objects. Objects can look distorted. A blind spot in the centre of your vision. If you experience any of these symptoms after looking at the sun, see your GP, optometrist or another medical practitioner as soon as possible...Recovery from solar retinopathy can take from around one month to twelve months, depending on the extent of the damage caused by the exposure to UV rays. If the damage is more severe and extends to the macula, then there may be permanent loss of vision...There have been several documented incidents of people suffering solar retinopathy on a mass scale: after the 1999 solar eclipse in East Sussex, England, while in 1988, Italian ophthalmologists treated 66 people who belonged to a sun-worshipping religious sect for solar retinopathy after a sun-staring ritual." [https://visioneyeinstitute.com.au/eyematters/dark-side-sun/]

- "Why Shouldn’t You Stare at the Sun?...What happens when you stare at the sun for too long. When ultraviolet (UV) light from the sun enters the eye, it’s focused through the lens of the eye and onto the retina at the back of the eye. The retina is the light-sensitive tissue lining the inner surface of the eye. Once absorbed into the retina, the UV rays result in the formation of free radicals. These free radicals start to oxidize the surrounding tissues. They ultimately destroy the rod and cone photoreceptors in the retina. The oxidative damage is referred to as solar or photic retinopathy. Damage can occur in as little as a few seconds of staring directly at the sun." [https://www.healthline.com/health/staring-at-the-sun#what-happens-to-your-eye]

- "Your Sight. Protect Your Eyes from the Sun. Solar Eclipse and Your Eyes...How can your eyes be affected by a solar eclipse? Exposing your eyes to the sun without proper eye protection during a solar eclipse can cause “eclipse blindness” or retinal burns, also known as solar retinopathy. This exposure to the light can cause damage or even destroy cells in the retina (the back of the eye) that transmit what you see to the brain. This damage can be temporary or permanent and occurs with no pain. It can take a few hours to a few days after viewing the solar eclipse to realize the damage that has occurred. What are the eye symptoms that can occur from looking at a solar eclipse without proper eye protection? Loss of central vision (solar retinopathy). Distorted vision. Altered color vision. If you notice symptoms after viewing a solar eclipse, seek treatment from an eye care professional." [https://preventblindness.org/solar-eclipse-and-your-eyes/#:~:text=Exposing%20your%20eyes%20to%20the%2c%20you%20see%20to%20brain.]

- "Getting Too Close to the Sun. This patient learned firsthand about the dangers of viewing the solar eclipse...A 19-year-old male college student with no medical history presented for evaluation of a "blind spot" in the right eye of two weeks duration following the August 21, 2017, solar eclipse. The patient reported that he intermittently looked at the eclipse without eye protection for a total of 2.5 minutes, taking breaks to look away every 10 to 15 seconds. He noticed the scotoma just nasal to fixation in the right eye starting about one hour after the eclipse. He noted no progressive enlargement of the scotoma or new scotomas in the subsequent days and found that the “blind spot” had grown less noticeable over time. His ocular history was unremarkable....Decreased visual acuity in solar retinopathy is often self-resolving, and
prognosis is correlated with initial visual acuity and photoreceptor damage on OCT.3,7 A study from Nepal found that more than 80 percent of 319 patients with solar retinopathy had final visual acuity of 20/40 or better.8 In a case series of 36 patients with solar retinopathy from a 1995 solar eclipse in Pakistan, 72 percent of patients had full recovery of vision and another 19 percent had partial recovery, with maximum recovery occurring between two weeks and six months." [https://www.retina-specialist.com/article/getting-too-close-to-the-sun](https://www.retina-specialist.com/article/getting-too-close-to-the-sun)

- "Photic retinopathy is damage to the eye's retina, particularly the macula, from prolonged exposure to solar radiation or other bright light, e.g., lasers or arc welders. The term includes solar, laser, and welder's retinopathy and is synonymous with retinal phototoxicity.[1] It usually occurs due to staring at the Sun, watching a solar eclipse, or viewing an ultraviolet, Illuminant D65, or other bright light...Although it is frequently claimed that the retina is burned by looking at the Sun, retinal damage appears to occur primarily due to photochemical injury rather than thermal injury. The temperature rise from looking at the Sun with a 3-mm pupil only causes a 4 °C increase in temperature, insufficient to photocoagulate. The energy is still phototoxic: since light promotes oxidation, chemical reactions occur in the exposed tissues with unbonded oxygen molecules.[1] It also appears that central serous retinopathy can be a result of a depression in a treated solar damaged eye.[4][5][6] The duration of exposure necessary to cause injury varies with the intensity of light, and also affects the possibility and length of recovery...A person with photic retinopathy may notice an impairment in their vision, for example a spot that does not go away after a reasonable recovery time, or blurring. They may also have eye pain or headaches. Vision impairment is usually in both eyes, but can be in just one. Impairment of a person with 20/20 vision usually ends up being about 20/40 or 20/60, but can be better or far worse...Generally speaking, people diagnosed with photic retinopathy recover visual acuity completely within two months,[7][8] though more severe cases may take longer, or not see complete recovery at all." [https://en.wikipedia.org/wiki/Photic_retinopathy](https://en.wikipedia.org/wiki/Photic_retinopathy)

- "Solar retinopathy (also known as, photic retinopathy, foveomacular retinitis, solar retinitis, and eclipse retinopathy) refers to a photochemical toxicity and resultant injury to retinal tissues, usually occurring at the fovea. This entity is commonly associated with sun-gazing or eclipse viewing, and often results in mild-to-moderate visual acuity deficit and/or central or paracentral scotomata. Recovery is spontaneous in nature and occurs over the course of 3-6 months after the inciting event, though visual recovery may be incomplete and patient may suffer from permanent visual acuity deficits and central or paracentral scotomata....The disease entity has been recognized, to some degree since the times of Classical Greece[1]. While this disease process is classically associated with sun-gazing and eclipse viewing, a number of reports have found phototoxic foveomacularopathy to occur secondary to a myriad of other mechanisms, including from ophthalmic operating microscopes[2][3], endoillumination techniques utilized during vitreoretinal surgeries[4], occupational hazards such as welding arcs[5] and laser pointers[6], and even photographic illumination mechanisms...Obtaining a good history is important for making a clinical diagnosis of solar or photic retinopathy. Sun-gazing, eclipse-viewing, occupational hazards such as welding without a welding helmet or welding goggles, repeated flash-photography, recent cataract extraction or other ophthalmologic operative procedures may be endorsed by the patient or may require pointed interrogation. Furthermore, cognizance on the part of the ophthalmologist of solar and other astronomical phenomena, such as solar eclipse, may aid in teasing out pertinent history from patients that raise suspicion for solar retinopathy." [https://eyewiki.aao.org/Solar_Retinopathy#:~:text=Solar%20retinopathy%20(also%20known%20as,usually%20occurring%20at%20the%20fovea](https://eyewiki.aao.org/Solar_Retinopathy#:~:text=Solar%20retinopathy%20(also%20known%20as,usually%20occurring%20at%20the%20fovea).
Altitude Diseases: Ultraviolet (UV) Radiation Hazards

- “It was well known to high altitude workers that the high ultraviolet (UV) radiation levels would damage rubber, plastics and paints outdoors at the observatory.” Steven Magee CEng MIET - Q
- “Sun Damage from UV Exposure at Higher Altitudes. Many people enjoy skiing, snowboarding, hiking, rock climbing or going on a family outing or camping trip. There is so much to see, do and experience. Unfortunately, people do not consider the increased risk of harmful UV sun exposure. This is due to the decreased level of ozone protection from being in the higher elevations. A case study conducted based on high elevation explains that for every 1,000 feet of elevation you climb, you’ll experience an 8-10 percent increase in ultraviolet intensity. If you are hiking at an elevation of just over 6,000 feet, you’re exposed to 60 percent more sun UV rays than you would be if you were at the same latitude at sea level. A UV index of 3 or higher can cause someone with fair skin to burn.” https://www.eclipserx.com/blog/sun-damage-from-uv-exposure-at-higher-altitudes-n15
- “Closer to the Sun: The Dermatological Benefits and Consequences of Living at High Altitude...As many of us know, high-altitude living goes hand-in-hand with a multitude of outdoor activities like biking, hiking, and skiing. But with all that outdoor activity comes an insidious risk: radiation from the sun. According to an article interviewing Kim Guthke PA-C, a Physician Assistant working in Dermatology in Boulder, CO, “living at a higher elevation exposes us to approximately 25 percent more ultraviolet radiation when compared to sea level” (Guthke 2018). This means that with all the outdoor activities we enjoy, we must also be proactive about protecting our skin from high altitude sun and the increased risks of long-term skin issues it brings. In a revelational article from Outside magazine called “Is Sunscreen the New Margarine?”, Rowan Jacobsen uncovered a novel study claiming only the sun can provide the vitamin D we need. He claims that we are trying and failing to supply vitamin D with pills alone, and the pills just aren’t good enough. Vitamin D is a vitamin required for calcium absorption whose levels, if low, can increase one’s risk of “cancer, diabetes, obesity, osteoporosis, heart attack, stroke, depression, cognitive impairment, autoimmune conditions, and more” (Jacobsen 2019). Thus healthcare workers have concluded that supplementing it will obviously decrease the risk of these diseases. Jacobsen reports that multiple different studies have proven that supplementation of vitamin D just isn’t enough to lower that risk. The studies reported that even if supplementation raised vitamin D levels, the general health of the patient did not improve. There was no correlation between high supplemented vitamin D levels and overall health.” https://highaltitudehealth.com/2019/09/24/closer-to-the-sun-the-dermatological-benefits-and-consequences-of-living-at-high-altitude/
- “Altitude Increases Sunburn Risk...The research model suggests an approximate 8 percent to 10 percent increase in ultraviolet intensity for each 1,000 feet of elevation across the studied altitudes. UV-B intensity decreases as light moving toward the Earth is scattered, reflected and/or absorbed. The higher the altitude, the more intense the UV-B light exposure can damage unprotected skin. With the increased exposure to UV-B, the expected annual non-melanoma skin cancer rate for year-round residents at 8,500 feet is estimated to be approximately 115 percent greater than those living at sea level at the same latitude. By comparison, the rate is projected to be 100 percent greater at sea level in Orlando than in New York. Melanoma rates can also be expected to be higher at increasing altitudes. "The American Academy of
Dermatology recommends that everyone wear protective clothing, avoid the strongest mid-day sun and wear sunscreen daily," said Dr. Rigel. "This study shows that this triad of protective measures is increasingly important as a skin cancer prevention measure in high altitude areas -- especially as the population of those areas grows."

https://www.newswise.com/articles/altitude-increases-sunburn-risk

“Sunlight and Skylight at High Altitudes...AT the Southampton meeting of the British Association, Captain Abney read a paper in which he called attention to the fact that photographs taken at high altitudes show skies that are nearly black by comparison with bright objects projected against them, and he went on to show that the higher above the sea-level the observer went, the darker the sky really is and the fainter the spectrum. In fact, the latter shows but little more than a band in the violet and ultraviolet at a height of 8500 feet, whilst at sea-level it shows nearly the whole photographic spectrum. The only reason of this must be particles of some reflecting matter from which sunlight is reflected. The author refers this to watery stuff of which nine-tenths is left behind at the altitude at which he worked. He then showed that the brightness of the ultra-violet of direct sunlight increased enormously the higher the observer went, but only to a certain point, for the spectrum suddenly terminated about 2940 wave-length. This abrupt absorption was due to extra atmospheric causes and perhaps to space. The increase in brightness of the ultra-violet was such that the usually invisible rays L, M, N could be distinctly seen showing that the visibility of these rays depended on the intensity of the radiation. The red and ultra-red part of the spectrum was also considered He showed that the absorption lines were present in undiminished force and number at this high altitude, thus placing their origin to extra atmospheric causes. The absorption from atmospheric causes of radiant energy in these parts he showed was due to “water-stuff,” which he hesitated to call aqueous vapour, since the banded spectrum of water was present, and not lines. The B and A line he also stated could not be claimed as telluric lines, much less as due to aqueous vapour, but must originate between the sun and our atmosphere. The author finally confirmed the presence of benzene and ethyl in the same region. He had found their presence indicated in the spectrum at sea-level, and found their absorption lines with undiminished intensity at 8500 feet. Thus without much doubt hydrocarbons must exist between our atmosphere and the sun, and it may be in space.”

https://www.nature.com/articles/026586a0

“Sun Protection at Higher Altitudes...Living in beautiful, sunny Boulder County can be both a blessing and a curse for our health. Benefits of moderate sun exposure may include stronger bones, improved moods during all seasons, and a more robust immune system. Unfortunately, living at a higher elevation also exposes us to approximately 25 percent more ultraviolet radiation when compared to sea level. Hence, while we enjoy a high number of sun-filled days here in Colorado, it is important to be aware of the increased long-term risks to our skin and health that come with high altitude sun exposure. Exposure to ultraviolet radiation from the sun is the primary cause of all skin cancers. Moreover, through years of sun exposure our skin becomes wrinkled, hyper-pigmented and thin. Ninety percent of wrinkles are caused by sun exposure alone...Ultraviolet radiation from the sun does pass through glass, so remember to wear sunscreen when driving or if you work near windows., Sun damage often occurs more on the left side of the face due to driving.”

https://www.bouldermedicalcenter.com/sun-protection-at-higher-altitudes/

“Is Sunscreen the New Margarine?...The idea that slavish application of SPF 50 might be as bad for you as Marlboro 100s generated a flurry of short news items, but the idea was so weird that it didn’t break through the deadly-sun paradigm. Some doctors, in fact, found it quite
dangerous...The results clearly showed that the reason people in sunnier climes have lower blood pressure is as simple as light hitting skin...Vitamin D now looks like the tip of the solar iceberg. Sunlight triggers the release of a number of other important compounds in the body, not only nitric oxide but also serotonin and endorphins. It reduces the risk of prostate, breast, colorectal, and pancreatic cancers. It improves circadian rhythms. It reduces inflammation and dampens autoimmune responses. It improves virtually every mental condition you can think of. And it’s free...Every year, Richard Weller spends time working in a skin hospital in Addis Ababa, Ethiopia. Not only is Addis Ababa near the equator, it also sits above 7,500 feet, so it receives massive UV radiation. Despite that, says Weller, “I have not seen a skin cancer. And yet Africans in Britain and America are told to avoid the sun.”

“Sunburn...Sunlight can help our mental outlook and help us feel healthier. For people who have arthritis, the sun's warmth can help relieve some of their physical pain. Many people also think that a suntan makes a person look young and healthy. But sunlight can be harmful to the skin, causing immediate problems as well as problems that may develop years later...Long-term problems include: An increased chance of having skin cancer. An increase in the number of cold sores. An increase in problems related to a health condition, such as lupus. Cataracts, from not protecting your eyes from direct or indirect sunlight over many years. Cataracts are one of the leading causes of blindness. Skin changes, such as premature wrinkling or brown spots...You may get a more severe sunburn depending on: The time of day. You are more likely to get a sunburn between 11 in the morning and 4 in the afternoon, when the sun's rays are the strongest. You might think the chance of getting a sunburn on cloudy days is less, but the sun's damaging UV light can pass through clouds. Whether you are near reflective surfaces, such as water, white sand, concrete, snow, and ice. All of these reflect the sun's rays and can cause sunburns. The season of the year. The position of the sun on summer days can cause a more severe sunburn. Altitude. It is easy to get sunburned at higher altitudes, because there is less of the earth's atmosphere to block the sunlight. UV exposure increases about 4% for every 300 m (1000 ft) gain in elevation. How close you are to the equator (latitude). The closer you are to the equator, the more direct sunlight passes through the atmosphere. The UV index of the day, which shows the risk of getting a sunburn that day.”

“The effects of UV-B radiation on human skin are varied and widespread. UV-B induces skin cancer by causing mutation in DNA and suppressing certain activities of the immune system...UV-B may also suppress the body’s immune response to Herpes simplex virus and to skin lesion development, and may similarly harm the spleen....Common eye problems resulting from over-exposure to UV-B include cataracts, snow blindness, and other ailments, both in humans and animals...Living organisms at high elevations are generally exposed to more solar radiation and with it, more UV-B than organisms at low elevations.”

“Ultraviolet radiation (UVR) whether of solar or artificial origin, is a known carcinogen. Excessive exposure to UVR increases the risk of several types of cancer, cortical cataract, some conjunctival neoplasms, ocular melanoma, autoimmune and viral diseases.”

“Health Hazards in Rock Climbing...Sun exposure causes skin cancer. Don’t ignore the need to cover-up, use sunscreen, and avoid the mid-day sun. Lips are especially vulnerable, and their exposure is often ignored by outdoor sports people.”
“Kilimanjaro Health Issues...Sun related injuries. About 55% of the earth’s protective atmosphere is below an altitude of 5000m. Far less ultraviolet light is being filtered out, making the sun’s rays much more powerful, which could result in severe sun burning of the skin. It is strongly recommended to use a 20+ sun protection cream at lower altitudes, and a total block cream above an altitude of 3000m. It is also important to wear dark sun glasses preferably with side panels above 4000m in daytime and essential when walking through snow or ice. Snow blindness can be very painful, and will require your eyes to be bandaged for at least 24 hours.”

“What Is Ultraviolet Light?...Ionization. UV radiation has enough energy to break chemical bonds. Due to their higher energies, UV photons can cause ionization, a process in which electrons break away from atoms. The resulting vacancy affects the chemical properties of the atoms and causes them to form or break chemical bonds that they otherwise would not. This can be useful for chemical processing, or it can be damaging to materials and living tissues. This damage can be beneficial, for instance, in disinfecting surfaces, but it can also be harmful, particularly to skin and eyes, which are most adversely affected by higher-energy UVB and UVC radiation.”

“Ultraviolet light is a known carcinogen and can affect human health in many ways that are only just starting to be understood.”

“What sort of radiation can cause genetic mutations?...Another source of radiation is ultraviolet radiation which can also mutate DNA. This radiation forms thymine dimers. These dimers are formed when two adjacent DNA molecules bond with each thus causing the conformation (shape of the DNA molecule) to buckle and thus impede replication. Fortunately, DNA has repair systems to correct this problem. But in nature, things are not always perfect, so if the repair system fails this raises the risk of cancer.”

“How UV Radiation Causes DNA Mutations...Both long and short wavelength UV light are damaging to DNA, but in different ways. Short wavelength UV-B and UV-C light can directly cause dimerization of pyrimidines, and directly prevent replication of plasmid DNA, or induce mutations after faulty repair. Long wavelength UV-A light is generally less directly damaging, and instead causes mutations through the production of reactive oxygen species. In the lab, UV-A is less harmful to naked DNA. This is why it is best to use a long-wavelength transilluminator to visualize DNA bands, if possible! However, with enough exposure, UV-A light could still damage your DNA.”

“UV-B lamps...UV-B lamps are lamps that emit a spectrum of ultraviolet light with wavelengths ranging from 290–320 nanometers. This spectrum is also commonly called the biological spectrum due to the human body's sensitivity to light of such a wavelength.[1] UV-B light does not tan the skin very much, compared to the UV-A lamps that are used in tanning beds...Too much UV ultraviolet radiation of an undesirable wavelength may lead to direct DNA damage, sunburn, and skin cancer.[5] In contrast to exposure to UV-B light given at low dosage, it was found that UV-A light increases the risk of skin cancer because of the problematic wavelength and because it is given in a much higher dosage.”

“Prevention: The Dangers of UV Radiation...Window glass blocks most UVB radiation, but only 30 percent of UVA radiation. The laminated glass of car windshields blocks most UVB and UVA radiation but side and rear window glass does not block most UVA radiation. Clear films for non-laminated car window glass are available.”
“Ultraviolet radiation. Ultraviolet (UV) radiation comes from natural sources (like the sun), and artificial sources (like black lights, welding equipment, lasers, and tanning equipment)...A nuclear reaction at the sun's core creates massive amounts of radiation, or energy. This energy (also known as the electromagnetic spectrum) includes radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays, and gamma rays. Depending on its wavelength, different types of solar radiation do different things: Infrared radiation makes us feel the warmth of the sun. Visible light allows us to see the world around us. Ultraviolet radiation affects our health...Surface reflections - Fresh white snow reflects up to 85% of UV radiation. Other bright surfaces (like sand, concrete, and water) reflect less. If you are skiing on a spring day at the end of March, for example, the reported UV index may only be 4, but because of reflection from the snow, you may experience a UV index of 7. Altitude - UV radiation increases with altitude (height above sea level) because there is less atmosphere to absorb the damaging rays. The UV index measured in Edmonton will be less than that measured at the top of a mountain in Jasper. At an altitude of around 2,000 metres, the amount of UV radiation can be up to 30% higher than at sea level. Latitude - UV is strongest at the equator where the UV index can reach about 12. In Canada, the UV index is highest in southern Ontario and is lowest at the North Pole.”

“Exposure to Ultraviolet Radiation in the Modulation of Human Diseases...This review focuses primarily on the beneficial effects for human health of exposure to ultraviolet radiation (UVR). UVR stimulates anti-inflammatory and immunosuppressive pathways in skin that modulate psoriasis, atopic dermatitis, and vitiligo; suppresses cutaneous lesions of graft-versus-host disease; and regulates some infection and vaccination outcomes. While polymorphic light eruption and the cutaneous photosensitivity of systemic lupus erythematosus are triggered by UVR, polymorphic light eruption also frequently benefits from UVR-induced immunomodulation. For systemic diseases such as multiple sclerosis, type 1 diabetes, asthma, schizophrenia, autism, and cardiovascular disease, any positive consequences of UVR exposure are more speculative, but could occur through the actions of UVR-induced regulatory cells and mediators, including 1,25-dihydroxy vitamin D3, interleukin-10, and nitric oxide. Reduced UVR exposure is a risk factor for the development of several inflammatory, allergic, and autoimmune conditions, including diseases initiated in early life. This suggests that UVR-induced molecules can regulate cell maturation in developing organs.”

“Light therapy...Ultraviolet light causes progressive damage to human skin and erythema even from small doses.[58][59] This is mediated by genetic damage, collagen damage, as well as destruction of vitamin A and vitamin C in the skin and free radical generation.[citation needed] Ultraviolet light is also known to be a factor in formation of cataracts.[60][61] Ultraviolet radiation exposure is strongly linked to incidence of skin cancer.”

“UV Light: Positive & Negative Effects...Dangers of UV Light to Humans...There are several negative effects of UV light on humans. Increasing the risk of skin cancer is the most well-known of these, with about 90 percent of skin cancers being down to UV radiation (mainly UV-B, but UV-A rays are implicated too). UV rays also cause sunburn, damaging the skin cells and causing extra blood flow to the affected area, which leads to the reddened skin typical of sunburn. The immune system is responsible for protecting the body from pathogens, and it’s generally thought that UV radiation suppresses this system to some extent. The functioning and
distribution of the white blood cells are affected up to a day after sunlight exposure, and excessive exposure may have even greater effects. UV light can also impact the tissues of your eye, effectively burning them and causing a condition called photokeratitis. UV Light’s Effects on Plant and Animal Life. Finally, UV light is known to have some effects on animal life as well. One key impact of UV-B light is that it can impact the process of photosynthesis, reducing the size, productivity and quality of plants such as: corn, cotton, soybeans, rice. It also has an impact on phytoplankton in the ocean (which produce energy through photosynthesis), reducing their productivity and having a range of knock-on effects for the ecosystem. UV-B is also thought to increase plants’ susceptibility to disease.”[1]
Altitude Diseases: UV & Cancer

- "The International Agency for Research on Cancer (IARC) is part of the World Health Organization (WHO). One of its major goals is to identify causes of cancer. Based on the available data, IARC has made the following determinations: Solar radiation is carcinogenic to humans. Use of UV-emitting tanning devices is carcinogenic to humans. UV radiation (including UVA, UVB, and UVC) is carcinogenic to humans. The National Toxicology Program (NTP) is formed from parts of several different US government agencies, including the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA). The NTP has made the following determinations: Solar radiation is known to be a human carcinogen. Exposure to sunlamps or sunbeds is known to be a human carcinogen. Broad-spectrum UV radiation is known to be a human carcinogen. UVA radiation is reasonably anticipated to be a human carcinogen. UVB radiation is reasonably anticipated to be a human carcinogen. UVC radiation is reasonably anticipated to be a human carcinogen." [https://www.cancer.org/cancer/cancer-causes/radiation-exposure/uv-radiation.html]

- "UV Radiation...Overexposure to UV radiation can lead to serious health issues, including cancer. Skin cancer is the most common cancer in the United States. The two most common types of skin cancer are basal cell cancer and squamous cell cancer. Typically, they form on the head, face, neck, hands, and arms because these body parts are the most exposed to UV radiation. Most cases of melanoma, the deadliest kind of skin cancer, are caused by exposure to UV radiation." [https://www.cdc.gov/nceh/features/uv-radiation-safety/index.html]

- "Health Effects of UV Radiation...Skin Cancer. Each year, more new cases of skin cancer are diagnosed in the U.S. than new cases of breast, prostate, lung, and colon cancer combined. One in five Americans will develop skin cancer in their lifetime. One American dies from skin cancer every hour. Unprotected exposure to UV radiation is the most preventable risk factor for skin cancer." [https://www.epa.gov/sunsafety/health-effects-uv-radiation]

- “A Review of Common Tanning Methods...UVR is light spectrum from the sun. This spectrum is made up of three different wavelengths—ultraviolet A (UVA), ultraviolet B (UVB), and ultraviolet C (UVC). UVA rays make up the majority of the light spectrum and are the longest of the three UV wavelengths at 320 to 400nm. UVB rays make up an estimated five percent of the light spectrum and extend 290 to 320nm. UVC rays are the shortest of the three wavelengths and most do not reach earth as the ozone absorbs them. UVA is primarily responsible for skin aging, wrinkling, and the formation of free radical species.10,11 UVB is less prevalent, but much more intense than UVA. UVB is the chief cause of skin reddening and sunburn.12,13 UVB light is responsible for direct damage to deoxyribonucleic acid (DNA) in the form of pyrimidine dimers.12,13 It plays a main role in the development of skin cancer.12,13 Excessive UVA and UVB exposure damages the skin’s cellular DNA and leads to mutations that can trigger skin cancer. The World Health Organization classified all wavelengths of UVR as a Group 1 carcinogen. This label is given to compounds that have proven carcinogenicity in humans.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4345932/]

- “1928-1948 Artificial sun for children. It might cure their vitamin deficiency. Or it might cause cancer...For much of the first half of the twentieth century, phototherapy or “sun ray” therapy was prescribed for children for a wide range of maladies, from chest infections to anemia. At the same time, concerns mounted over the link between exposure to ultraviolet light and skin
cancer...Recently, some of the people who were subjected to weekly sun ray treatments as children have reported diagnoses of basal cell carcinoma. Though a direct causal link between sun ray treatment as a child and cancer as an adult is impossible to establish, the American Cancer Society lists exposure to ultraviolet light as the primary risk factor for skin cancers.”

https://mashable.com/2015/08/07/sun-therapy-children/

- “Point mutation...A point mutation or substitution is a genetic mutation where a single nucleotide base is changed, inserted or deleted from a DNA or RNA sequence of an organism's genome.[1] Point mutations have a variety of effects on the downstream protein product—consequences that are moderately predictable based upon the specifics of the mutation. These consequences can range from no effect (e.g. synonymous mutations) to deleterious effects (e.g. frameshift mutations), with regard to protein production, composition, and function...Point mutations usually take place during DNA replication. DNA replication occurs when one double-stranded DNA molecule creates two single strands of DNA, each of which is a template for the creation of the complementary strand. A single point mutation can change the whole DNA sequence. Changing one purine or pyrimidine may change the amino acid that the nucleotides code for. Point mutations may arise from spontaneous mutations that occur during DNA replication. The rate of mutation may be increased by mutagens. Mutagens can be physical, such as radiation from UV rays, X-rays or extreme heat, or chemical (molecules that misplace base pairs or disrupt the helical shape of DNA). Mutagens associated with cancers are often studied to learn about cancer and its prevention. There are multiple ways for point mutations to occur. First, ultraviolet (UV) light and higher-frequency light are capable of ionizing electrons, which in turn can affect DNA. Reactive oxygen molecules with free radicals, which are a byproduct of cellular metabolism, can also be very harmful to DNA. These reactants can lead to both single-stranded DNA breaks and double-stranded DNA breaks. Third, bonds in DNA eventually degrade, which creates another problem to keep the integrity of DNA to a high standard. There can also be replication errors that lead to substitution, insertion, or deletion mutations.”

https://en.m.wikipedia.org/wiki/Point_mutation
Altitude Diseases: UV & Immune System

- "UV health effects on the immune system. The immune system is the body’s defence mechanism against infections and cancers, and is normally very effective at recognizing and responding to an invading micro-organism or the onset of a tumour. Although the data remain preliminary, there is increasing evidence for a systematic immunosuppressive effect of both acute and low-dose UV radiation exposure. Animal experiments have demonstrated that UV radiation can modify the course and severity of skin tumours. Also, people treated with immunosuppressive drugs have a greater incidence of squamous cell carcinoma than the normal population. Consequently, beyond its role in the initiation of skin cancer, sun exposure may reduce the body’s defences that normally limit the progressive development of skin tumours. Several studies have demonstrated that exposure to environmental levels of UV radiation alters the activity and distribution of some of the cells responsible for triggering immune responses in humans. Consequently, sun exposure may enhance the risk of infection with viral, bacterial, parasitic or fungal infections, which has been demonstrated in a variety of animal models. Furthermore, especially in countries of the developing world, high UV radiation levels may reduce the effectiveness of vaccines. Since many vaccine-preventable diseases are extremely infectious, any factor that results in even a small decrease in vaccine efficacy can have a major impact on public health." [https://www.who.int/uv/health/uv_health2/en/index3.html

- “Allergy to UV Light...Allergies are triggered by a variety of things that don't bother most of the population -- pet dander, dust mites, mold, insect stings and certain foods. However, it's also possible to have an allergy to UV light -- a sun allergy. Like more common allergies, allergy to the sun's ultraviolet rays is tied to a faulty immune system...Sun Allergy/Photosensitivity. Bumps, hives, blisters and blotchy red patches on your skin are symptoms of an allergy to UV light, also known as photosensitivity.” [https://healthfully.com/allergy-to-uv-light-5848200.html

- "Green light effects on biological systems: a new biophysical phenomenon...This paper reports a new phenomenon connected with the influence of green light (GL) on biological systems. Our experiments have revealed an antioxidant effect of GL on cells subjected to lethal doses of UV at the cellular level and a protective effect of GL on DNA denatured by UV, coupled with a structural modification of DNA macromolecules under GL irradiation, at the molecular level. Mouse melanocyte cultures are subjected to UV irradiations with L50 fluxes of 16.0 J m−2 s−1. GL is obtained from a strontium aluminate pigment, which emits GL under UV activation. Cells grown in GL, prior to UV irradiation, present a clear surprising protective effect with surviving values close to the controls. A GL antioxidant effect is suggested to be mediated through GL influence on cellular water cluster dynamics. To test this hypothesis, reactive oxygen species (ROS) are determined in cell cultures. The results revealed a decrease of cellular ROS generation in the UV-irradiated samples protected by a previous 24 h of GL irradiation. At the DNA level, the same type of GL protection against UV damage is recorded by gel electrophoresis and by UV spectroscopy of the irradiated DNA molecules. Two physical methods, impedance spectroscopy and chronoamperometry, have revealed at the level of GL-irradiated DNA molecules spectral modifications that correlate with the UV spectroscopy results. The interaction between the chargeless photons and the field of water molecules from the cellular compartments is discussed in relation with the new field of macroscopic quantum coherence phenomena." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2710461/
Altitude Diseases: UV & Eye Damage

- "Sunbeds & UV Radiation...How can the eyes be damaged by solar UV radiation? The eye is a complex organ with several layers that receives visible radiation on its innermost part, the retina. The layers in front of the retina – the cornea, the lens and the vitreous humor – protect the retina from ultraviolet damage by absorbing and attenuating a significant part of the radiation. The only short-term health effect of UV radiation on the eye is a kind of "sunburn" of the eye known as photokeratitis, a painful but temporary inflammation of the cornea that appears typically 6 – 12 hours after exposure and usually resolves within 48 hours. Long-term exposure to UV radiation from the sun, and particularly to UVB, increases the risk of several disorders of the lens of the eye, including cataracts. There is also evidence that solar UV radiation causes melanoma of the eye."

Altitude Diseases: UV & Reproduction

- "Ultraviolet radiation influence on the human reproductive system...The objective of this project is to perform research and development work to study the adverse effects of UV radiation on the reproduction system of the human body. The most sensitive to UV-function is cell - pision. The dose of 10-19 Jm-2 stops the pison of about 90% of the bacterial cells. But the growth and vitality of cells does not stop. Over time the pision is restored and causes the death of 90% of cells, suppression of the synthesis of nucleic acids and proteins, the formation of mutations necessary to bring the radiation dose to 10-18Jm-2. Upon irradiation with light of a specific wavelength, electrical charge of the molecules decrees, they clump together and loose their activity - enzyme, hormone, antigen, etc. Photolysis and denaturation of proteins are parallel and independent from each other. They are caused by different ranges of radiation beams, photolysis is mainly caused by 280 - 302 nm and denaturation mostly by 250 - 265 nm length waves. The combinations of these processes determine the pattern of the cell under ultraviolet rays. Ultraviolet rays trigger changes in nucleic acids, which affect the growth, pision, heredity, cells, i.e., on the main manifestations of life. The value of the mechanism of action for nucleic acid is due to the fact that each molecule of DNA (deoxyribonucleic acid) is unique. DNA - inherits memory cells. In its structure it encrypts information on the structure and properties of all cellular proteins. If the protein is present in every living cell in the form of hundreds of identical molecules, DNA stores information about the structure of the cell as a whole, the nature and direction of the metabolic processes in it. Therefore, disturbances in the structure of DNA can be irreversible and cause serious disruption of life. In order to be able to predict the process of action of ultraviolet rays, we have to find out in what context does the energy of the molecules interact with the energy of the fragments and chemical compounds with ionization energy. The scope of the work is represented by four tasks. Each task – the development of the physical model of UV radiation influence on human reproductive system; development an assessment of propagation mechanism of UV rays and the effect on the parameters of the human reproductive system; identification of effective methods for studies of the effect of UV on the reproductive system, and execution of the complete set of elaboration of training modules for doctors, nurses and patients aimed to know well the negative influence of UV radiation and approaches for their proper use – comprises the characteristic milestones of the research and development work. The following should be regarded as major expected final results: Assessment of propagation mechanism of UV rays and the effect on the parameters of the human reproductive system. Definitions of the characteristic parameters of the reproductive system and assessment of adverse events. Identifying effective methods for studies of the effect of UV on the reproductive system. Taking into account the factor of solar activity that conducts to UV radiation, this will help in implementing the prevention of radioactive contamination of people. Training the doctors for proper use devices with UV radiation in the treatment of patients, and patients who received UV irradiation, for their treatment and pregnancy planning. The work on the project will be performed by the GTU team supporting with group of biomed researchers, medical doctors and clinical personal from Tbilisi State University Medical Clinic. Leading scientific workers having an experience with technology development investigations belong to the Institute. They represent the main body of the project team. Ten of them have scientific ranks. Six researchers of previous weapon expertise participate in the project. The proposed project provides an opportunity for continuing our ability to be reoriented to peaceful
activities. The project supports as well earlier applied peaceful investigations helping human health care. The integration of the scientists of the GTU into the International Science Community is encouraged. The project sustains the actual prospects of setting up a joint venture with foreign establishments, thereby transmitting to the market economy. It is intended to choose foreign collaborators at the time of considering the project. Their interest will provide the opportunity for exchanging information during implementation of the project, commenting the technical reports, using joint equipment and materials under production, checking the results and the technical control of the project activities, joint attendance to conferences, workshops and participation in publications. The technical approach and methodology have been preconditioned by the objective of the project, its scope and expected final results. The equipment and facilities used earlier to conduct the research and development work for optical and biological investigations are mostly available at the GTU."

http://www.istc.int/en/project/5834040D795F34D044257B2E0022ADDC

"Influence of near-ultraviolet radiation on reproductive and immunological development in juvenile male Siberian hamsters...The aim of this study was to characterize the lenticular ultraviolet transmission of the Siberian hamster (Phodopus sungorus) and to probe the range of near-ultraviolet (UV-A, 315–400nm) and visible wavelengths (400–760nm) for modulating the photoperiodic regulation of its reproductive and immune systems. Ocular lenses from adult hamsters were found to transmit UV-A wavelengths at similar levels to visible wavelengths, with a short-wavelength cut-off of 300nm. Five separate studies compared the responses of juvenile male hamsters to long photoperiods (16h:8h L:D), short photoperiods (10h:14h L:D) and short photoperiods interrupted by an equal photon pulse of monochromatic light of 320, 340, 360, 500 or 725nm during the night. The results show that UV-A wavelengths at 320, 340 and 360nm can regulate both reproductive and immune short-photoperiod responses as effectively as visible monochromatic light at 500nm. In contrast, long-wavelength visible light at 725nm did not block the short-photoperiod responses. These results suggest that both wavelengths in the visible spectrum, together with UV-A wavelengths, contribute to hamster photoperiodism in natural habitats." https://jeb.biologists.org/content/204/14/2535

Identifying conserved UV exposure genes and mechanisms...Studies have been showing how changes in ultraviolet (UV) affect the terrestrial system, mostly focusing on higher plants and indirect effects, e.g. UV changed food quality/decomposition. Much less attention has been given to direct effect on terrestrial species, although the negative effects have been recognized for some earthworms. Further, the actual mechanisms of UV toxicity to soil invertebrates are even less understood. We here studied the effect of UV on the soil oligochaete Enchytraeus crypticus, and attempted to identify the possible mechanisms of toxicity using high-throughput gene expression. Applying a UV dose equivalent to UV during the winter months in northern Europe we observed an 80% decrease in reproduction. For these organisms, approximately 5% of the genes were differentially expressed. Among the observations was an activation of the DNA repair mechanisms, nucleotide excision repair, which correlated with survival of the organisms. An observed repressing of apoptosis seems to have deleterious effects (e.g. because it may lead to the accumulation of aberrant cells) leading to a decline in reproduction. The mechanisms activated by UV were similar to those mechanisms activated in humans, showing conservation across species." https://www.nature.com/articles/s41598-018-26865-9

The Effect of Ultraviolet-A Radiation Exposure on the Reproductive Ability, Longevity, and Development of the Dialeurodes citri (Homoptera: Aleyrodidae) F1 Generation...Ultraviolet (UV) light has been used worldwide to monitor and trap insect pests. Whitefly adults show
conspicuous positive phototactic behavior toward UV light stimuli; however, knowledge of the
effect of UV light exposure on various life-history parameters of Dialeurodes citri remains
limited. The present research aimed to investigate the effect of ultraviolet radiation (UV-A;
long-wave) exposure on the reproduction and longevity of D. citri adults as well as the
development of immature (eggs, larvae, and pupae) flies in the F1 generation. Paired D. citri
adults were exposed to UV-A radiation for different periods (0, 1, 4, and 7 h/d) until the end of
their life. The results of the experiment revealed that fecundity and oviposition rates increased
when adults were irradiated for 1 and 4 h/d, but interestingly, both were significantly decreased
compared with those of the controls after the longest exposure time (7 h/d). The longevity of
adults of both sexes and the cumulative survival of F1 immatures were decreased with increased
exposure time. Exposure to UV-A radiation prolonged the developmental time of immature
stages, and a positive correlation was observed with exposure time. Exposure to UV light
significantly inhibited egg hatching, larval development, pupation, and adult emergence. To the
best of our knowledge, this is the first study describing the effect of UV radiation on a
homopteran insect pest. This research may provide a foundation for the scientific community to
use UV light in the field as an integrated pest management strategy to control this devastating

- "Are Led Grow Lights Safe For Pets?...The absorption of UV rays for a long period of time can
also lead to cancer. It can harm our eyes, skin, and nervous system. It can also affect your pets
like Cats, Dogs, Hamsters, Rabbits, sparrows, and many others. Some studies did prove that
UV rays affect the reproductive systems of animals. They have a test on the basis of several
complaints from the people around the country. The people did complain about the lights and
their effects on the animals. The Rabbit Farm has been selected and Female rabbits are arranged
in three rows in that area. So one row contains Fluorescent Lamps, Another Row Contains
Incandescent Lamps, and the Third one Contains Led Lamps. The result was really shocking.
Because of the fluorescent lamp row, 40% of female rabbits have a miscarriage. The same
happens with the Incandescent Lamps. But in Led Lamps, only 10% of rabbits were infected.
Thus Led Grow Lights have minimum effects on the Pets and Humans. There are also some
tests conducted on the Chicken in a poultry Farm. Mostly the UV rays affect the animals." 
https://growlightsbuddy.com/are-led-grow-lights-safe-for-pets/
Altitude Diseases: UV, Asthma & Allergies

- "Ultraviolet radiation and human health...Asthma. People who live at latitudes close to the equator where there is higher UVB have an increased risk of developing atopic asthma. Conversely, they have a lower risk of non-atopic asthma." [https://dermnetnz.org/topics/ultraviolet-radiation-and-human-health/]
- "Asthma...atopic asthma (sometimes called extrinsic asthma) is due to an allergy to antigens; usually the offending allergens are suspended in the air in the form of pollen, dust, smoke, automobile exhaust, or animal dander. More than half of the cases of asthma in children and young adults are of this type." [https://medical-dictionary.thefreedictionary.com/atopic+asthma]
- "I developed atopic asthma after living an allergy free life until my forties. I have lived in some of the sunniest places in the world." Steven Magee CEng MIET – Q
- "Sunlight Exposure, Allergies & Asthma...a study in the Journal of Allergy and Clinical Immunology found that southern states have the fewest Epipen prescriptions, while New England states have the most. (The Epipen contains injectable epinephrine and is necessary for people who have severe, life-threatening allergies.) Researchers hypothesize that since southern states have more year-round sunlight, people in those states have a lower incidence of allergic disease because of higher Vitamin D levels. In 2006, Australian researchers found that exposure to sunlight for 15 to 30 minutes before exposure to allergens significantly reduces the development of asthma-like symptoms! (So if you have a child with asthma, don’t let him or her sit indoors and play video games all summer even if the game system is a fitness-conscious Wii!) At the 2008 annual meeting of the American Academy of Allergy, Asthma and Immunology (AAAAI), Dr. Matthias Wjst explained that dietary sources of vitamin D are not ideal. It is best to get your vitamin D from natural sunlight exposure, as opposed to dietary supplements. In fact, dietary supplementation of vitamin D may be related to the increase in allergies and asthma in recent years." [https://www.achooallergy.com/blog/learning/sunlight-exposure-allergies-asthma/]
- "Food allergy is linked to season of birth, sun exposure, and vitamin D deficiency...The season of birth and ultraviolet B exposure have been related to the occurrence of food allergy. The levels of vitamin D produced from skin by ultraviolet B exposure might reflect this relationship. Vitamin D is known to induce antimicrobial peptides, protect intestinal flora, enhance the gut epithelial barrier, suppress mast cell activation and IgE synthesis from B cells, and increase the number of tolerogenic dendritic cells and IL-10-producing regulatory T cells. Vitamin D deficiency has been shown to exacerbate sensitization and allergic symptoms in a murine model of food allergy. However, in clinical situations, contradictory observations have been reported regarding the relationship between food allergy and vitamin D deficiency/supplementation. In this review, we have explored the links between food allergy and vitamin D levels. One explanation for the discrepant findings is confounding factors such as race, age, residency, skin color, and epigenetic changes that contribute to vitamin D levels. In addition, the season of birth influences the development of atopic dermatitis, which could lead to food sensitization. Finally, ultraviolet radiation could lead to regulatory T cell expansion and immunosuppression, irrespective of vitamin D status. Based on our current understanding, we believe that correction of vitamin D deficiency by supplementation, appropriate skin care, and sufficient ultraviolet radiation exposure could alter the prognosis of food allergy. To identify potential treatment strategies for food allergy, it is essential to gain a better understanding of the appropriate levels

- "Sunshine vitamin 'may treat asthma'...The amount of time asthma patients spend soaking up the sun may have an impact on the illness, researchers have suggested. A team at King's College London said low levels of vitamin D, which is made by the body in sunlight, was linked to a worsening of symptoms...She said a culture of covering up in the sun and using sun cream may have increased asthma rates, but "it is a careful message because too much sun is bad for you"." [https://www.bbc.com/news/health-22570859](https://www.bbc.com/news/health-22570859)

- "Vitamin D and Allergic Disease: Sunlight at the End of the Tunnel?...A role for vitamin D in the regulation of immune function was first proposed after the identification of Vitamin D Receptors in lymphocytes. It has since been recognized that the active form of vitamin D, 1α,25(OH)2D3, has direct affects on naïve and activated helper T cells, regulatory T cells, activated B cells and dendritic cells. There is a growing body of literature linking vitamin D (serum 25(OH)D, oral intake and surrogate indicators such as latitude) to various immune-related conditions, including allergy, although the nature of this relationship is still unclear. This review explores the findings of epidemiological, clinical and laboratory research, and the potential role of vitamin D in promoting the inappropriate immune responses which underpin the rise in a broad range of immune diseases." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3277098/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3277098/)

- "Higher latitude and lower solar radiation influence on anaphylaxis in Chilean children...Background. Recent studies suggest an association between higher latitude, a proxy of vitamin D (VD) status, and allergic diseases. Chile provides an ideal setting to study this association due to its latitude span and high rates of VD deficiency in southern regions. The aim of this study is to explore the associations of latitude and solar radiation with anaphylaxis admission rates. Methods. We reviewed anaphylaxis admissions in Chile's hospital discharge database between 2001 and 2010 and investigated associations with latitude and solar radiation. Results. 2316 anaphylaxis admissions were registered. Median age of patients was 41 years; 53% were female. National anaphylaxis admission rate was 1.41 per 100,000 persons per year. We observed a strong north-south increasing gradient of anaphylaxis admissions (β 0.04, P=0.01), with increasing rates south of latitude 34°S. A significant association was also observed between solar radiation and anaphylaxis admissions (β −0.11, P=0.009). Latitude was associated with food-induced (β 0.05, P=0.02), but not drug-induced (β −0.002, P=0.27), anaphylaxis. The association between latitude and food-induced anaphylaxis was significant in children (β 0.01, P=0.006), but not adults (β 0.003, P=0.16). Anaphylaxis admissions were not associated with regional sociodemographic factors like poverty, rurality, educational level, ethnicity, or physician density. Conclusions. Anaphylaxis admission rates in Chile are highest at higher latitudes and lower solar radiation, used as proxies of VD status. The associations appear driven by food-induced anaphylaxis. Our data support a possible role of VD deficiency as an etiological factor in the high anaphylaxis admission rates found in southern Chile." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4069239/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4069239/)

- "Is Sun Poisoning an Allergic Reaction?...Sun poisoning, on the other hand, is more severe and lasts for a longer period. Symptoms of sun poisoning include: - Itchiness, bumps, or blisters - Pain and swelling, which have a similar appearance to eczema lesions - Swollen or red skin - Darkening of the skin, which is also known as hyperpigmentation. While a sunburn is typical in cases of sun poisoning, the main difference between the two is that sun poisoning can be a hereditary type of allergy in some people. In some cases, a pre-existing condition, such as
eczema and lupus, could cause your skin to be more sensitive to UV rays, heightening the risk of sun poisoning." [https://www.caageorgia.com/blog/2019/june/is-sun-poisoning-an-allergic-reaction/](https://www.caageorgia.com/blog/2019/june/is-sun-poisoning-an-allergic-reaction/)

- "Here's Why Some of Us Develop an Allergy to Sunlight...A more dramatic 'sun allergy' produces not just a rash, but large hives on sun-exposed skin - this super-rare condition is called solar urticaria. It can be quite painful to deal with, as an outbreak will start with itching and then develop into big welts. If a large enough area of the skin is exposed and develops the reaction, a person can even go into anaphylactic shock. Sunbathing is the stuff of horrors for people afflicted with this condition. Solar urticaria is mediated by immunoglobulin E (IgE) - the same antibody that plays a role in various allergies, including pollen, food sensitivities, asthma, and others. Hence treatment includes taking antihistamines to deal with the allergic response in the body, as well as a steroid cream to treat the skin itself." [https://www.sciencealert.com/here-s-what-happens-if-you-develop-an-allergy-to-sunlight](https://www.sciencealert.com/here-s-what-happens-if-you-develop-an-allergy-to-sunlight)


- “Tucson, Arizona...The city's elevation is 2,643 ft (806 m) above sea level (as measured at the Tucson International Airport)...Tucson has a hot semi-arid climate (Köppen BSh), with two major seasons, a hot summer and mild winter. Tucson averages 11.8 inches (299.7 mm) of precipitation per year, concentrated between the Pacific storms of winter and the North American Monsoon of summer. Fall and spring months tend to be sunny and dry….The sun is intense in Tucson during part of the year, and significant protection is needed for those who spend time outdoors. Recent studies show the rate of skin cancer in Arizona is at least three times higher than in more northerly regions. Additionally, heat stroke is a concern for hikers, mountain bikers, and adventurers exploring canyons, open desert lands, and other exposed areas.” [https://en.wikipedia.org/wiki/Tucson,_Arizona](https://en.wikipedia.org/wiki/Tucson,_Arizona)
Altitude Diseases: UV & Skin Microbiome

- "While the skin microbiome has been shown to play important roles in health and disease in several species, the effects of altitude on the skin microbiome and how high-altitude skin microbiomes may be associated with health and disease states remains largely unknown. Using 16S rRNA marker gene sequencing, we characterized the skin microbiomes of people from two racial groups (the Tibetans and the Hans) and of three local pig breeds (Tibetan pig, Rongchang pig, and Qingyu pig) at high and low altitudes. The skin microbial communities of low-altitude pigs and humans were distinct from those of high-altitude pigs and humans, with five bacterial taxa (Arthrobacter, Paenibacillus, Carnobacterium, and two unclassified genera in families Cellulomonadaceae and Xanthomonadaceae) consistently enriched in both pigs and humans at high altitude. Alpha diversity was also significantly lower in skin samples collected from individuals living at high altitude compared to individuals at low altitude. Several of the taxa unique to high-altitude humans and pigs are known extremophiles adapted to harsh environments such as those found at high altitude. Altogether our data reveal that altitude has a significant effect on the skin microbiome of pigs and humans."

Altitude Diseases: UV & Dermatology

- "High Altitude Dermatology...Approximately, 140 million people worldwide live permanently at high altitudes (HAs) and approximately another 40 million people travel to HA area (HAA) every year for reasons of occupation, sports or recreation. In India, whole of Ladakh region, part of Northwest Kashmir, Northern part of Sikkim and Tenga valley of Arunachal are considered inhabited areas of HAA. The low quantity of oxygen, high exposure of ultraviolet (UV) light, very low humidity, extreme subzero temperature in winter, high wind velocity, make this region difficult for lowlanders as well as for tourists. Acute mountain sickness, HA pulmonary edema, HA cerebral edema, and thromboembolic conditions are known to occur in HA. However, enough knowledge has not been shared on dermatoses peculiar to this region. Xerosis, UV-related skin disorders (tanning, photomelanosis, acute and chronic sunburn, polymorphic light eruption, chronic actinic dermatitis, actinic cheilitis, etc.), cold injuries (frostbite, chilblains, acrocyanosis, erythrocyanosis, etc.) nail changes (koilonychias), airborne contact dermatitis, insect bite reaction, and skin carcinoma (basal cell carcinomas, squamous cell carcinomas, and also rarely malignant melanoma) are the dermatoses seen in HAAs. Early diagnosis and knowledge of HA dermatoses may prevent serious consequences of disease and improve the quality of life for the visitors as well as for native of the place."
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5286755/
Altitude Diseases: UV & Vitamin D Deficiency

- "Vitamin D deficiency...Fat percentage. Since vitamin D3 (also known as cholecalciferol) and vitamin D2 (ergocalciferol) are fat-soluble, humans and other animals with a skeleton need to store some fat. Without fat, the animal will have a hard time absorbing vitamin D2 and vitamin D3 and the lower the fat percentage, the greater the risk of vitamin deficiency, which is true in some athletes who strive to get as lean as possible...Malnutrition. Although rickets and osteomalacia are now rare in Britain, osteomalacia outbreaks in some immigrant communities included women with seemingly adequate daylight outdoor exposure wearing typical Western clothing.[19] Having darker skin and reduced exposure to sunshine did not produce rickets unless the diet deviated from a Western omnivore pattern characterized by high intakes of meat, fish, and eggs, and low intakes of high-extraction cereals.[20][21][22] In sunny countries where rickets occurs among older toddlers and children, vitamin D deficiency has been attributed to low dietary calcium intakes. This is characteristic of cereal-based diets with limited access to dairy products.[22] Rickets was formerly a major public health problem among the US population; in Denver, where ultraviolet rays are about 20% stronger than at sea level on the same latitude,[23] almost two-thirds of 500 children had mild rickets in the late 1920s.[24] An increase in the proportion of animal protein in the 20th-century American diet coupled with increased consumption of milk fortified with relatively small quantities of vitamin D coincided with a dramatic decline in the number of rickets cases.[25][26][27] One study of children in a hospital in Uganda however showed no significant difference in vitamin D levels of malnourished children compared to non-malnourished children. Because both groups were at risk due to darker skin pigmentation, both groups had vitamin D deficiency. Nutritional status did not appear to play a role in this study...Obesity. There is an increased risk of vitamin D deficiency in people who are considered overweight or obese based on their body mass index (BMI) measurement.[29] The relationship between these conditions is not well understood. There are different factors that could contribute to this relationship, particularly diet and sunlight exposure.[29] Alternatively, vitamin D is fat-soluble therefore excess amounts can be stored in fat tissue and used during winter, when sun exposure is limited...Sun exposure. The use of sunscreen with a sun protection factor of 8 can theoretically inhibit more than 95% of vitamin D production in the skin.[25] In practice, however, sunscreen is applied so as to have a negligible effect on vitamin D status.[31] The vitamin D status of those in Australia and New Zealand is unlikely to have been affected by campaigns advocating sunscreen.[32] Instead, wearing clothing is more effective at reducing the amount of skin exposed to UVB and reducing natural vitamin D synthesis. Clothing which covers a large portion of the skin, when worn on a consistent and regular basis, such as the burqa, is correlated with lower vitamin D levels and an increased prevalence of hypovitaminosis D.[33] Regions far from the equator have a high seasonal variation of the amount and intensity of sunlight. In the UK the prevalence of low vitamin D status in children and adolescents is found to be higher in winter than in summer.[34] Lifestyle factors such as indoor versus outdoor work and time spent in outdoor recreation play an important role. Additionally, vitamin D deficiency has been associated with urbanisation in terms of both air pollution, which blocks UV light, and an increase in the number of people working indoors. The elderly are generally exposed to less UV light due to hospitalisation, immobility, institutionalisation, and being housebound, leading to decreased levels of vitamin D...Darker skin color. The reduced pigmentation of light-skinned individuals may result in...
higher vitamin D levels and that, because melanin acts like a sun-block, dark-skinned individuals, in particular, may require extra vitamin D to avoid deficiency at higher latitudes.

[3]...Malabsorption...Rates of vitamin D deficiency are higher among people with untreated celiac disease,[36][37] inflammatory bowel disease, exocrine pancreatic insufficiency from cystic fibrosis, and short bowel syndrome,[37] which can all produce problems of malabsorption. Vitamin D deficiency is also more common after surgical procedures that reduce absorption from the intestine, including weight loss procedures.[38]...Critical illness. Vitamin D deficiency is associated with increased mortality in critical illness.[39] People who take vitamin D supplements before being admitted for intensive care are less likely to die than those who do not take vitamin D supplements.[39] Additionally, vitamin D levels decline during stays in intensive care.[40] Vitamin D3 (cholecalciferol) or calcitriol given orally may reduce the mortality rate without significant adverse effects.[40]

"Status of Vitamin D Deficiency in School-Aged Children Living in High-Altitude Regions in India...Background: Vitamin D is required for calcium absorption and bone development in children. Beyond bone integrity and calcium absorption, vitamin D is involved in various physiological and pathological processes. The studies conducted in plain regions of India have documented a high prevalence of vitamin D deficiency (85–98%) in the age group of 6–18 y. However, there is a lack of data on the prevalence of vitamin D deficiency in high altitude regions of the country. Hence, this study was conducted in District Shimla of Himachal Pradesh situated at 2000 m above sea level. Objectives: To assess the prevalence and associated risk factors of vitamin D deficiency in children living at high altitude regions. Methods: A community-based cross-sectional study was conducted. Thirty clusters were selected using PPS methodology. In each cluster, 20 children were to be covered. A total of 626 children in the age group of 6–18 y were included. Data on physical activity and exposure to sunlight was assessed. Blood samples were collected for serum vitamin D and parathyroid hormone (PTH) concentrations estimation. Results: The prevalence of vitamin D deficiency was found to be 93% in children using the serum cut-off of 20 ng/ml. The mean serum vitamin D concentration was 11.7 ± 5.7 ng/ml. Eighty-three percent of subjects with VDD had low physically active lifestyles. Thirty percent of subjects had severe vitamin D deficiency (<5 ng/ml) and had PTH concentrations of more than 65 pg/ml indicating skeletal involvement. The PTH values increased with increasing severity of vitamin D deficiency. Conclusions: The prevalence of vitamin D deficiency among children living at high altitudes was 93%. Public Health Implications: The study highlights the urgent need for public health intervention through food fortification at a national level for all school-age children to prevent VDD."

"Vitamin D Status in Cold Trans-Himalayan Deserts at Altitude of 4000 meter and above in India...Recent scientific evidence suggests there is high prevalence of Vitamin D deficiency in India. There is paucity of scientific data on Vitamin D status in population residing at high altitude regions in India. Hence, the present study was undertaken to determine Vitamin D status of adult population residing at altitude of 4000 meter and above in Himachal Pradesh, India. A total of 105 subjects aged 19-56 years were recruited (3 subjects per village) from 35 villages in Lahaul & Spiti district. The data on socio-demographic profile was collected by administering a questionnaire. Venous blood samples were withdrawn. Serum 25-OHD level was measured by using direct competitive chemiluminescence immunoassay. Vitamin D status was categorized as deficient (<20ng/ml), insufficient (21-29ng/ml) and sufficient (≥30ng/ml)."
The mean±SD level of 25-OHD was 14.76±7.03 ng/ml. The subjects with vitamin D deficiency, insufficiency and sufficiency were 83.8%, 11.4% and 4.8%, respectively suggestive of significant Vitamin D deficiency in high altitude Lahaul & Spiti district, Himachal Pradesh."

“Dietary Recommendations for Cyclists during Altitude Training...One of the more significant elements of altitude nutrition relates to the monitoring of iron, for which intake needs to amount to at least 100 mg/day. A deficit of iron may disturb erythropoiesis. Despite the increased UVB radiation from sunlight, it is recommended to supplement athletes training at altitude with up to 4000 IU/day of vitamin D, especially in the winter months of the year.”

"Vitamin D Deficiency and Clinically Detected Scoliosis among Male Adolescents at High-Altitude Area in Southwestern Saudi Arabia...BACKGROUND AND OBJECTIVES: Reports suggest that Vitamin D deficiency (VDD) is common and is a general health challenge worldwide and at high altitude in particular...AIM: The objectives were to explore Vitamin D status, to examine the association of VDD and clinically detected scoliosis, and to find a cutoff point of Vitamin D level predicting clinical scoliosis in Abha City (high-altitude area)....METHODS: A nested case–control design was conducted among a screened population of 417 male adolescents from intermediate and secondary schools in Abha City, Southwest Saudi Arabia. From the surveyed adolescents, 62 cases with clinically detected scoliosis and 205 age-matched controls without scoliosis were selected. For both groups, serum level of 25-hydroxyvitamin D was assessed by standardized technique....RESULTS: More than two-thirds (68.5%) of male adolescents suffered from VDD (<25 nmol/L). The risk of clinical scoliosis was significantly higher among adolescents with VDD compared to those without deficiency (grade adjusted odds ratio = 6.88, 95% CI: 2.63–17.99). Receiver operating characteristic curve analysis showed acceptable discriminative ability of serum Vitamin D (area under the curve = 0.702) to predict scoliosis at a threshold value of ≤20.2 nmol/L....CONCLUSIONS: Overall levels of Vitamin D in the study adolescents suggest a high prevalence of VDD at high-altitude area in Southwest Saudi Arabia. There is evidence for a positive association between VDD and clinically detected scoliosis. A threshold cutoff value of 20.2 nmol/L has been identified to predict clinically detected scoliosis. The role of possible preventive effect of Vitamin D supplementation should be considered by school health authorities."
Professorship at Aarhus University, also led a 2016 Dutch study that found a link between prenatal vitamin D deficiency and increased risk of childhood autism traits...Vitamin D deficiency has been associated with a lot of other ailments." https://www.labroots.com/trending/neuroscience/13496/vitamin-schizophrenia

- "The pathology of vitamin D deficiency in domesticated animals: An evolutionary and comparative overview...Although vitamin D is critical to calcium/phosphorus homeostasis, bone formation and remodeling, there is evolution-based variation between species in vitamin D metabolism and susceptibility to rickets and osteomalacia. Most herbivores produce vitamin D3 in response to sunlight, but dogs and cats have generally lost the ability as carnivore diets are rich in vitamin D. Nutritional deficiencies and/or poor exposure to sunlight can induce rickets in birds, swine, cattle and sheep, but horses are less susceptible as they have evolved a calcium homeostasis that is quite different than other animals. Adaptations to specific environments also affect disease incidence: llamas/alpacas out of their natural high altitude intense solar radiation environments are highly susceptible to vitamin D deficiency. The pathology of rickets/osteomalacia is similar across species, however fibrous osteodystrophy is more common and may also be present. Rickets/osteomalacia were likely more common in animals before the advent of commercial diets, but can be difficult to definitively diagnose especially in single archeological specimens. Consideration of species susceptibility, location – especially in terms of latitude, and any available information on diet, season of occurrence, husbandry practices or descriptions of affected animals can support the diagnosis of metabolic bone disease in animals." https://www.sciencedirect.com/science/article/pii/S1879981717301213

- "Shining Some (UV) Light on Rabbit Husbandry...The importance of ultraviolet radiation for captive animals is only now being investigated, primarily in reptiles. Because rabbits, much like diurnal reptiles, can synthesize vitamin D when exposed to natural ultraviolet B radiation, we recently studied the impact of artificial ultraviolet B radiation on the vitamin D levels of captive rabbits. We found vitamin D levels significantly higher in rabbits exposed to artificial ultraviolet B radiation than in their cohorts not exposed to ultraviolet B radiation. Given the importance of vitamin D as an essential hormone that regulates many biological functions, a further study was completed by Dr. Megan Watson to evaluate the long-term (6 months) effects of exposing rabbits to ultraviolet B radiation. The findings reinforced the pilot study and showed that rabbits exposed to ultraviolet B radiation maintained significantly higher vitamin D levels over the course of the study. No side effects were found to be associated with regular exposure to ultraviolet B radiation. The research suggests that pet rabbits housed indoors would benefit from exposure to ultraviolet B radiation." https://vetmed.illinois.edu/shining-uv-light-rabbit-husbandry/

- "Indoor Rabbits Need More Sunshine, Vets Say...Rabbits that don't get enough sunlight face several types of diseases that can develop with vitamin D deficiency," Mitchell states. He frequently encounters rabbits with tooth and bone problems -- issues associated with too-little vitamin D....keeping a rabbit permanently indoors comes with its own problems. Windows block the type of ultraviolet light that triggers vitamin D production, and a rabbit's diet doesn't always provide enough of the nutrient." https://www.thedodo.com/indoor-rabbits-need-more-sunsh-504703908.html

- "Effects of ultraviolet radiation produced from artificial lights on serum 25-hydroxyvitamin D concentration in captive domestic rabbits (Oryctolagus cuniculi)...Objective—To determine the effects of UVB radiation produced by artificial lights on serum 25-hydroxyvitamin D concentrations in domestic rabbits (Oryctolagus cuniculi). Animals—9 juvenile domestic
rabbits. Procedures—After an acclimation period, rabbits were anesthetized with isoflurane, and an initial blood sample was collected for determination of serum 25-hydroxyvitamin D concentration. Rabbits were randomly assigned to receive 12-hour exposure to UVB radiation produced by 2 compact fluorescent lights daily (n = 5) or no UVB supplementation (4) commencing on day 1. The UVB radiation emitted into the cage was measured at 9 points approximately 34 cm from the surface of the UVB light sources (representing the position of the rabbits in the cage) after 10 hours of exposure on days 1, 8, and 14. On day 14, another blood sample was collected from anesthetized rabbits for determination of serum 25-hydroxyvitamin D concentration. Results—The UVB radiation level was 8.3 to 58.1 μW/cm² for the exposed rabbits and consistently < 0.001 μW/cm² for the control rabbits. Mean ± SD serum 25-hydroxyvitamin D concentrations in the rabbits that were or were not provided supplemental UVB radiation for 14 days differed significantly (66.4 ± 14.3 nmol/L and 31.7 ± 9.9 nmol/L, respectively). Conclusions and Clinical Relevance—Exposure to UVB radiation produced by artificial light significantly increased serum 25-hydroxyvitamin D concentration in juvenile rabbits. Because vitamin D is an essential hormone in vertebrates, these findings suggested that the provision of supplemental UVB radiation to captive rabbits may be important." https://avmajournals.avma.org/doi/abs/10.2460/ajvr.75.4.380?journalCode=ajvr

- "How to Make Sure Your Rabbit Gets Enough Sunlight...Why is Vitamin D so important? In rabbits, Vitamin D helps the body absorb calcium. It’s essential to helping rabbits maintain healthy teeth and bones. A Vitamin D deficiency can cause weak bones and dental problems. A lack of this vitamin for an extended period of time can also potentially cause the rabbit to develop anemia and have a weakened immune system." https://bunnylady.com/rabbits-and-sunlight/
Altitude Diseases: Vitamin D Deficiency

- "After a decade in high altitude astronomy, I discovered that my body produces virtually no vitamin D" Steven Magee CEng MIET - Q
- "10 Illnesses Linked to Vitamin D Deficiency." [link](https://www.everydayhealth.com/news/illnesses-linked-vitamin-d-deficiency/)
- "Vitamin D deficiency, or hypovitaminosis D is defined as a vitamin D level that is below normal. It most commonly occurs in people when they have inadequate sunlight exposure (in particular sunlight with adequate ultraviolet B rays).[1] Vitamin D deficiency can also be caused by inadequate nutritional intake of vitamin D, disorders limiting vitamin D absorption, and conditions impairing vitamin D conversion into active metabolites—including certain liver, kidney, and hereditary disorders.[2] Deficiency impairs bone mineralization, leading to bone softening diseases such as rickets in children. It can also worsen osteomalacia and osteoporosis in adults, leading to an increased risk of bone fractures.[1][2] Muscle weakness is also a common symptom of vitamin D deficiency, further increasing the risk of fall and bone fractures in adults.[1] Ultraviolet B rays from sunlight is a large source of vitamin D. Fatty fish such as salmon, herring, and mackerel are also sources of vitamin D as are mushrooms. Milk is often fortified with vitamin D and sometimes bread, juices, and other dairy products are fortified with vitamin D as well. Many multivitamins now contain vitamin D in different amounts." [link](https://en.wikipedia.org/wiki/Vitamin_D_deficiency)
Altitude Diseases: Anemia and Vitamin D Deficiency

- "Vitamin D and Anemia: Insights into an Emerging Association...Purpose of review. This review highlights recent findings in the emerging association between vitamin D and anemia through discussion of mechanistic studies, epidemiologic studies, and clinical trials. Recent findings. Vitamin D has previously been found to be associated with anemia in various healthy and diseased populations. Recent studies indicate that the association may differ between race and ethnic groups and is likely specific to anemia of inflammation. The mechanism underlying this association involves the reduction of pro-inflammatory cytokines by vitamin D as well as the direct suppression of hepcidin mRNA transcription. There is also evidence that vitamin D may be protective against anemia by supporting erythropoiesis. Other calcitropic hormones, fibroblast growth factor 23 (FGF-23) and parathyroid hormone (PTH) have also been found to be involved in iron homeostasis and erythropoiesis. Summary. Recent advances in our understanding the association between vitamin D and anemia suggest that maintenance of sufficient vitamin D status may be important in preventing anemia, particularly in diseases characterized by inflammation. Early clinical trials have been promising, but further research is needed to define the efficacy of vitamin D as a future approach for the treatment of anemia." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4659411/#S11title]

- "Anemia and Vitamin D Deficiency...Vitamin D is required to help the body function normally. It especially affects the formation and health of red blood cells. Since vitamin D is needed to help red blood cells use iron, a deficiency of vitamin D is associated with anemia. Severe vitamin D deficiency can lead to more serious conditions as well...People with anemia tend to feel tired a lot...Those who were deficient in vitamin D had more than a fivefold increase in the prevalence of anemia compared to those who did not have a vitamin D deficiency." [https://www.livestrong.com/article/280007-anemia-and-vitamin-d-deficiency/]

- "Vitamin D Status Inversely Related to Anemia, According to New Study...A recent study suggested that vitamin D status is a modifiable risk factor for anemia. Approximately one of every three individuals is affected by anemia worldwide. Anemia is a condition characterized by an inadequate amount of healthy red blood cells. Red blood cells are the body’s primary means of delivering oxygen to the body’s tissues. When the body dies not have enough red blood cells, one often feels tired and weak. While vitamin B12 and iron are most widely recognized for their role in anemia, researchers have begun investigating the role vitamin D may play. They have found that vitamin D deficiency is directly related to reticulocytosis, the increase of immature red blood cells, which can cause anemia to develop." [https://smarttan.com/news/index.php/vitamin-d-status-inversely-related-to-anemia-according-to-new-study/]

- "The interrelationship between hepcidin, vitamin D, and anemia in children with acute infectious disease...Background. Hepcidin is a master regulator of iron metabolism. Recently, it has been shown that vitamin D suppresses hepcidin expression. Our hypothesis was that hepcidin levels inversely correlate with vitamin D levels in anemic children during acute infection. Methods. A prospective study was performed on 90 patients (45 females, 45 males, mean age 7.3 ± 5 years) who were admitted to the pediatric ward. Sixty-two patients had infectious disease (32 with coexisting anemia, 30 without anemia), and 28 patients were hospitalized for noninfectious causes. Blood samples for IL-6, hepcidin, iron status parameters, and 25-hydroxyvitamin D (25-OHD) were obtained within 72 h after admission. Results."
Serum concentrations of IL-6 and hepcidin were significantly higher and 25-OHD, iron, and transferrin were significantly lower in anemic children with infectious disease compared with controls. Children with a serum 25-OHD level < 20 ng/ml had significantly increased odds of having anemia than those with a level > 20 ng/ml (OR: 6.1, CI: 1.15–32.76). Correlation analyses found positive associations between hepcidin levels and ferritin (R2 = 0.47, P < 0.001) and negative associations between hepcidin and transferrin (R2 = 0.57, P < 0.001). Conclusion. Higher IL-6 and lower 25-OHD levels may lead to higher hepcidin levels and subsequently to hypoferremia and anemia in children with acute infection. 

- "Low Vitamin D Levels Raise Anemia Risk in Children, Hopkins-Led Study Shows...Low levels of the “sunshine” vitamin D appear to increase a child’s risk of anemia...The researchers caution that their results are not proof of cause and effect, but rather evidence of a complex interplay between low vitamin D levels and hemoglobin, the oxygen-binding protein in red blood cells. The investigators say several mechanisms could account for the link between vitamin D and anemia, including vitamin D’s effects on red blood cell production in the bone marrow, as well as its ability to regulate immune inflammation, a known catalyst of anemia." [Source](https://www.hopkinsmedicine.org/news/media/releases/low_vitamin_d_levels_raise_anemia_risk_in_children_hopkins_led_study_shows)

- "Vitamin D deficiency and anemia risk in children: a review of emerging evidence...There has been renewed scientific interest in the sequelae of vitamin D deficiency, given the emerging evidence on the diverse biologic functions of vitamin D, besides its fundamental role in bone and mineral metabolism. For the past decade, the evidence in the medical literature pointing to a relationship between anemia risk and vitamin D deficiency has been accumulating. This paper critically reviews the current evidence linking vitamin D deficiency to anemia risk in children. The synthesized evidence indicates that the studies, which were preponderantly conducted among the adult population, not only reported a bidirectional relationship between vitamin D deficiency and anemia but also showed a racial effect. In studies conducted among children, similar results were reported. Although the causal association of vitamin D deficiency with anemia risk (especially iron-deficiency anemia) remains debatable, the noncalcemic actions of the vitamin and its analogs hold prospects for several novel clinical applications. There is, however, unanimity in many reports suggesting that vitamin D deficiency is directly associated with anemia of chronic disease or inflammation. Despite the advances in unraveling the role of vitamin D in iron homeostasis, further research is still required to validate causality in the relationship between vitamin D deficiency and anemia, as well as to determine its optimal dosing, the ideal recipients for therapeutic intervention, and the preferred analogs to administer." [Source](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5774601/)

- "Vitamin D Status and the Risk of Anemia in Community-Dwelling Adults...Low vitamin D status has been implicated in several chronic medical conditions and unfavorable health outcomes. Our goal was to investigate whether serum 25-hydroxyvitamin D (25OHD) levels are a potentially modifiable risk factor for anemia in a nationally representative cohort of community-dwelling individuals in the United States. We performed a cross-sectional study of 5456 individuals (≥17 years) from the National Health and Nutrition Examination Survey from 2001 to 2006. Locally weighted scatterplot smoothing (LOWESS) was used to graphically depict the relationship between serum 25OHD levels and the cumulative frequency of anemia. Multivariable logistic regression models were then used to assess the independent association of 25OHD levels with anemia, while controlling for age, sex, race, body mass index, chronic..."
kidney disease, as well as serum levels of C-reactive protein, ferritin, iron, vitamin B12, and folic acid. The mean (standard error) 25OHD and hemoglobin levels in the analytic group were 23.5 (0.4) ng/mL and 14.4 (0.1) g/dL, respectively. Prevalence of anemia was 3.9%. Locally weighted scatterplot smoothing analysis demonstrated a near-linear relationship between vitamin D status and cumulative frequency of anemia up to 25OHD levels of approximately 20 ng/mL. With increasing 25OHD levels, the curve flattened out progressively. Multivariable regression analysis demonstrated an inverse association of 25OHD levels with the risk of anemia (adjusted odds ratio 0.97; 95% confidence interval 0.95–0.99 per 1 ng/mL change in 25OHD). Compared to individuals with ≥20 ng/mL, individuals with 25OHD levels <20 ng/mL were more likely to be anemic (adjusted odds ratio 1.64; 95% confidence interval 1.08–2.49). In a nationally representative sample of community-dwelling individuals in the United States, low 25OHD levels were associated with increased risk of anemia. Randomized controlled trials are needed to determine whether optimizing vitamin D status can reduce the burden of anemia in the general population."

https://journals.lww.com/md-journal/fulltext/2015/12150/vitamin_d_status_and_the_risk_of_anemia_in.3.aspx
Altitude Diseases: Hyperparathyroidism

- "Bell’s palsy at high altitude -- an unsuspected finding...Background. Bell’s palsy is a common condition seen in clinical practice. The aetiology of this condition is not clearly defined and neuroimaging is essential to exclude intracranial causes of infra-nuclear facial palsy. Case presentation. We report a young soldier, who presented with Bell’s palsy and neuroimaging revealed an unsuspected finding of multiple intracranial calcifications. Detailed evaluation revealed the additional diagnosis of vitamin D deficiency and secondary hyperparathyroidism due to lack of sun exposure at high altitude area. Conclusion. The health care practitioners, looking after the soldiers at high altitude areas should be aware of the measures to prevent vitamin D deficiency. Intracranial calcifications are uncommon in hyperparathyroidism and Bell’s palsy." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4865988/]
- "Hyperparathyroidism...Hyperparathyroidism is when your parathyroid glands create too much parathyroid hormone in the bloodstream. These glands, located behind the thyroid at the bottom of your neck, are about the size of a grain of rice. The parathyroid glands produce parathyroid hormone. This hormone helps maintain an appropriate balance of calcium in the bloodstream and in tissues that depend on calcium for proper functioning. Two types of hyperparathyroidism exist. In primary hyperparathyroidism, an enlargement of one or more of the parathyroid glands causes overproduction of the hormone. This causes high calcium levels in the blood, which can cause a variety of health problems. Surgery is the most common treatment for primary hyperparathyroidism. Secondary hyperparathyroidism occurs due to another disease that first causes low calcium levels in the body. Over time, increased parathyroid hormone levels occur...Symptoms may be so mild and nonspecific that they don't seem related to parathyroid function, or they may be severe. The range of signs and symptoms include: Osteoporosis, Kidney stones, Excessive urination, Abdominal pain, Tiring easily or weakness, Depression or forgetfulness, Bone and joint pain, Frequent complaints of illness with no apparent cause, Nausea, vomiting or loss of appetite...Secondary hyperparathyroidism is the result of another condition that lowers calcium levels. This causes your parathyroid glands to overwork to compensate for the calcium loss. This causes your parathyroid glands to overwork to compensate for the calcium loss. Factors that may contribute to secondary hyperparathyroidism include: Severe calcium deficiency. Your body may not get enough calcium from your diet, often because your digestive system doesn't absorb the calcium from it. Severe vitamin D deficiency. Vitamin D helps maintain appropriate calcium levels in the blood. It also helps your digestive system absorb calcium from your food. Your body produces vitamin D when your skin is exposed to sunlight. You also consume some vitamin D in food. If you don't get enough vitamin D, then calcium levels may drop...You may be at an increased risk of primary hyperparathyroidism if you: Are a woman who has gone through menopause. Have had prolonged, severe calcium or vitamin D deficiency. Have had radiation treatment for cancer that has exposed your neck to radiation." [https://www.mayoclinic.org/diseases-conditions/hyperparathyroidism/symptoms-causes/syc-20356194]
- "Hyperparathyroidism...Primary Hyperparathyroidism...have a long history of calcium and vitamin D deficiencies, have been exposed to radiation from cancer treatment...Secondary Hyperparathyroidism. With this type, you may have skeletal abnormalities, such as fractures, swollen joints, and bone deformities. Other symptoms depend on the underlying cause, such as chronic kidney failure or severe vitamin D deficiency."
"Hyperparathyroidism is an increase in parathyroid hormone (PTH) levels in the blood.[1][4] This occurs from a disorder either within the parathyroid glands (primary hyperparathyroidism) or outside the parathyroid glands (secondary hyperparathyroidism).[1] Most people with primary disease have no symptoms at the time of diagnosis.[3] When symptoms occur, they are due to elevated blood calcium.[1] With long-standing elevation, the most common symptom is kidney stones.[1] Other symptoms may include bone pain, weakness, depression, confusion, and increased urination.[1][2] Both primary and secondary may result in osteoporosis (weakening of the bones).[2][3] In 80% of cases, primary hyperparathyroidism is due to a single benign tumor known as a parathyroid adenoma.[1][2] Most of the remainder are due to several of these adenomas.[1][2] Rarely it may be due to parathyroid cancer.[2] Secondary hyperparathyroidism typically occurs due to vitamin D deficiency, chronic kidney disease, or other causes of low blood calcium.[1] The diagnosis of primary hyperparathyroidism is made by finding elevated calcium and PTH in the blood.[2] Primary hyperparathyroidism may be cured by removing the adenoma or overactive parathyroid glands.[1][2] In those without symptoms, mildly increased blood calcium levels, normal kidneys, and normal bone density monitoring may be all that is required.[2] The medication cinacalcet may also be used to decrease PTH levels.[2] In those with very high blood calcium levels, treatment may include large amounts of intravenous normal saline.[1] Low vitamin D levels should be corrected.[2] Primary hyperparathyroidism is the most common type.[1] In the developed world, between one and four per thousand people are affected.[3] It occurs three times more often in women than men and is typically diagnosed between the ages of 50 and 60.[2] The disease was first described in the 1700s.[5] In the late 1800s, it was determined to be related to the parathyroid.[5] Surgery as a treatment was first carried out in 1925.[5]...Symptoms directly due to hypercalcemia are relatively rare, being more common in patients with malignant hypercalcemia. If present, common manifestations of hypercalcemia include weakness and fatigue, depression, bone pain, muscle soreness (myalgias), decreased appetite, feelings of nausea and vomiting, constipation, polyuria, polydipsia, cognitive impairment, kidney stones ([nb 1]) and osteopenia or osteoporosis.[8] A history of acquired racquet nails (brachyonychia) may be indicative of bone resorption.[9] Parathyroid adenomas are very rarely detectable on clinical examination. Surgical removal of a parathyroid tumor eliminates the symptoms in most patients. In secondary hyperparathyroidism, the parathyroid gland is behaving normally; clinical problems are due to bone resorption and manifest as bone syndromes such as rickets, osteomalacia, and renal osteodystrophy...Causes. Radiation exposure increases the risk of primary hyperparathyroidism."
Altitude Diseases: Skin Color Hazards

- "Dark skin is a human skin color that is rich in melanin pigments, especially eumelanin.[1][2][3] People with very dark skin are often referred to as "black people",[4] although this usage can be ambiguous in some countries where it is also used to specifically refer to different ethnic groups or populations.[5][6][7][8] The evolution of dark skin is believed to have begun around 1.2 million years ago,[9] in light-skinned early hominid species after they moved from the equatorial rainforest to the sunny savannas. In the heat of the savannas, better cooling mechanisms were required, which were achieved through the loss of body hair and development of more efficient perspiration. The loss of body hair led to the development of dark skin pigmentation, which acted as a mechanism of natural selection against folate depletion, and to a lesser extent, DNA damage. The primary factor contributing to the evolution of dark skin pigmentation was the breakdown of folate in reaction to ultraviolet radiation; the relationship between folate breakdown induced by ultraviolet radiation and reduced fitness as a failure of normal embryogenesis and spermatogenesis led to the selection of dark skin pigmentation. By the time modern Homo sapiens evolved, all humans were dark-skinned.[3][10][11][12][13][14][15] Humans with dark skin pigmentation have skin naturally rich in melanin (especially eumelanin), and have more melanosomes which provide superior protection against the deleterious effects of ultraviolet radiation. This helps the body to retain its folate reserves and protects against damage to DNA.[3][16] Dark-skinned people who live in high latitudes with mild sunlight are at an increased risk—especially in the winter—of vitamin D deficiency. As a consequence of vitamin D deficiency, they are at a higher risk of developing rickets, and numerous types of cancers, and possibly cardiovascular disease and low immune system activity.[3][17] However, some recent studies have questioned if the thresholds indicating vitamin D deficiency in light-skinned individuals are relevant for dark-skinned individuals, as they found that, on average, dark-skinned individuals have higher bone density and lower risk of fractures than lighter-skinned individuals with the same levels of vitamin D. This is possibly attributed to lower presence of vitamin D binding agents (and thus its higher bioavailability) in dark-skinned individuals.[18][19] The global distribution of generally dark-skinned populations is strongly correlated with the high ultraviolet radiation levels of the regions inhabited by them. These populations, with the exception of indigenous Tasmanians almost exclusively live near the equator, in tropical areas with intense sunlight: Australia, Melanesia, New Guinea, South Asia, and Africa. Studies into these populations indicates dark skin is a retention of the pre-existing high UVR-adapted state of modern humans before the out of Africa migration and not a later evolutionary adaptation.[20][21] Due to mass migration and increased mobility of people between geographical regions in the recent past, dark-skinned populations today are found all over the world.[3][22][23]...A 1978 study examined the effect of sunlight on folate—a vitamin B complex—levels. The study found that even short periods of intense sunlight are able to halve folate levels if someone has light skin. Low folate levels are correlated with neural tube defects, such as anencephaly and spina bifida. UV rays can strip away folate, which is important to the development of healthy foetuses. In these abnormalities children are born with an incomplete brain or spinal cord. Nina Jablonski, a professor of anthropology and expert on evolution of human skin coloration,[33] found several cases in which mothers' visits to tanning studios were connected to neural tube defects in early pregnancy. She also found that folate was crucial to sperm development; some male contraception drugs are based on folate inhibition. It has been
found that folate may have been the driving force behind the evolution of dark skin.[3][20] As humans dispersed from equatorial Africa to low UVR areas and higher altitudes sometime between 120,000 and 65,000 years ago, dark skin posed a disadvantage.[34][35] Populations with light skin pigmentation evolved in climates of little sunlight. Light skin pigmentation protects against vitamin D deficiency. It is known that dark-skinned people who have moved to climates of limited sunlight can develop vitamin D-related conditions such as rickets, and different forms of cancer.[3][36] "Light skin is a human skin color, which has little eumelanin pigmentation and which has been adapted to environments of low UV radiation.[1][2][3] Light skin is most commonly found amongst the native populations of Europe and East Asia as measured through skin reflectance. [4] People with light skin pigmentation are often referred to as "white"[5][6] or "fair", although these usages can be ambiguous in some countries where they are used to refer specifically to certain ethnic groups or populations.[7] As populations migrated away from the tropics between 125,000 and 65,000 years ago into areas of low UV radiation,[8] they developed light skin pigmentation as an evolutionary selection acting against vitamin D depletion.[3][9] Based on ancient DNA analysis conducted in 2014 on human skeletal remains from western Europe, this change from dark to light skin pigmentation likely occurred only recently for at least some Europeans. Paleogenomics researcher Carles Lalueza-Fox of the Pompeu Fabra University in Spain and his colleagues observed that a 7,000-year-old hunter-gatherer from the La Brâna-Arintero labyrinthine cave in the Cantabrian Mountains (León, Spain) possessed the allele for blue eyes but not the European mutations for lighter skin pigmentation.[10] Humans with light skin pigmentation have skin with low amounts of eumelanin, and possess fewer melanosomes than humans with dark skin pigmentation. Light skin provides better absorption qualities of ultraviolet radiation. This helps the body to synthesize higher amounts of vitamin D for bodily processes such as calcium development.[3][11] Light-skinned people who live near the equator with high sunlight are at an increased risk of folate depletion. As consequence of folate depletion, they are at a higher risk of DNA damage, birth defects, and numerous types of cancers, especially skin cancer.[3] The distribution of light-skinned populations is highly correlated with the low ultraviolet radiation levels of the regions inhabited by them. Historically, light-skinned populations almost exclusively lived far from the equator, in high latitude areas with low sunlight intensity; for example, in Northwestern Europe. Due to colonization, imperialism, and increased mobility of people between geographical regions in recent centuries, light-skinned populations today are found all over the world.[3][12][13]...Disadvantages in high sunlight. Light-skinned people living in high sunlight environments are more susceptible to the harmful UV rays of sunlight because of the lack of melanin produced in the skin. The most common risk that comes with high exposure to sunlight is the increased risk of sunburns. This increased risk has come along with the cultural practice of sunbathing, which is popular among some human populations. This cultural practice to gain tanned skin if not regulated properly can lead to sunburn, especially among very lightly-skinned humans. The overexposure to sunlight also can lead to basal cell carcinoma, which is a common form of skin cancer. Another health implication is the depletion of folate within the body, where the overexposure to UV light can lead to megaloblastic anemia. Folate deficiency in pregnant women can be detrimental to the health of their newborn babies in the form of neural tube defects, miscarriages, and spina bifida, a birth defect in which the backbone and spinal canal do not close before birth.[60] The peak of neural tube defect occurrences is the highest in the May–June period in the Northern Hemisphere.[3] Folate is needed for DNA replication in
dividing cells and deficiency can lead to failures of normal embryogenesis and spermatogenesis.[3][12][61] Individuals with lightly pigmented skin who are repeatedly exposed to strong UV radiation, experience faster aging of the skin, which shows in increased wrinkling and anomalies of pigmentation. Oxidative damage causes the degradation of protective tissue in the dermis, which confers the strength of the skin.[14] It has been postulated that white women may develop wrinkles faster after menopause than black women because they are more susceptible to the lifetime damage of the sun through life. Dr. Taylor, of Yale School of Medicine, concluded that the study could not prove the findings but they suspect the underlying cause. Light-coloured skin has been suspected to be one of the contributing factors that promote wrinkling.[62][63]...As a general rule, populations that evolved north or south of 46 degrees latitude therefore tend to be lighter skinned; for example, in Western Europe, Canada, Russia, Scandinavia, and Mongolia.[64] Exceptions do exist as in some cases Southern Europeans turned out paler skinned than Northern ones.[14][65]" [https://en.wikipedia.org/wiki/Light_skin](https://en.wikipedia.org/wiki/Light_skin)

- "Folate degradation due to ultraviolet radiation: possible implications for human health and nutrition...FOLATE AND ULTRAVIOLET RADIATION: OVERVIEW. With folate's role in many aspects of human health, environmental factors that may affect folate status are of great interest from a health perspective. One of these environmental factors is the photosensitivity of folates upon exposure to UV radiation. While there has been a recent upsurge of research in the area of UV-induced folate degradation, interest in this area is not a recent phenomenon. Branda and Eaton 34 proposed a relationship between UV sun exposure and the evolution of human skin color in 1978, suggesting that maintenance of genetic characteristics such as dark skin color requires continuous positive selection. Therefore, there must be strong evolutionary pressures favoring retention of highly melanized skin in people living in areas of intense solar radiation. This hypothesis is based on the observation that populations with more heavily melanized skin evolved in and near to equatorial regions, most likely because darker skin provided these populations with a survival advantage by reducing photodegradation of folate and, possibly, other nutrients by solar UV exposure. 35 Other explanations for the retention of dark skin color, such as the protection that dark skin provides against the carcinogenic effects of UV, are likely not to have impacted reproduction, and therefore selection, while micronutrient deficiencies, particularly of folate, are known to play essential roles in fetal development and fertility and are consequently much more likely to drive selection pressures. 34 Following publication of that article, several other authors published reports supporting the theory of a photoprotective role of melanized skin for reducing micronutrient degradation and its resulting impact on the evolution of human skin color.35–38 Similarly, it has been hypothesized that lighter skin provided a survival advantage away from the equator at higher latitudes; in this case, by improving UV-induced vitamin D synthesis, which is reduced in more heavily melanized populations." [https://academic.oup.com/nutritionreviews/article/70/7/414/1846796#:~:text=Folate%20is%20essential%20for%20human%20health%20in%20the%20ultraviolet%20%28UV%29%20radiation%2C%20is%20of%20great%20health%20significance](https://academic.oup.com/nutritionreviews/article/70/7/414/1846796#:~:text=Folate%20is%20essential%20for%20human%20health%20in%20the%20ultraviolet%20%28UV%29%20radiation%2C%20is%20of%20great%20health%20significance)

- "Modern Human Diversity - Skin Color...Melanin, the skin's brown pigment, is a natural sunscreen that protects tropical peoples from the many harmful effects of ultraviolet (UV) rays. UV rays can, for example, strip away folic acid, a nutrient essential to the development of healthy fetuses. Yet when a certain amount of UV rays penetrates the skin, it helps the human body use vitamin D to absorb the calcium necessary for strong bones. This delicate balancing
act explains why the peoples that migrated to colder geographic zones with less sunlight developed lighter skin color. As people moved to areas farther from the equator with lower UV levels, natural selection favored lighter skin which allowed UV rays to penetrate and produce essential vitamin D. The darker skin of peoples who lived closer to the equator was important in preventing folate deficiency. Measures of skin reflectance, a way to quantify skin color by measuring the amount of light it reflects, in people around the world support this idea. While UV rays can cause skin cancer, because skin cancer usually affects people after they have had children, it likely had little effect on the evolution of skin color because evolution favors changes that improve reproductive success."

https://humanorigins.si.edu/evidence/genetics/human-skin-color-variation/modern-human-diversity-skin-color

- "Human Skin Pigmentation as an Adaptation to UV Radiation...Human skin pigmentation is the product of two clines produced by natural selection to adjust levels of constitutive pigmentation to levels of UV radiation (UVR). One cline was generated by high UVR near the equator and led to the evolution of dark, photoprotective, eumelanin-rich pigmentation. The other was produced by the requirement for UVB photons to sustain cutaneous photosynthesis of vitamin D3 in low-UVB environments, and resulted in the evolution of depigmented skin. As hominins dispersed outside of the tropics, they experienced different intensities and seasonal mixtures of UVA and UVB. Extreme UVA throughout the year and two equinoctial peaks of UVB prevail within the tropics. Under these conditions, the primary selective pressure was to protect folate by maintaining dark pigmentation. Photolysis of folate and its main serum form of 5-methylhydrofolate is caused by UVR and by reactive oxygen species generated by UVA. Competition for folate between the needs for cell division, DNA repair, and melanogenesis is severe under stressful, high-UVR conditions and is exacerbated by dietary insufficiency. Outside of tropical latitudes, UVB levels are generally low and peak only once during the year. The populations exhibiting maximally depigmented skin are those inhabiting environments with the lowest annual and summer peak levels of UVB. Development of facultative pigmentation (tanning) was important to populations settling between roughly 23º and 46º, where levels of UVB varied strongly according to season. Depigmented and tannable skin evolved numerous times in hominin evolution via independent genetic pathways under positive selection...The possibility that photolysis of folate by sunlight was a determining factor in the evolution of dark pigmentation was first explored (Branda and Eaton, 1978) before the full importance of folate in DNA biosynthesis, repair, DNA methylation, amino acid metabolism, and melanin production was recognized. In 2000, we advanced the theory that dark skin pigmentation in humans had evolved primarily to prevent reduction of fertility due to the photolysis of folate present in cutaneous blood vessels (Jablonski and Chaplin, 2000). "

https://www.ncbi.nlm.nih.gov/books/NBK210015/
Altitude Diseases: Photosensitivity

- "Photosensitivity & Your Skin...No matter your skin type, if you develop photosensitivity, you may be especially at risk for lasting skin damage and skin cancer from even limited exposure to ultraviolet (UV) radiation. Understanding what photosensitivity is and why it occurs will help you take extra care to safeguard your skin health. Not everyone develops photosensitivity. But, if you have a higher risk, your best option is to take steps to prevent a sun-sensitive reaction from happening at all...You can become photosensitive as a result of prescription or over-the-counter medications, a medical condition or genetic disorder, or even by using certain types of skin care products. There are two distinct types of photosensitivity reactions: photoallergic and phototoxic." [https://www.skincancer.org/risk-factors/photosensitivity/](https://www.skincancer.org/risk-factors/photosensitivity/)

- "Ultraviolet Radiation...Certain chemicals and medications act as photosensitizing agents and enhance the effect of UV radiation form sunlight or other sources. Such agents include thiazide diuretics (drugs which cause excessive urine production), drugs used in the treatment of high blood pressure, certain antibiotics (tetracyclines, sulfonamides), cosmetics, and thiazine tranquilizers. These are just a few examples; this is not intended to be a comprehensive list. However, it is important to know that these photosensitizing effects can occur in case people are exposed to UV radiation at work. For example, an inexperienced welder, who was taking a phenothiazine anti-depressant drug, suffered damage in both eyes in the part of the retina that absorbs short wavelength light (bilateral maculopathy). He began complaining of eye problems a day after he was arc welding for two minutes without wearing any eye protection. This damage, that fortunately was reversible after several months, occurred because the drug he was taking sensitized him to the UV radiation to which he was exposed. Various plants such as carrot, celery, dill, fig, lemon and some types of weeds are known to cause photosensitivity. Exposure to fluids from these plants, especially if crushed, followed by exposure to sunlight can cause dermatitis. Citrus fruit handlers and vegetable harvesters, gardeners, florists and bartenders are at risk for experiencing dermatitis following exposure to certain plants and then to sunlight (phytophotodermatitis). Coal tar and creosote are examples of photosensitizing agents in the workplace. Effects of repeated exposures (chronic effects) include skin aging and skin cancer. There is a strong causal link between skin cancer and prolonged exposure to solar UV and from artificial sources." [https://www.ccohs.ca/oshanswers/phys_agents/ultravioletradiation.html](https://www.ccohs.ca/oshanswers/phys_agents/ultravioletradiation.html)

- "Ultraviolet (UV) Radiation...What effect does UV radiation have on my body? Both UVA and UVB rays can cause damage to your skin. Sunburn is a sign of short-term overexposure, while premature aging and skin cancer are side effects of prolonged UV exposure. Certain oral and topical medicines, such as antibiotics, birth control pills, and benzoyl peroxide products, as well as some cosmetics, may increase skin and eye sensitivity to UV in all skin types. Check the label and ask your doctor for more information. Sunlight is not the only source of UV radiation you may encounter. Other sources include:Tanning booths, Mercury vapor lighting (often found in stadiums and school gyms), Some halogen, fluorescent, and incandescent lights, Some types of lasers." [https://www.fda.gov/radiation-emitting-products/tanning/ultraviolet-uv-radiation](https://www.fda.gov/radiation-emitting-products/tanning/ultraviolet-uv-radiation)
Altitude Diseases: Folate Degradation Due to Ultraviolet Radiation

- "Folate Degradation Due to Ultraviolet Radiation: Possible Implications for Human Health and Nutrition...Folate is essential for human health in the prevention of megaloblastic anemia and neural tube birth defects and plays important roles in cardiovascular disease and cancer. Therefore, research into environmental factors that may impact folate status, such as solar ultraviolet (UV) radiation, is of great health significance. In vitro studies have shown that UV radiation can degrade folate and folic acid in human blood and this has been confirmed in several human studies. Despite these findings, there is a dearth of epidemiological research into investigating the relationship between folate status and the links to solar UV exposure." [https://pubmed.ncbi.nlm.nih.gov/22747844/]

- "Ultraviolet photodegradation of folic acid...The vitamin folate is vital for all living creatures. Scientists have suggested that ultraviolet degradation of folate in vivo played a role in the evolution of mankind. In order to better understand the photodegradation of folate, we have provided a spectroscopic study of the ultraviolet photodegradation of aqueous folic acid under aerobic conditions. We found strong indications that the folic acid molecule is cleaved into p-aminobenzoyl-l-glutamic acid and 6-formyl pterin when exposed to ultraviolet radiation. When the irradiation continues, 6-formyl pterin is degraded to pterin-6-carboxylic acid. The photodegradation of folic acid is divided into three phases. In the first phase, the formation of photoproducts follows a zero order rate law. In the second phase the presence of photoproducts sensitizes the degradation of folic acid and the degradation process is accelerated. In the third phase the degradation of 6-formyl pterin to pterin-6-carboxylic acid is the dominating process. This reaction follows a first order rate law. We show that both 6-formyl pterin and pterin-6-carboxylic acid sensitize the photodegradation of folic acid. However, experiments performed in heavy water indicate that generation of singlet oxygen is probably not the explanation for the photosensitizing of folic acid." [https://www.sciencedirect.com/science/article/abs/pii/S101113440500059X]

- "UV exposure found to lower folate levels in young women...Women who are pregnant or trying to get pregnant and taking a folic acid supplement may be at risk of reducing their folate benefit through sun exposure, a new study has warned. Folic acid is a B vitamin that is very important for pregnant women and those planning a baby. Folate is found in foods such as green leafy vegetables like spinach, citrus fruits, legumes, whole grains and vegemite. Folic acid is also added to many foods such as breads, flours and pastas. Folic acid can also be taken as a pill." [https://www.sciencedaily.com/releases/2014/03/140321095240.htm]

- "Association between seasonal serum folate levels and ultraviolet radiation...UV radiation has been consistently reported to cause folate photodegradation in vitro and in human skin. Seasonal variations in UV radiation might explain seasonal changes in folate levels in blood. Yet, few studies have addressed this phenomenon. The main objective of this study was to investigate whether a relationship exists between seasonal variations in serum folate levels in a population of Spain (Latitude: 36° 41’ 6.88”; Longitude: 4° 30’ 0.64”) and the annual variations of solar ultraviolet reached in the localization. From a sample of 118,831 serum folate determinations, two studies were performed. The first one, which included all subjects, showed a decreased in mean folate concentrations in all seasons with respect to winter with lower values in summer. The risk of folate deficiency was 1.37 times greater in summer than in winter (95%CI: 1.29–1.46). In the second study, subjects with a first folate determination in winter and
a second one in summer were 3.32 more likely to develop folate deficiency than those with a first folate determination in summer and a second one in winter (95%CI: 1.55 to 7.11). Folate levels showed a seasonal variation inversely related to solar total UV radiation reached in our location, with maximum daily doses of 5000 J m\(^{-2}\) reached in June. A gradual increase in percentage of folate deficiency is observed since spring. So, patients with folate levels close to deficiency are at a higher risk of having folate deficiency in summer."


- "Folate levels decrease depending on sun exposure, study says...Folate levels decrease during the months when solar radiation is higher and ultraviolet radiation proportionately affects folate levels in the blood. This is according to University of Malaga researchers, who have determined a seasonal risk threshold for people with folate deficiency in the blood. The team has developed a mobile app to determine sensitivity to sunlight depending on folate levels and suggests folate supplementation during the summer months to keep its levels balanced. “There is a significant percentage of people with low levels of folate during winter. Their folate levels decrease significantly in spring and summer so there is a seasonal risk level that requires special attention to these patients. We recommend supplementation to prevent the levels of folate from dropping significantly in the warmer months,” researcher José Aguilera tells NutritionInsight...The researchers have been working since 2006 on photoprotection and the relationship between the skin and sunlight." https://www.nutritioninsight.com/news/folate-levels-decrease-depending-on-sun-exposure-study-says.html

- "Rearrangement and depletion of folate in human skin by ultraviolet radiation...Exposure to sunlight, especially its ultraviolet component, is a major risk factor for several forms of skin cancer.(1) Both the more energetic UVB and the more abundant and deeply penetrating UVA (used in modern tanning beds) stimulate the progression of melanoma. Long duration or high frequency use of tanning beds and sunlamps has been associated with increased risk for basal and squamous cell carcinoma, while meta-analysis also suggests a link to melanoma." https://www.researchgate.net/publication/275896479_Rearrangement_and_Depletion_of_Folate_in_Human_Skin_by_Ultraviolet_Radiation

- "Serum folate levels after UVA exposure: a two-group parallel randomised controlled trial...Background. Photodegradation of certain vitamins such as riboflavins, carotinoids, tocopherol, and folate has been well-documented. Previous observations suggest that ultraviolet (UV) radiation may cause folate deficiency. This is of great importance since folate deficiency is also known to be linked with the development of neural tube defects. To investigate the influence of UVA radiation on serum folate levels in vivo, we conducted a two-group randomised controlled trial on healthy subjects. Material and methods. Twenty-four healthy volunteers with skin type II were enrolled into the study. Eight volunteers of the study population were randomly assigned to the control group. UVA irradiation was administered with an air-conditioned sunbed. Blood samples were taken from all volunteers at baseline (T1), 30 min after the first UVA exposure (T2), and at the end of the study 24 h after the sixth UV exposure (T3). The volunteers had two UVA exposures weekly within three weeks (cumulative UVA dose: 96 J/cm2). Volunteers of the control group had no UVA exposures. Serum folate was analysed with an automated immunoassay system. Results. At all times of blood collection the differences between serum folate levels were insignificant (P > 0.05), except of the non-exposed controls at T2 (P < 0.05). We did not observed significant differences of folate levels between UVA exposed and non-exposed volunteers (P > 0.05). Conclusions. Our data suggest that both single and serial UVA exposures do not significantly influence serum folate levels of healthy
subjects. Therefore, neural tube defects claimed to occur after periconceptual UVA exposure are probably not due to UVA induced folate deficiency."

Altitude Diseases: UV, Vitamin D & Folate

- "Skin color & Vitamin D & folate...Nina Jablonski has put forward a more reproductively salient selective pressure: the interference with folic acid synthesis which occurs when excessive UV radiation penetrates deep into the dermis. The end result of this is reduced folate levels, which in pregnant females often causes neural tube abnormalities. Any impact on pregnancy success is an extremely powerful selective force. In this model the dark skin of humans naturally arose because women who were darker skinned carried more normal fetuses to term than those who were light skinned. In dark skinned populations the MC1R locus is extremely conserved, suggesting powerful selective constraints which prevent sequence variation. No matter the phylogenetic relationships between dark skinned populations there is a consensus sequence which seems to have been selected for deep in the human past which remains the norm across these groups (i.e., though Melanesians and Africans are both very distantly related their dark skin is the end product of the same genetic architecture). But counterbalancing the need to block sunlight due to reduction in folate levels is the fact that vitamin D synthesis requires a minimum level of radiation to be catalyzed. Reduced vitamin D levels not only result in bone deformations (i.e., rickets), but a heightened sensitivity to a host of diseases."

- "Folate and fun in the sun. While we’re on the subject of folate, let’s look at a few other little known facts about this nutrient and the dance it does with vitamin D in the sunshine. Sunlight, more specifically the ultraviolet B (UVB) wavelength of sunlight, when absorbed by the skin destroys folate. The same UVB, when absorbed by the skin, stimulates the production of vitamin D. Since we need both folate and vitamin D, natural selection was presented with a real problem in dealing with both...Light-skinned people who get a ton of sun exposure can destroy enough folate to cause problems, but are protected because the UVB rays burn them, driving them from the sun...Another interesting aspect to all this is how it impacts cholesterol levels. Vitamin D is made in the skin from cholesterol. People who live in areas where there isn’t much sun exposure tend to run higher cholesterol levels to trap as much of the tiny UVB exposure as they can. For this reason, if you check your cholesterol levels, they will almost always be higher in winter than in the summer...One other factoid is that the main protein in the blood, albumin, prevents much of the UVB-induced destruction of folate. Albumin is made in the liver, and levels of it are a marker of liver function. When your liver is compromised, you don’t make as much albumin. If you go on a low-protein diet, you don’t make as much albumin."

- "Folate in Skin Cancer Prevention...Skin, the largest, most exposed organ of the body, provides a protective interface between humans and the environment. One of its primary roles is protection against exposure to sunlight, a major source of skin damage where the UV radiation (UVR) component functions as a complete carcinogen. Melanin pigmentation and the evolution of dark skin is an adaptive protective mechanism against high levels of UVR exposure. Recently, the hypothesis that skin pigmentation balances folate preservation and Vitamin D production has emerged. Both micronutrients are essential for reproductive success. Photodegradation of bioactive folates suggests a mechanism for the increased tendency of populations of low melanin pigmentation residing in areas of high UV exposure to develop skin cancers. Folate is proposed as a cancer prevention target for its role in providing precursors for..."
DNA repair and replication, as well as its ability to promote genomic integrity through the generation of methyl groups needed for control of gene expression. The cancer prevention potential of folate has been demonstrated by large-scale epidemiological and nutritional studies indicating that decreased folate status increases the risk of developing certain cancers. While folate deficiency has been extensively documented by analysis of human plasma, folate status within skin has not been widely investigated. Nevertheless, inefficient delivery of micronutrients to skin and photolysis of folate argue that documented folate deficiencies will be present if not exacerbated in skin. Our studies indicate a critical role for folate in skin and the potential to protect sun exposed skin by effective topical delivery as a strategy for cancer prevention."

"Ultraviolet Light in Human Health, Diseases and Environment (Advances in Experimental Medicine and Biology...This book is about the roles and importance of Ultraviolet (UV) light from sun and from man-made UV lamps in our daily life, on health and diseases, also its application in sterilization and treatment. The key words are: reactive oxygen species, DNA damage, UV mutagenicity, skin cancers, polymorphous light eruption, Xeroderma pigmentosum, vitiligo, psoriasis, rheumatoid arthritis, diabetes mellitus, metabolic syndromes, cardiovascular diseases, dermatology, photobiology, photodermatosis, vitamin D synthesis, vitamin D efficiency, water sterilization, blood sterilization, phototherapies, skin tanning and UV dosimeter. The book starts with introduction to UV light and the history of development of UV lamps and its applications. It then moves to describing the interaction of this light with biological components and the production of reactive oxygen species, their roles in cell signaling, cellular defense from foreign invaders, in mutagenesis leading to skin diseases including vitiligo, polymorphous light eruption and various forms of skin cancer. Then it presents the synthesis and importance of UV light and diseases, induced due to the deficiency of vitamin D. Roles of UV light in sterilization, disinfection, phototherapies are depicted in the next part and finally use and abuse of UV light in tanning salon and the availability and importance of use of UV dosimeter are highlighted. The three main focuses of this book are: - Damage to biological systems by UV light leading to certain skin diseases; most importantly skin cancers. - Importance of UV light in the in vivo synthesis of vitamin D when human bodies are exposed to it. - Diseases caused due to the deficiency of vitamin D and the use of UV lamps in phototherapy and sterilization processes. The editor has considerable experience in publishing medical books and has used it critically selecting the matters which will attract the readers from many areas of medical and non-medical fields. It is hoped that the materials presented in this book will give great benefit and will stimulate both novice and expert researchers in the field. The book gives excellent overviews of the current status of research and pointers to the future research achievements. Clinicians, medical general practitioners, technicians and staff working in UV related industries and especially those working in tanning salon should benefit from the information presented in safe handling of this light."
Altitude Diseases: Ultraviolet Blood Irradiation

- "Blood irradiation therapy is an alternative medical procedure in which the blood is exposed to low level light (often laser light) for therapeutic reasons. The practice was originally developed in the United States, but most recent research on it has been conducted in Germany (by UV lamps) and in Russia (in all variants). Low-level laser therapy has been tested for a wide range of conditions, but rigorous double-blinded studies have not yet been performed. Furthermore, it has been claimed that ultraviolet irradiation of blood kills bacteria by DNA damage and also activation of the immune system. Blood irradiation therapy is highly controversial, and has fallen from mainstream use since its heyday in the 1940s and 1950s. Blood irradiation therapy can be administered in three ways: extracorporeally, transcutaneously, and intravenously. The extracorporeal (outside the body) method removes blood from the body and irradiates it in a special cuvette (tube). This method is used for the ultraviolet (UV) blood irradiation (UVBI) by UV lamps. In the transcutaneous method, the radiation goes through the skin, by placing a device on the outside of the skin. In the intravenous method, a device is inserted into a large blood vessel. The laser light is monochromatic."

- "Light therapy—or phototherapy, classically referred to as heliotherapy—consists either of A.) exposure to daylight or some equivalent form of light as a treatment for seasonal affective disorder (SAD) or B.) exposure of the skin to specific wavelengths of light using polychromatic polarised light to treat a skin condition. It is used as a treatment for wintertime seasonal affective disorder and in circadian rhythm disorders, such as delayed sleep phase disorder. There is tentative evidence to support its use to treat non-seasonal psychiatric disorders, in particular major depression and depression in bipolar disorder. As a treatment for disorders of the skin, the second kind of light therapy is meant to correct psoriasis, acne vulgaris, eczema and neonatal jaundice... Ultraviolet light causes progressive damage to human skin and erythema even from small doses. This is mediated by genetic damage, collagen damage, as well as destruction of vitamin A and vitamin C in the skin and free radical generation. Ultraviolet light is also known to be a factor in formation of cataracts. Ultraviolet radiation exposure is strongly linked to incidence of skin cancer. Optical radiation of any kind with enough intensity can cause damage to the eyes and skin including photoconjunctivitis and photokeratitis. Researchers have questioned whether limiting blue light exposure could reduce the risk of age-related macular degeneration. It is reported that bright light therapy may activate the production of reproductive hormones, such as testosterone, luteinizing hormone, follicle-stimulating hormone, and estradiol. Modern phototherapy lamps used in the treatment of seasonal affective disorder and sleep disorders either filter out or do not emit ultraviolet light and are considered safe and effective for the intended purpose, as long as photosensitizing drugs are not being taken at the same time and in the absence of any existing eye conditions. Light therapy is a mood altering treatment, and just as with drug treatments, there is a possibility of triggering a manic state from a depressive state, causing anxiety and other side effects. While these side effects are usually controllable, it is recommended that patients undertake light therapy under the supervision of an experienced clinician, rather than attempting to self-medicate. Contraindications to light therapy for seasonal affective disorder include conditions that might render the eyes more vulnerable to phototoxicity, tendency toward mania, photosensitive skin
Patients with porphyria should avoid most forms of light therapy. Patients on certain drugs such as methotrexate or chloroquine should use caution with light therapy as there is a chance that these drugs could cause porphyria.[citation needed] Side effects of light therapy for sleep phase disorders include jumpiness or jitteriness, headache, eye irritation and nausea.[71] Some non-depressive physical complaints, such as poor vision and skin rash or irritation, may improve with light therapy.[72]

- "Excessive UV illumination results in RBC damage."

- "Despite Skeptics, Alternative Doctors ‘Detoxifying’ Blood With UV Rays...A blood treatment that was popular 75 years ago but faded away when antibiotics came along may be making a comeback with the increasing popularity of ‘integrative medicine.’” Historically called “ultraviolet blood irradiation” (UBI), the treatment appeals to alternative practitioners, especially those who give regular IV treatments for energy boosts and “detoxification.”...If the UBI treatment actually pumped up the immune system, Lockey said, “we’d be using it.”...“The reason blood irradiation faded away is that it is fundamentally stupid, and it doesn’t work,” Crislip says."  [https://health.wusf.usf.edu/post/despite-skeptics-alternative-doctors-detoxifying-blood-uv-rays#stream/0](https://health.wusf.usf.edu/post/despite-skeptics-alternative-doctors-detoxifying-blood-uv-rays#stream/0)

- "Intravascular Hemolytic Anemia with Acanthocytosis Following Alternative Treatment with Ozone, UV Light, and Perfluorocarbon...Alternative medicine has become more common as patients seek approaches to diseases where traditional medicine has failed. Treatment with ozone has been purported to have benefits for a variety of infectious, inflammatory and neoplastic conditions. Treatment can be administered by the intra arterial, intravenous, intra rectal and subcutaneous routes as well as ozonated autohaemotherapy. We describe a 44 year old woman who received treatment at an alternative medical center for recurrent breast cancer including laetrile, perfluorocarbon emulsion, high dose ascorbic acid, vitamin K and extracorporeal treatment of her blood with ozone and ultraviolet light. After receiving her second treatment, she presented to our hospital with a syncopal episode and was found to be anemic (Hb 4 gm/dl). The LDH was 8X> ULN, the serum haptoglobin was undetectable, and the reticulocyte count was increased. The peripheral blood smear showed anisocytosis, poikilocytosis and polychromasia. There was also severe acanthocytosis. Heinz bodies were not detected. The patient refused blood products and after 48h of hospitalization, her Hb rose to 7gm and she was discharged. She did not return for follow-up evaluation. Acanthocytosis has been associated with impairment of cholesterol membrane fluidity seen with acquired hepatic disease as well as some congenital diseases. Oxidative stress can lead to peroxidation of membrane phospholipids, and if the intrinsic repair mechanism of the RBC is overwhelmed, the RBCs transform into acanthocytes. To date, there has been no literature describing hemolysis associated with any of the individual treatments which this patient received; however the combination of treatments exposed the RBC’s to multiple oxidative stresses which might lead to lipid peroxidation and formation of acanthocytes. This case illustrates the potential problems that face clinicians when encountering patients who seek alternative therapy."  [https://ashpublications.org/blood/article/112/11/5388/62826/Intravascular-Hemolytic-Anemia-with-Acanthocytosis](https://ashpublications.org/blood/article/112/11/5388/62826/Intravascular-Hemolytic-Anemia-with-Acanthocytosis)

- "EFFECT OF ULTRAVIOLET LIGHT ON THE BLOOD OF NEW-BORN INFANTS...With the increasing use of ultraviolet light as an important therapeutic measure for children, it is
obviously necessary to ascertain the effect of this procedure on the young organism. In the first paper of this series, it was shown that the ultraviolet light was capable of increasing the blood platelets in the new-born.\(^1\) This paper deals with the effect on the erythrocytes and hemoglobin.\(^2\)

- "Ultraviolet blood irradiation: Is it time to remember “the cure that time forgot”?...Ultraviolet blood irradiation (UBI) was extensively used in the 1940s and 1950s to treat many diseases including septicemia, pneumonia, tuberculosis, arthritis, asthma and even poliomyelitis. The early studies were carried out by several physicians in USA and published in the American Journal of Surgery. However with the development of antibiotics, the use of UBI declined and it has now been called “the cure that time forgot”. Later studies were mostly performed by Russian workers and in other Eastern countries, and the modern view in Western countries is that UBI remains highly controversial. This review discusses the potential of UBI as an alternative approach to current methods used to treat infections, as an immune-modulating therapy and as a method for normalizing blood parameters. Low and mild doses of UV kill microorganisms by damaging the DNA, while any DNA damage in host cells can be rapidly repaired by DNA repair enzymes. However the use of UBI to treat septicemia cannot be solely due to UV-mediated killing of bacteria in the bloodstream, as only 5–7% of blood volume needs to be treated with UV to produce the optimum benefit, and higher doses can be damaging. There may be some similarities to extracorporeal photopheresis (ECP) using psoralens and UVA irradiation. However there are differences between UBI and ECP in that UBI tends to stimulate the immune system, while ECP tends to be immunosuppressive. With the recent emergence of bacteria that are resistant to all known antibiotics, UBI should be more investigated as an alternative approach to infections, and as an immune-modulating therapy."
Altitude Diseases: UV Exposure Skin Problems

- "Improvement of vitiligo after oral treatment with vitamin B12 and folic acid and the importance of sun exposure. Acta Derm Venereol. 1997. The aim of this 2-year study was to test the hypothesis that folic acid, vitamin B12 and sun exposure could be helpful in treating vitiligo. One hundred patients with vitiligo were treated with oral folic acid and vitamin B12 after being informed that sun exposure might enhance repigmentation. They were requested to keep a record of sun exposure in summer and UVB irradiation in winter. The minimal treatment time suggested was 3-6 months but should be longer if improvement was achieved. Clear repigmentation occurred in 52 patients, including 37 who exposed their skin to summer sun and 6 who used UVB lamps in winter. Repigmentation was most evident on sun-exposed areas, where 38% of the patients had previously noted repigmentation during summer months. Total repigmentation was seen in 6 patients. The spread of vitiligo stopped in 64% of the patients after treatment. Folic acid and vitamin B12 supplementation combined with sun exposure can induce repigmentation better than either the vitamins or sun exposure alone. Treatment should continue as long as the white areas continue to repigment. Further studies are needed to determine ideal minimal dosages of vitamins and UV exposure, as well as treatment time." [https://thevitpro.com/b12-folic-acid-uv-exposure/]

- "Pilot study of folate status in healthy volunteers and in patients with psoriasis before and after UV exposure...Ultraviolet radiation, UV, is widely used for treatment of psoriasis. UV radiation may destroy blood folates in test tubes, but clinical data are scarce. Folate deficiency may increase the risk of cardiovascular diseases, colorectal carcinoma, megaloblastic anemia, pregnancy and birth complications, depression and dementia. The aim of the present study was to investigate the influence of solar radiation, sunbeds and/or broadband UVB phototherapy on the levels of serum and erythrocyte folate in patients with psoriasis or healthy volunteers. Serum and erythrocyte folate status in patients with psoriasis and healthy volunteers was measured before and after exposure to solar radiation, broadband UVB or use of sunbeds. In some cases plasma homocysteine and serum 25-hydroxyvitamin D (25(OH)D) were also measured. Serum and erythrocyte folate levels in healthy volunteers and in psoriasis patients were not influenced to any statistically significant extent after exposure to solar radiation, to single or to multiple UV treatments. However, a slight decay of blood folates and an increase of plasma homocysteine levels were observed in psoriasis patients after exposure to UV radiation. Exposure to sun or sunbeds does not have any significant effect on the levels of blood folate of healthy humans. High doses of broadband UVB phototherapy may slightly decrease blood folates in psoriasis patients. Further studies, using proper, adequate 5-methyltetrahydrofolate methodology, are needed to clarify the influence of broadband phototherapy on folate degradation and the consequences of these on the health of psoriasis patients." [https://europepmc.org/article/med/20207157]

- "Beneficial effects of UV radiation other than via vitamin D production...Most of the positive effects of solar radiation are mediated via ultraviolet-B (UVB) induced production of vitamin D in skin. However, several other pathways may exist for the action of ultraviolet (UV) radiation on humans as focused on in this review. One is induction of cosmetic tanning (immediate pigment darkening, persistent pigment darkening and delayed tanning). UVB-induced, delayed tanning (increases melanin in skin after several days), acts as a sunscreen. Several human skin diseases, like psoriasis, vitiligo, atopic dermatitis and localized scleroderma, can be treated with..."
solar radiation (heliotherapy) or artificial UV radiation (phototherapy). UV exposure can suppress the clinical symptoms of multiple sclerosis independently of vitamin D synthesis. Furthermore, UV generates nitric oxide (NO), which may reduce blood pressure and generally improve cardiovascular health. UVA-induced NO may also have antimicrobial effects and furthermore, act as a neurotransmitter. Finally, UV exposure may improve mood through the release of endorphins." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3427189/]
Altitude Diseases: UV Exposure & Genetics

- "UV-associated decline in systemic folate: implications for human nutrigenetics, health, and evolutionary processes...Objectives: The purpose of this study was to examine whether UV exposure alters folate status according to C677T-MTHFR genotype, and to consider the relevance of this to human health and the evolutionary model of skin pigmentation. Methods: Total Ozone Mapping Spectrometer (TOMS) satellite data were used to examine surface UV-irradiance, as a marker of UV exposure, in a large (n = 649) Australian cross-sectional study population. PCR/RFLP analysis was used to genotype C677T-MTHFR. Results: Overall, cumulative UV-irradiance (42 and 120 days pre-clinic) was significantly negatively related to red cell folate (RCF) levels. When the cohort was stratified by MTHFR-C677T genotype, the relationship between UV-irradiance (42 days pre-clinic) and RCF remained significant only in the cohorts containing carriers of the T allele. Statistically significant z-score statistics and interaction terms from genotype and UV-irradiance (p-interaction) demonstrated that genotype did modify the effect of UV-irradiance on RCF, with the largest effect of UV being demonstrated in the 677TT-MTHFR subjects. Conclusions: Data provide strong evidence that surface UV-irradiance reduces long-term systemic folate levels, and that this is influenced by the C677T-MTHFR gene variant. We speculate this effect may be due to 677TT-MTHFR individuals containing more 5,10CH2-H4PteGlu, and that this folate form may be particularly UV labile. Since UV-irradiance lowers RCF in an MTHFR genotype-specific way, there are likely implications for human health and the evolution of skin pigmentation."

- "Human skin pigmentation as an adaptation to UV radiation...Human skin pigmentation is the product of two clines produced by natural selection to adjust levels of constitutive pigmentation to levels of UV radiation (UVR). One cline was generated by high UVR near the equator and led to the evolution of dark, photoprotective, eumelanin-rich pigmentation. The other was produced by the requirement for UVB photons to sustain cutaneous photosynthesis of vitamin D3 in low-UVB environments, and resulted in the evolution of depigmented skin. As hominins dispersed outside of the tropics, they experienced different intensities and seasonal mixtures of UVA and UVB. Extreme UVA throughout the year and two equinoctial peaks of UVB prevail within the tropics. Under these conditions, the primary selective pressure was to protect folate by maintaining dark pigmentation. Photolysis of folate and its main serum form of 5-methylhydrofolate is caused by UVR and by reactive oxygen species generated by UVA. Competition for folate between the needs for cell division, DNA repair, and melanogenesis is severe under stressful, high-UVR conditions and is exacerbated by dietary insufficiency. Outside of tropical latitudes, UVB levels are generally low and peak only once during the year. The populations exhibiting maximally depigmented skin are those inhabiting environments with the lowest annual and summer peak levels of UVB. Development of facultative pigmentation (tanning) was important to populations settling between roughly 23° and 46°, where levels of UVB varied strongly according to season. Depigmented and tannable skin evolved numerous times in hominin evolution via independent genetic pathways under positive selection."

https://www.pnas.org/content/107/Supplement_2/8962
Altitude Diseases: Folate Depletion

- "Folate deficiency, also known as vitamin B9 deficiency, is a low level of folate and derivatives in the body. Signs of folate deficiency are often subtle. A low number of red blood cells (anemia) is a late finding in folate deficiency and folate deficiency anemia is the term given for this medical condition.[1] It is characterized by the appearance of large-sized, abnormal red blood cells (megaloblasts), which form when there are inadequate stores of folic acid within the body....Signs and symptoms. Loss of appetite and weight loss can occur. Additional signs are weakness, sore tongue, headaches, heart palpitations, irritability, and behavioral disorders.[3] In adults, anemia (macrocytic, megaloblastic anemia) can be a sign of advanced folate deficiency. Women with folate deficiency who become pregnant are more likely to give birth to low birth weight premature infants, and infants with neural tube defects. In infants and children, folate deficiency can lead to failure to thrive or slow growth rate, diarrhea, oral ulcers, megaloblastic anemia, neurological deterioration. An abnormally small head, irritability, developmental delay, seizures, blindness and cerebellar ataxia can also be observed.[4]...Research. Folate deficiency during gestation or infancy due to development by the fetus or infant of autoantibodies to the folate receptor might result in various developmental disorders.[36] Studies suggest that insufficient folate and vitamin B12 status may contribute to major depressive disorder and that supplementation might be useful in this condition.[37] The role of vitamin B12 and folate in depression is due to their role in transmethylation reactions, which are crucial for the formation of neurotransmitters (e.g. serotonin, epinephrine, nicotinamides, purines, phospholipids).[37] [38] The proposed mechanism, is that low levels of folate or vitamin B12 can disrupt transmethylation reaction, leading to an accumulation of homocysteine (hyperhomocysteinemia) and to impaired metabolism of neurotransmitters (especially the hydroxylation of dopamine and serotonin from tyrosine and tryptophan), phospholipids, myelin, and receptors. High homocysteine levels in the blood can lead to vascular injuries by oxidative mechanisms which can contribute to cerebral dysfunction. All of these can lead to the development of various disorders, including depression." [https://en.wikipedia.org/wiki/Folate_deficiency]

- "Folate...Health effects. Folate is especially important during periods of frequent cell division and growth, such as infancy and pregnancy. Folate deficiency hinders DNA synthesis and cell division, affecting hematopoietic cells and neoplasms the most because of their greater frequency of cell division. RNA transcription and subsequent protein synthesis are less affected by folate deficiency, as the mRNA can be recycled and used again (as opposed to DNA synthesis, where a new genomic copy must be created)....Folate deficiency may lead to glossitis, diarrhea, depression, confusion, anemia, and fetal neural tube and brain defects.[29] Other symptoms include fatigue, gray hair, mouth sores, poor growth, and swollen tongue.[27] Folate deficiency is diagnosed by analyzing a complete blood count (CBC) and plasma vitamin B12 and folate levels. A serum folate of 3 μg/L or lower indicates deficiency.[29] Serum folate level reflects folate status, but erythrocyte folate level better reflects tissue stores after intake. An erythrocyte folate level of 140 μg/L or lower indicates inadequate folate status. Serum folate reacts more rapidly to folate intake than erythrocyte folate....Fertility. Folate contributes to spermatogenesis.[45] In women, folate is important for oocyte quality and maturation, implantation, placentation, fetal growth and organ development....Heart disease. One meta-analysis reported that multi-year folic acid supplementation, in amounts in most of the included..."
clinical trials at higher than the UL of 1,000 μg/day, reduced the relative risk of cardiovascular disease by a modest 4%.\[12\] Two older meta-analyses, which would not have incorporated results from newer clinical trials, reported no changes to the risk of cardiovascular disease...Stroke. The absolute risk of stroke with supplementation decreases from 4.4% to 3.8% (a 10% decrease in relative risk).\[12\] Two other meta-analyses reported a similar decrease in relative risk.\[48\]\[49\] Two of these three were limited to people with pre-existing cardiovascular disease or coronary heart disease.\[12\]\[48\] The beneficial result may be associated with lowering circulating homocysteine concentration, as stratified analysis showed that risk was reduced more when there was a larger decrease in homocysteine.\[12\]\[48\] The effect was also larger for the studies that were conducted in countries that did not have mandatory grain folic acid fortification.\[48\]\[49\] The beneficial effect was larger in the subset of trials that used a lower folic acid supplement compared to higher...Cancer. Chronically insufficient intake of folate may increase the risk of colorectal, breast, ovarian, pancreas, brain, lung, cervical, and prostate cancers.\[6\]\[50\]\[51\] Early after fortification programs were implemented, high intakes were theorized to accelerate the growth of preneoplastic lesions that could lead to cancer, specifically colon cancer.\[52\]\[53\] Subsequent meta-analyses of the effects of low versus high dietary folate, elevated serum folate, and supplemental folate in the form of folic acid have reported at times conflicting results. Comparing low to high dietary folate showed a modest but statistically significant reduced risk of colon cancer.\[54\] For prostate cancer risk, comparing low to high dietary folate showed no effect,\[55\]\[56\] but the same two studies reported a significant increased risk for prostate cancer correlating to elevated serum folate.\[55\]\[56\] Two reviews of trials that involved folic acid dietary supplements reported, respectively, a statistically significant 24% increase in prostate cancer risk\[13\] and a not significant 17% increase in prostate cancer risk.\[57\] Supplementation with folic acid at 1,000 to 2,500 μg/day – the amounts used in many of the supplement trials\[13\]\[57\] – would result in higher concentrations of serum folate than what is achieved from diets high in food-derived folate. The second study reported no significant increase or decrease in total cancer incidence, colorectal cancer, other gastrointestinal cancer, genitourinary cancer, lung cancer or hematological malignancies in people who were consuming folic acid supplements.\[57\] A third supplementation meta-analysis limited to reporting only on colorectal cancer incidence showed that folic acid treatment was not associated with colorectal cancer risk...Neurological disorders. Conversion of homocysteine to methionine requires folate and vitamin B12. Elevated plasma homocysteine and low folate are associated with cognitive impairment, dementia and Alzheimer's disease.\[67\]\[68\] Supplementing the diet with folic acid and vitamin B12 lowers plasma homocysteine.\[68\] However, several reviews reported that supplementation with folic acid alone or in combination with other B vitamins did not prevent development of cognitive impairment nor slow cognitive decline.\[69\]\[68\]\[70\] The relative risk of autism spectrum disorders was reduced by 23% when the maternal diet was supplemented during pregnancy. Subset analysis confirmed this among Asian, European and American populations.\[71\] Some evidence links a shortage of folate with clinical depression.\[72\] Limited evidence from randomized controlled trials showed using folic acid in addition to selective serotonin reuptake inhibitors (SSRIs) may have benefits.\[73\] Research found a link between depression and low levels of folate.\[74\]\[75\] The exact mechanisms involved in the development of schizophrenia and depression are not entirely clear, but the bioactive folate, methyltetrahydrofolate (5-MTHF), a direct target of methyl donors such as S-adenosyl methionine (SAMe), recycles the inactive dihydrobiopterin (BH2) into tetrahydrobiopterin (BH4), the necessary cofactor in various steps of monoamine synthesis,
including that of dopamine. BH4 serves a regulatory role in monoamine neurotransmission and is required to mediate the actions of most antidepressants. 5-MTHF also plays both direct & indirect roles in DNA methylation, NO2 synthesis, and one-carbon metabolism...Folic acid, B12 and iron. A complex interaction occurs between folic acid, vitamin B12, and iron. A deficiency of folic acid or vitamin B12 may mask the deficiency of iron; so when taken as dietary supplements, the three need to be in balance...Wills demonstrated that anemia could be reversed with brewer's yeast.[15][137] In the late 1930s, folate was identified as the corrective substance in brewer's yeast." https://en.wikipedia.org/wiki/Folate
Altitude Diseases: Increased Vitamin B12 Requirements

- "Senior Scene : Vitamin B-12, Deficiency at Altitude...When I first arrived in Nederland, a friend sadly moved “down below” because she felt tired all the time at altitude. Another complained that they just feel “spacey” up here and feel more forgetful and distracted. Granted, the scenery is a wonderful distraction even for the most focused minds, but it was a chemical disturbance she didn’t feel elsewhere. Nutrition books don’t mention this much, but one thing we mountain dwellers need to watch is our Vitamin B-12. This vitamin aids folic acid in regulating the formation of red blood cells, since we need to make extra ones up here, and helps in the utilization of iron, says Dr. Balch in “Prescription for Nutritional Healing.” It is also required for proper digestion, absorption of foods, the synthesis of protein, and the metabolism of carbohydrates and fats. Aiding in cell formation and longevity, it prevents nerve damage and is linked to the production of the neurotransmitter that assists memory and learning." [Source](https://themtnear.com/2018/06/senior-scene-vitamin-b-12-deficiency-at-altitude/)

- "Vitamin B12 deficiency...Effect of folic acid. Large amounts of folic acid can correct the megaloblastic anemia caused by vitamin B12 deficiency without correcting the neurological abnormalities, and could also worsen the anemia and the cognitive symptoms associated with vitamin B12 deficiency.[2] Due to the fact that in the United States legislation has required enriched flour to contain folic acid to reduce cases of fetal neural-tube defects, consumers may be ingesting more folate than they realize.[22] To avoid this potential problem, the U.S. Food and Drug Administration recommends that folic acid intake from fortified food and supplements should not exceed 1,000 µg daily in healthy adults.[2] The European Food Safety Authority reviewed the safety question and agreed with US that the UL be set at 1,000 µg.[24] The Japan National Institute of Health and Nutrition set the adult UL at 1,300 or 1,400 µg depending on age." [Source](https://en.wikipedia.org/wiki/Vitamin_B12_deficiency)

- "Effects of Cold and Altitude on Vitamin and Mineral Requirements...Folic Acid...Concern exists about the ability of folic acid oversupplementation to mask symptoms of pernicious anemia, particularly in the elderly. Pernicious anemia is caused by decreased absorption of vitamin B12. It is suggested that the micronutrient intake goal for folic acid be set at 400 µg/d (Table 13-1). This level should provide sufficient folic acid to women of childbearing age to reduce the incidence of neural tube defects in their children (Czeizel, 1993). It is important, however, that this level of folic acid be made available in the foods actually consumed in the cold or at high altitudes due to the lack of fresh leafy green vegetables in the normal diet in these environments." [Source](https://www.ncbi.nlm.nih.gov/books/NBK232871/)

- "Sickness at Altitude...Nearly half of all athletes ascending to 8,000- 14,000 ft. altitude experience headache, malaise, and decreased appetite. This is "Sickness at Altitude." Since elevation gain predictably induces sickness associated with altitude, the cause and the cure for managing these symptoms in order to reduce their effect on performance is a real and present concern. The preventatives discussed are time required for the body to adapt to less oxygen, adequate hydration, sufficient carbohydrates, pace-associated calorie expense, devices utilized to monitor or reduce altitude-associated edema, oral preventative medication, or over-the-counter NSAIDS (e.g. analgesics such as ibuprofen, aspirin).... DIET - A high carbohydrate, low salt diet stimulates physiological adaptation and lowers the risk of "Altitude Sickness." Some people experience significant decline in appetite resulting in loss of muscle. Iron is used to make oxygen-carrying hemoglobin. To make red blood cells our body requires iron-adequate
foods. Most of us consume adequate levels of iron though females and vegetarians may lack the Vitamin B-12, Folate and Iron to make red blood cells at an increased rate for the blood's oxygen carrying needs at altitude...CONCLUSION. While it would seem reasonable to slow down when oxygen saturation volume is reduced due to the thin air at altitude, very few athletes possess the ability to restrain their competitive instincts to perform well. Fluid intake needs to be up to 30 fluid ounces per hour, including electrolytes (3-6 Endurolytes) per hour in divided dose in an isotonic solution containing between 240-280 calories. Acclimatizing to a given altitude for 10-14 days is ideal. If this is not convenient, the athlete is advised to show up the day the event starts in order to avoid performance-inhibiting gradual onset of pulmonary or cerebral edema that occurs prior to completing the ideal 10-14 days acclimatization. The athlete's physician in anticipation of cerebral or pulmonary edema may determine the prescription drug Acetazolamide."

- "Altitude Boost. High Altitude Training in a Bottle to Increase VO2 Max, Endurance, Oxygen with Alpha Lipoic Acid, Iron and Vitamin B12 (60 Tablets)...ALTITUDE BOOST. With natural compounds that mimic the effects of high altitude training, Altitude Boost stimulates red blood cell production for more efficient oxygen use and increased lung capacity for increased speed, strength and endurance. NEXT FRONTIER IN PERFORMANCE. Safe, effective, and natural, Altitude Boost has been shown to significantly increase EPO levels in athletes. This results in substantial gains in EPO levels on endurance and recovery."

Altitude Diseases: Increased Iron Requirements

- "Pumping Iron: Blood Health at High Altitude.... I learned that anemia and acute mountain sickness/altitude sickness can have pretty serious compounding effects. And so, to better acclimate and increase my overall health and energy altitude, I’ve looked into some ways to support my blood health. B VITAMINS (B6, B9, B12)– These vitamins are essential in producing hemoglobin, the protein containing red blood cells. The recommended daily intake of each is: B12 – 2.4 micrograms; B9 – 400micrograms; B6 – 1.3milligrams. Vitamin A– This is essential for red blood cell development and reproduction, as well as letting our red bloods cells access iron. The recommended amount for women is 700 micrograms and for men is 900 micrograms. Copper and Iron– Iron directly bonds to oxygen in red blood cells and carries it. Copper helps iron be in the necessary form for it to carry oxygen. The recommended daily amount of iron for women is 18 milligrams and for men is 8 milligrams, and for both 900 micrograms of copper. Vitamin C– Aids in the body’s absorption of iron. Recommended 65 milligrams per day." [https://www.14ers.org/pumping-iron-blood-health-at-high-altitude/]

- "Preventing Altitude Sickness: The Importance Of Iron - Summit Strength...Iron is a naturally occurring mineral in the body. It is used for a number of things such as converting food to energy, protecting the immune system and maintaining cognitive function. But what most concerns altitude trekkers is that iron is essential for the production of haemoglobin. Haemoglobin is a protein found in our red blood cells whose primary role is to transport oxygen from the lungs to body tissues and muscles. While we are at altitude, the air is literally thinner, and as a result out blood oxygen saturation levels drop. One of the ways our bodies try to combat in the acclimatisation process this is to produce more haemoglobin. However, if we don't have healthy iron levels the acclimatisation process will be inhibited. And this is a short road to altitude sickness." [https://www.summitstrength.com.au/blog/preventing-altitude-sickness-the-importance-of-iron]

- "The influence of high-altitude living on body iron...The quantitative assessment of body iron based on measurements of the serum ferritin and transferrin receptor was used to examine iron status in 800 Bolivian mothers and one of their children younger than 5 years. The survey included populations living at altitudes between 156 to 3750 m. Body iron stores in the mothers averaged 3.88 ± 4.31 mg/kg (mean ± 1 SD) and 1.72 ± 4.53 mg/kg in children. No consistent effect of altitude on body iron was detected in children but body iron stores of 2.77 ± 0.70 mg/kg (mean ± 2 standard error [SE]) in women living above 3000 m was reduced by one-third compared with women living at lower altitudes (P < .001). One half of the children younger than 2 years were iron deficient, but iron stores then increased linearly to approach values in their mothers by 4 years of age. When body iron in mothers was compared with that of their children, a striking correlation was observed over the entire spectrum of maternal iron status (r = 0.61, P < .001). This finding could provide the strongest evidence to date of the importance of dietary iron as a determinant of iron status in vulnerable segments of a population. (Blood. 2005;106:1441-1446)" [https://ashpublications.org/blood/article/106/4/1441/21557/The-influence-of-high-altitude-living-on-body-iron]

- "Iron Levels and Altitude. Taking supplements may increase the benefits of thin-air training...The results were pretty striking: the non-supplemented group increased their hemoglobin mass by 1.1 percent on average during altitude training; the 105-mg group increased by 3.3 percent; and the 210-mg group increased by 4.0 percent. That seems like fairly
strong evidence that iron supplementation is a good idea if you’re headed to altitude for most people (barring conditions like hemochromatosis): after all, 163 of the 178 athletes fell into the category where the AIS felt they needed supplements...But the overall picture definitely suggests that extra iron is helpful for a lot people who wouldn’t need supplements at sea level (where a ferritin threshold of 35 micrograms/L is often used for athletes).”

https://www.runnersworld.com/training/a20853845/iron-levels-and-altitude/

- “Iron insufficiency diminishes the erythropoietic response to moderate altitude exposure...The effects of iron stores and supplementation on erythropoietic responses to moderate altitude in endurance athletes were examined. In a retrospective study, red cell compartment volume (RCV) responses to 4 wk at 2,500 m were assessed in athletes with low (n = 9, ≤20 and ≤30 ng/mL for women and men, respectively) and normal (n = 10) serum ferritin levels ([Ferritin]) without iron supplementation. In a subsequent prospective study, the same responses were assessed in athletes (n = 26) with a protocol designed to provide sufficient iron before and during identical altitude exposure. The responses to a 4-wk training camp at sea level were assessed in another group of athletes (n = 13) as controls. RCV and maximal oxygen uptake (\(\dot{V}o2max\)) were determined at sea level before and after intervention. In the retrospective study, athletes with low [Ferritin] did not increase RCV (27.0 ± 2.9 to 27.5 ± 3.8 mL/kg, mean ± SD, P = 0.65) or \(\dot{V}o2max\) (60.2 ± 7.2 to 62.2 ± 7.5 mL·kg−1·min−1, P = 0.23) after 4 wk at altitude, whereas athletes with normal [Ferritin] increased both (RCV: 27.3 ± 3.1 to 29.8 ± 2.4 mL/kg, P = 0.002; \(\dot{V}o2max\): 62.0 ± 3.1 to 66.2 ± 3.7 mL·kg−1·min−1, P = 0.003). In the prospective study, iron supplementation normalized low [Ferritin] observed in athletes exposed to altitude (n = 14) and sea level (n = 6) before the altitude/sea-level camp and maintained [Ferritin] within normal range in all athletes during the camp. RCV and \(\dot{V}o2max\) increased in the altitude group but remained unchanged in the sea-level group. Finally, the increase in RCV correlated with the increase in \(\dot{V}o2max\) [(r = 0.368, 95% confidence interval (CI): 0.059–0.612, P = 0.022). Thus, iron deficiency in athletes restrains erythropoiesis to altitude exposure and may preclude improvement in sea-level athletic performance. NEW & NOTEWORTHY Hypoxic exposure increases iron requirements and utilization for erythropoiesis in athletes. This study clearly demonstrates that iron deficiency in athletes inhibits accelerated erythropoiesis to a sojourn to moderate high altitude and may preclude a potential improvement in sea-level athletic performance with altitude training. Iron replacement therapy before and during altitude exposure is important to maximize performance gains after altitude training in endurance athletes.”


- “Nutrition and Altitude: Strategies to Enhance Adaptation, Improve Performance and Maintain Health: A Narrative Review...Training at low to moderate altitudes (~ 1600–2400 m) is a common approach used by endurance athletes to provide a distinctive environmental stressor to augment training stimulus in the anticipation of increasing subsequent altitude- and sea-level-based performance. Despite some scientific progress being made on the impact of various nutrition-related changes in physiology and associated interventions at mountaineering altitudes (> 3000 m), the impact of nutrition and/or supplements on further optimization of these hypoxic adaptations at low–moderate altitudes is only an emerging topic. Within this narrative review we have highlighted six major themes involving nutrition: altered energy availability, iron, carbohydrate, hydration, antioxidant requirements and various performance supplements. Of these issues, emerging data suggest that particular attention be given to the potential risk for poor energy availability and increased iron requirements at the altitudes typical of elite athlete
Environmental Radiation LLC - https://www.environmentalradiation.com

training (~1600–2400 m) to interfere with optimal adaptations. Furthermore, the safest way to address the possible increase in oxidative stress associated with altitude exposure is via the consumption of antioxidant-rich foods rather than high-dose antioxidant supplements. Meanwhile, many other important questions regarding nutrition and altitude training remain to be answered. At the elite level of sport where the differences between winning and losing are incredibly small, the strategic use of nutritional interventions to enhance the adaptations to altitude training provides an important consideration in the search for optimal performance.”

- “The Influence of Vitamin A Supplementation on Iron Status...Vitamin A (VA) and iron deficiencies are important nutritional problems, affecting particularly preschool children, as well as pregnant and lactating women. A PubMed (National Library of Medicine, National Institutes of Health, Bethesda, MD, USA) literature review was carried out to search for clinical trials published from 1992 to 2013 that assessed the influence of vitamin A supplementation on iron status. Simultaneous use of iron and vitamin A supplements seemed to be more effective to prevent iron deficiency anemia than the use of these micronutrients alone. Some studies did not include a placebo group and only a few of them assessed vitamin A status of the individuals at baseline. Moreover, the studies did not consider any inflammatory marker and a reasonable number of iron parameters. Another important limitation was the lack of assessment of hemoglobin variants, especially in regions with a high prevalence of anemia. Assessment of hemoglobin variants, inflammatory markers and anemia of chronic inflammation would be important to the studies investigated. Studies involving different populations are necessary to elucidate the interaction between the two micronutrients, especially regarding iron absorption and modulation of erythropoiesis.”
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847738/
Altitude Diseases: Megaloblastic Anemia

- "Folate...Folate Deficiency. Isolated folate deficiency is uncommon; folate deficiency usually coexists with other nutrient deficiencies because of its strong association with poor diet, alcoholism, and malabsorptive disorders [4]. Megaloblastic anemia, which is characterized by large, abnormally nucleated erythrocytes, is the primary clinical sign of folate or vitamin B12 deficiency [1,4]. Its symptoms include weakness, fatigue, difficulty concentrating, irritability, headache, heart palpitations, and shortness of breath [2]. Folate deficiency can also produce soreness in and shallow ulcerations on the tongue and oral mucosa; changes in skin, hair, or fingernail pigmentation; gastrointestinal symptoms; and elevated blood concentrations of homocysteine [1,2,4,34]. Women with insufficient folate intakes are at increased risk of giving birth to infants with NTDs [2]. Inadequate maternal folate status has also been associated with low infant birth weight, preterm delivery, and fetal growth retardation [1,35]...Large amounts of folate can correct the megaloblastic anemia, but not the neurological damage, that can result from vitamin B12 deficiency. Some experts have therefore been concerned that high intakes of folate supplements might “mask” vitamin B12 deficiency until its neurological consequences become irreversible. Questions about this possibility still remain, but the focus of concern has shifted to the potential for large amounts of folate to precipitate or exacerbate the anemia and cognitive symptoms associated with vitamin B12 deficiency." https://ods.od.nih.gov/factsheets/Folate-HealthProfessional/

- "Megaloblastic anemia...Megaloblastic anemia is an anemia (of macrocytic classification) that results from inhibition of DNA synthesis during red blood cell production.[1] When DNA synthesis is impaired, the cell cycle cannot progress from the G2 growth stage to the mitosis (M) stage. This leads to continuing cell growth without division, which presents as macrocytosis. Megaloblastic anemia has a rather slow onset, especially when compared to that of other anemias. The defect in red cell DNA synthesis is most often due to hypovitaminosis, specifically vitamin B12 deficiency or folate deficiency. Loss of micronutrients may also be a cause. Copper deficiency resulting from an excess of zinc from unusually high oral consumption of zinc-containing denture-fixation creams has been found to be a cause.[2] Megaloblastic anemia not due to hypovitaminosis may be caused by antimetabolites that poison DNA production directly, such as some chemotherapeutic or antimicrobial agents (for example azathioprine or trimethoprim). The pathological state of megaloblastosis is characterized by many large immature and dysfunctional red blood cells (megaloblasts) in the bone marrow[3] and also by hypersegmented neutrophils (defined as the presence of neutrophils with six or more lobes or the presence of more than 3% of neutrophils with at least five lobes).[4] These hypersegmented neutrophils can be detected in the peripheral blood (using a diagnostic smear of a blood sample)." https://en.wikipedia.org/wiki/Megaloblastic_anemia

- "Folate deficiency...Classically presents as megaloblastic anemia, with absence of neurologic signs. Common causes include malabsorption, drugs and toxins, states of increased demand, and dietary deficiency. Hereditary folate malabsorption and other inborn errors of folate metabolism are rare causes. In early disease, hemoglobin and mean corpuscular volume are normal. In severe disease, patients present with symptomatic anemia and pancytopenia. Maternal folate deficiency is associated with fetal neural tube defects (NTDs). Diagnosis is confirmed by the presence of low serum folate. Low red blood cell folate and elevated plasma homocysteine levels are helpful in situations of diagnostic difficulty. Vitamin B12 (cobalamin)
deficiency must be ruled out before initiating folic acid therapy, as the therapy may mask neurologic manifestations of underlying vitamin B12 deficiency. Oral folic acid is usually considered sufficient therapy. Underlying cause should be identified and treated. Food fortification programs instituted in some countries have decreased the incidence of folate deficiency and associated anemia and fetal NTDs...Other diagnostic factors: prolonged diarrhea, headache, loss of appetite and weight loss, fatigue."

https://bestpractice.bmj.com/topics/en-us/823

- "Women and Anemia...Megaloblastic Anemia. Megaloblastic anemia is caused by incomplete formation of the red blood cell, resulting in large numbers of immature and incompletely developed cells. These red blood cells do not function like healthy red blood cells. They crowd out the healthy cells, causing anemia. Since these cells are underdeveloped, they also have a short life expectancy. Low levels of vitamin B12 or folate are the most common causes of this type of anemia. Statistics. Megaloblastic anemia is most common in the elderly, with 1 in 8000 being affected. This type of anemia can be seen in all races but is particularly common in Nordic people. There is an association with other autoimmune diseases, particularly thyroid disease, Addison’s disease, and vitiligo. Prevalence of this anemia in the U.S. is rather low, with fewer than 200,000 people affected."

https://www.siemens-healthineers.com/clinical-specialities/womens-health-information/laboratory-diagnostics/anemia/types

- "Vitamin deficiency anemia...Diagnosis. Doctors diagnose vitamin deficiency anemias through blood tests that check: The number and appearance of red blood cells. People with anemia have fewer red blood cells than normal. In vitamin deficiency anemias related to a lack of vitamin B-12 and folate, the red blood cells appear large and underdeveloped. In advanced deficiencies, the numbers of white blood cells and platelets also might be decreased and look abnormal under a microscope. The amount of folate, vitamin B-12 and vitamin C in your blood. Folate and vitamin B-12 levels are measured at the same time because these deficiencies can cause similar signs and symptoms."

https://www.mayoclinic.org/diseases-conditions/vitamin-deficiency-anemia/diagnosis-treatment/drc-20355031

- "Vitamin B12 or folate deficiency anaemia...Symptoms of vitamin B12 or folate deficiency. Vitamin B12 and folate perform several important functions in the body, including keeping the nervous system healthy. A deficiency in either of these vitamins can cause a wide range of problems, including: extreme tiredness, a lack of energy, pins and needles (paraesthesia), a sore and red tongue, mouth ulcers, muscle weakness, disturbed vision psychological problems, which may include depression and confusion, problems with memory, understanding and judgement. Some of these problems can also occur if you have a deficiency in vitamin B12 or folate, but don't have anaemia."

https://www.nhsinform.scot/illnesses-and-conditions/nutritional/vitamin-b12-or-folate-deficiency-anaemia

- "The Impact of Altitude and Diet on Anemia in School-Aged Children in Lago San Pablo, Ecuador...Abstract: Childhood anemia is often complicated in developing nations by altitude-induced polycythemia, parasitosis, and dietary inadequacy; however, school-aged children are often overlooked in research and public health efforts. The objectives of this study were to determine the prevalence of anemia among school-aged children in rural Ecuador and to investigate the etiology of anemia in this population to assist program development. A cross-sectional design and cluster sampling was used to sample 347 children aged 5 to 12 years in 5 communities in the Andean region. Altitude ranged from 2795 to 3240 m above sea level. Data collection included health and diet questionnaires, fecal parasite and finger-stick
hemoglobin analysis, and anthropometric measures. World Health Organization standards were applied to adjust hemoglobin for altitude and determine the rate of anemia. Parasitosis affected 95% of children tested but showed no statistical impact on anemia. Anemia prevalence rose from 15% to 65%, once adjusted for altitude. Significant factors affecting anemia included failure to adjust for altitude and low dietary intakes of vitamins A, B12, folate, and zinc, with a minimal proportion of nutrients from animal-source foods. Dietary niacin and calcium were significantly correlated with the reduction of anemia (P < .05). Anemia prevention programs may benefit from increased emphasis on animal-source foods.

https://journals.sagepub.com/doi/pdf/10.1177/1941406410383013

- "Folic Acid Deficiency Anemia...What Is Folic Acid Deficiency Anemia? Having too little folate (vitamin B9) in your blood causes folic acid deficiency anemia. Folate is necessary for your body to make new red blood cells. Your body needs red blood cells to carry oxygen to your organs. Not having enough red blood cells causes a condition called anemia, which can make you feel weak and tired. Your baby may be at higher risk of developing serious birth defects like spina bifida if you have folic acid deficiency anemia during pregnancy. Spina bifida causes the baby’s spinal column to be malformed. If you’re folic acid deficient, taking supplements to increase your folic acid level can reduce your risk of developing anemia. What’s more: Experts at Harvard Medical School say that getting enough folic acid can reduce your risk of developing colon cancer and heart disease....Symptoms of folic acid deficiency include: fatigue, mouth sores, gray hair, swollen tongue, poor growth (also among the chief symptoms of malnutrition). Once anemia occurs, you might experience the following: fatigue, dizziness, feeling cold, irritability, headache, difficulty breathing, pale skin, diarrhea, weight loss, loss of appetite, difficulty concentrating"  https://www.healthline.com/health/folate-deficiency-anemia

- "Folic acid...Folic acid is the man-made version of the vitamin folate (also known as vitamin B9). Folate helps the body make healthy red blood cells and is found in certain foods. Folic acid is used to: treat or prevent folate deficiency anaemia, help your unborn baby's brain, skull and spinal cord develop properly to avoid development problems (called neural tube defects) such as spina bifida, help reduce side effects from methotrexate, a medicine used to treat severe arthritis, Crohn's disease or psoriasis...Folate deficiency anaemia. To treat anaemia, the usual dose for adults and children over 1 year old is 5mg, taken once a day, for 4 months. Sometimes the dose may be increased to 15mg a day...Folic acid usually starts to work in a few hours. But if you're taking it for folate deficiency anaemia, it may be a few weeks before you start to feel better....treatment is usually for 4 months. But if the cause of your folate deficiency anaemia does not change or go away, you may have to take folic acid for longer, possibly for the rest of your life."  https://www.nhs.uk/medicines/folic-acid/

- "Macrocytic anemia: Symptoms and treatment...Macrocytic anemia is a type of anemia that causes unusually large red blood cells. Like other types of anemia, macrocytic anemia means that the red blood cells also have low hemoglobin. Hemoglobin is an iron-containing protein that transports oxygen around the body. Deficiencies in vitamin B-12 or folate often cause macrocytic anemia, so it is sometimes called vitamin deficiency anemia....Macrocytic anemia is almost always due to a deficiency of folate or vitamin B-12. A person may have a deficiency of one of these if their body cannot absorb vitamins due to an underlying disease, or because they do not eat enough foods with these vitamins."  https://www.medicalnewstoday.com/articles/321620#causes

- "Macrocytic anemia...The term macrocytic is from Greek words meaning "large cell". A macrocytic class of anemia is an anemia (defined as blood with an insufficient concentration of
hemoglobin) in which the red blood cells (erythrocytes) are larger than their normal volume. The normal erythrocyte volume in humans is about 80 to 100 femtoliters (fL = 10−15 L). In metric terms the size is given in equivalent cubic micrometers (1 μm3 = 1 fL). The condition of having erythrocytes which (on average) are too large, is called macrocytosis. In contrast, in microcytic anemia, the erythrocytes are smaller than normal. In a macrocytic anemia, the larger red cells are always associated with insufficient numbers of cells and often also insufficient hemoglobin content per cell. Both of these factors work to the opposite effect of larger cell size, to finally result in a total blood hemoglobin concentration that is less than normal (i.e., anemia). Macrocytic anemia is not a disease in the sense of having a single pathology but, rather, is a condition. As such, it is the class name for a set of pathologies that all produce somewhat the same red blood cell abnormality. Different pathologies result in macrocytic-type anemias. Some of these pathologies produce slightly different sets of appearances in blood cells that are detectable from red and white cell morphology, and others are only detectable with chemical testing....Megaloblastic anemias represent a type of macrocytic anemia characterized by certain morphologic abnormalities noted on a peripheral blood smear examination. These abnormalities include the presence of enlarged oval shaped red blood cells (macroovalocytes) and hypersegmented neutrophils (defined as a neutrophil with six or more lobes).[1] Hypersegmented neutrophils may be seen in the absence of macroovalocytes as hypersegmentation of neutrophils is an early sign of megaloblastic anemia and may precede the appearance of macroovalocytes; they may also be seen in other anemias (e.g., iron deficiency anemia) and thus are suggestive of megaloblastic anemia but not specific for it.[1] An increased red cell distribution width (anisocytosis) also suggests megaloblastosis and is commonly seen in Vitamin B12 deficiency and folic acid deficiency.[1] This type of anemia is caused by impaired DNA synthesis and repair, often from deficient thymidine production.[1] Thiamine responsive megaloblastic anemia syndrome also causes megaloblastic anemia." [1] Thiamine responsive megaloblastic anemia syndrome also causes megaloblastic anemia. "Thymidine (deoxythymidine; other names deoxyribosylthymine, thymine deoxyriboside) is a pyrimidine deoxynucleoside. Deoxythymidine is the DNA nucleoside T, which pairs with deoxyadenosine (A) in double-stranded DNA. In cell biology it is used to synchronize the cells in G1/early S phase. Before the boom in thymidine use caused by the need for thymidine in the production of the antiretroviral drug azidothymidine (AZT), much of the world's thymidine production came from herring sperm.[1] Thymidine occurs almost exclusively in DNA but it also occurs in the T-loop of tRNA." [1] Thiamine responsive megaloblastic anemia syndrome also causes megaloblastic anemia. "Folic Acid Dosage...Usual Adult Dose for Megaloblastic Anemia. Usual therapeutic dose: 1 mg daily, orally, intramuscularly, IV, or subcutaneously. Resistant cases may require larger doses. Maintenance dose: 0.4 mg daily (adults), 0.8 mg daily (pregnancy and lactation). Minimum dose: 0.1 mg daily." [1] Thiamine responsive megaloblastic anemia syndrome also causes megaloblastic anemia.
Altitude Diseases: Anemia & Vitamin D Deficiency

- "Anemia and Vitamin D Deficiency...Vitamin D is necessary for several functions in different tissues throughout the body. Researchers have discovered this because there is a relationship between vitamin D deficiency and anemia. In a sample of patients with chronic kidney disease, 41% of patients met the criteria for anemia according to the findings of a study published in 2010 in "Kidney International." Those who were deficient in vitamin D had more than a fivefold increase in the prevalence of anemia compared to those who did not have a vitamin D deficiency. Yet, the researchers note that they are uncertain if the effects are causal. Specifically, it is hard to determine if vitamin D deficiencies lead to anemia or if anemia causes vitamin D deficiencies." [https://www.livestrong.com/article/280007-anemia-and-vitamin-d-deficiency/]

- "Vitamin D deficiency and anemia: a cross-sectional study...Vitamin D has been suggested to have an effect on erythropoiesis. We sought to evaluate the prevalence of anemia in a population of individuals with vitamin D deficiency compared with those with normal levels in a population of a large integrated healthplan. A cross-sectional analysis in the period 1 January 2004 through 31 December 2006 of subjects with documented concurrent levels of 25-hydroxyvitamin D and hemoglobin were evaluated. Vitamin D deficiency was defined as <30 ng/mL and anemia was defined as a hemoglobin <11 g/dL. A total of 554 subjects were included in the analysis. Anemia was present in 49% of 25-hydroxyvitamin D-deficient subjects compared with 36% with normal 25-hydroxyvitamin D levels (p < 0.01). Odds ratio for anemia in subjects with 25-hydroxyvitamin D deficiency using logistic regressions and controlling for age, gender, and chronic kidney disease was 1.9 (95% CI 1.3–2.7). 25-hydroxyvitamin D-deficient subjects had a lower mean Hb (11.0 vs. 11.7; p = 0.12 ) and a higher prevalence of erythrocyte stimulating agent use (47% vs. 24%; p < 0.05). This study demonstrates an association of vitamin D deficiency and a greater risk of anemia, lower mean hemoglobin, and higher usage of erythrocyte-stimulating agents. Future randomized studies are warranted to examine whether vitamin D directly affects erythropoiesis." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2840674/]

- "What’s the Connection Between Vitamin D and Iron Deficiency?...There is an incredibly strong connection between Vitamin D and Iron, despite the fact that you’ve probably never heard about it before...the relationship between Vitamin D and Iron possibly runs both ways, as the research suggests that each are cofactors for each other. If you don’t have enough vitamin D, you can’t absorb iron properly; if you don’t have enough iron, you can’t have adequate vitamin D levels...Possibly one of the most interesting things about iron metabolism is that it is controlled by a master iron regulator called Hepcidin. This substance was only discovered in the 1990’s, which is probably one of the reasons that you’ve never heard about it, and it’s nuances are still being figured out by scientists...when hepcidin goes up, iron absorption goes down and vice versa. How does Vitamin D fit into this? Vitamin D is one of the few nutrients that can reduce hepcidin levels and allow more iron to be absorbed...Another way that vitamin D indirectly regulates iron metabolism is that vitamin D reduces the inflammatory response in the body. And inflammation can dramatically reduce iron absorption. In fact, it’s such a well-known phenomenon that doctors even have classified a type of anemia called Anemia of Chronic Disease that recognizes inflammation as one of the Causes of Iron Deficiency Anemia...Vitamin C for Improved Iron Absorption is a must, but cofactors such as zinc and folate are vital as well" [https://anemiacentral.com/vitamin-d-and-iron/]
Altitude Diseases: Magee's Bright Light Adaptation Disease

- "I was surprised when I started to use full spectrum 10,000 lux bright light therapy in summertime 2020 that I had Seasonal Affective Disorder (SAD) and was responding to the treatment." Steven Magee CEng MIET
- "There appears to be an adaptation process that occurs in people that have been exposed to high levels of solar radiation. That adaptation makes them 'allergic' to the low levels of indoor light and may bring on symptoms of depression, such as fatigue. I call this process 'Magee's Bright Light Adaptation Disease'.'" Steven Magee CEng MIET – Q
- "The low light indoor environment becomes biologically toxic to people with Bright Light Adaptation Disease (BLAD)." Steven Magee CEng MIET – Q
- "Two decades into living in sunny climates, my body was covered with black and brown pigmentatation spots. I was clearly starting the process of turning into a black person." Steven Magee CEng MIET – Q
- "Bright Light Adaptation Disease (BLAD) should be suspected in anyone that is from a dull climate that has spent significant time living in a sunny environment. They may be experiencing fatigue and depression from the much lower indoor lighting levels." Steven Magee CEng MIET – Q
- "Bright Light Adaptation Disease (BLAD) should be suspected in anyone that has worked with industrial high powered LASER's." Steven Magee CEng MIET – Q
- "The continuous all year long fatigue and/or depression in indoor environments is what separates Bright Light Adaptation Disease (BLAD) from Seasonal Affective Disorder (SAD)." Steven Magee CEng MIET – Q
- "The treatment that I used for Bright Light Adaptation Disease (BLAD) was a daily high dose of vitamins B6, B9 and B12 in conjunction with continuous daytime light therapy." Steven Magee CEng MIET – Q
- "Continuous daytime full spectrum 10,000 lux light therapy for Bright Light Adaptation Disease (BLAD) made me feel sickly and caused headaches during the first week of treatment." Steven Magee CEng MIET – Q
- "Continuous daytime light therapy caused me to start waking up at sunrise with the birds." Steven Magee CEng MIET – Q
- "Bright Light Adaptation Disease (BLAD) is a form of Outdoor Adaptation Disease (OAD)." Steven Magee CEng MIET – Q
- "Bright Light Adaptation Disease (BLAD) is not unique to high altitude workers and may be occurring in many other areas, such as welders, winter snow sports, sunny vacationers, window cleaners, solar workers, immigrants to sunny climates, electricians working with bright electric lights, and so on. Anyone in a bright environment is at risk of developing it." Steven Magee CEng MIET – Q
- "Bright Light Adaptation Disease may occur with aging, as radiation exposures are cumulative." Steven Magee CEng MIET – Q
- "An Overview of Phototherapy...History of Phototherapy. Phototherapy has been used to treat medical conditions for as far back as 3,500 years ago when ancient the Egyptians and Indians used sunlight to treat skin conditions like vitiligo. Modern phototherapy, using artificial light sources, began with Niels Ryberg Finsen. Widely regarded as the founder of modern
phototherapy, he treated a skin condition called lupus vulgaris with sunlight and ultraviolet radiation. From then on, usage of phototherapy in medical fields grew, techniques were refined and developed, and it eventually gained widespread acceptance." [3]

- "Niels Ryberg Finsen (15 December 1860 – 24 September 1904) was a Danish-Faroese physician and scientist, the first and currently only Nobel laureate from the country. In 1903, he was awarded the Nobel Prize in Medicine and Physiology "in recognition of his contribution to the treatment of diseases, especially lupus vulgaris, with concentrated light radiation, whereby he has opened a new avenue for medical science."...Finsen suffered from Niemann–Pick disease, which inspired him to sunbathe and investigate the effects of light on living things.[2] As a result, Finsen is best known for his theory of phototherapy, in which certain wavelengths of light can have beneficial medical effects.[10] His most notable writings were Finsen Om Lysets Indvirkninger paa Huden ("On the effects of light on the skin"), published in 1893 and Om Anvendelse i Medicinen af koncentrerede kemiske Lysstraaler ("The use of concentrated chemical light rays in medicine"), published in 1896. The papers were rapidly translated and published in both German and French. In his late work he researched the effects of sodium chloride, observing the results of a low sodium diet, which he published in 1904 as En Ophobning af Salt i Organismen ("An accumulation of salt in the organism")...Finsen's health began to fail in the mid-1880s. He had symptoms of heart trouble and suffered from ascites and general weakness. The sickness disabled his body but not his mind, and he continued to work from his wheelchair. He died in Copenhagen on September 24, 1904. Accounts of his funeral can be found at the National Library of Medicine." [4]

- "Light therapy—or phototherapy, classically referred to as heliotherapy—consists either of A.) exposure to daylight or some equivalent form of light as a treatment for seasonal affective disorder (SAD) or B.) exposure of the skin to specific wavelengths of light using polychromatic polarised light to treat a skin condition. It is used as a treatment for wintertime seasonal affective disorder and in circadian rhythm disorders, such as delayed sleep phase disorder.[1] There is tentative evidence to support its use to treat non-seasonal psychiatric disorders, in particular major depression and depression in bipolar disorder.[2][3][4] As a treatment for disorders of the skin, the second kind of light therapy is meant to correct psoriasis, acne vulgaris, eczema and neonatal jaundice." [5]

- "Weather Can Change Your Mood...So, sorry, yes, weather does appear to impact our moods. And that effect may become serious. Look no further for evidence of this than the very real condition called Seasonal Affective Disorder (SAD). SAD is characterized by feelings of sadness and depression that occur in the winter months when the temperatures drop and the days grow short. This specific form of depression is often associated with excessive eating or sleeping and weight gain. Women are twice to three times more likely to suffer from the winter blues than men. If SAD is merely a “culturally transmitted idea” (as the blog quotes the researchers as suggesting), then so is every mental disorder to one extent or another." [6]

- "The SAD Implications of Light and Sound....Whether or not you are susceptible to what is known clinically as Seasonal Affective Disorder, or SAD, depends more upon where you live than who you are. As I have discovered moving from Tucson to Boston, the farther away from the equator one resides, the greater the chances of developing SAD." [7]
"What is Seasonal Affective Disorder?....As you can imagine, the prevalence of SAD increases the further people live from the equator. In one study of people at four different locations in the U.S., for example, my colleagues and I found that in Florida, the prevalence of SAD was only 1.5% of the population, whereas in New Hampshire, it was almost 10.2%. If all else fails, you can always move further south, though this is of course a major life change and needs to be carefully thought through. In Winter Blues, I outline some of the considerations required before such a major move is undertaken." https://www.normanrosenthal.com/about/research/seasonal-affective-disorder/

"Beating the blues abroad...Eagles has conducted studies in the north of Scotland that compare the levels of Sad in those born and bred in the region with those who've moved there from sunnier climates and found the latter to be at increased risk. Other studies of people who have migrated away from the equator have drawn similar conclusions, although Eagles says there has been little research into movements the other way. 'It has always been known, or at least strongly suspected, that moving away from the equator can increase risk,' says Eagles. 'We just assume that the reverse is the case. The idea that it [emigrating] would make you better is based on the strong belief that Sad relates to light deprivation, so the more sunlight you get the better you are likely to be. 'Many of our patients who take sun holidays in winter are greatly restored by them, so you could infer that if they were to live abroad all the time, they would be generally better.'...Research suggests that Sad is five times more prevalent in the northern tier of the US than the southern, but this clearly shows that it is not absent in the south,' he warns. 'Never contemplate a permanent move south until you have wintered over a long sojourn and found yourself to be depression-free for the first time in years.' And although winter Sad may be rarer in warmer areas, summer Sad – sometimes called 'reverse Sad' – occurs more frequently. An estimated 10% of Sad sufferers experience their symptoms over summer rather than winter. Symptoms are in some cases the opposite of winter Sad, and include weight loss, insomnia and increased sex drive." https://www.theguardian.com/money/2007/dec/20/expat-finance-health

"Why the warm weather might be triggering your depression. Reverse SAD - or Summer SAD - is a less common version of seasonal affective disorder many suffer in winter....After what feels like an eternity of a winter, the arrival of some warm and bright weather has cheered most of us up no end. But that's not the case for everyone; particularly those who suffer from 'Reverse Seasonal Affective Disorder (SAD)'- also known as 'Summer SAD'.... "It is thought that 10% of people who are affected by SAD have reverse SAD," she said, noting that it can be more common in (but isn't exclusive to) people who live in countries located near the equator." https://www.cosmopolitan.com/uk/body/health/a19869387/reverse-sad-summer-seasonal-affective-disorder/

"For some, too much sunshine may bring on the blues...“Other times of year, I’m basically an upbeat person,” Smith says. “But when summer hits, it’s like I’m operating on a low battery. Last summer, I had no desire to eat, I lost 15 pounds, I had anxiety attacks and I stopped seeing any of my friends. Even going to the grocery store felt like an impossible task.” Smith, who grew up in Seattle and has lived in New York City and Germany (all areas with notably moody skies), is convinced she has seasonal affective disorder, or SAD. The condition first surfaced after she and her husband moved to Los Angeles almost three years ago. “It’s the unrelenting sun day after day after day,” she says. “I feel like I’m trapped and there’s no relief from it. At my lowest point [last summer] I just wanted to die.”... ‘The closer you get to the equator -- countries like India, China and Brazil -- it turns out the condition is quite common. But here a lot of people with summer depression feel isolated,” says Wehr, an expert on seasonal affective
disorder."

- "Light Therapy & The Best SAD Lamps to Boost Your Seasonal Depression... Though the exact cause(s) of SAD have not been officially recognized, the disorder usually occurs alongside the following factors: Circadian Disruption – Because sunlight controls the circadian clock, lack of exposure to natural light can disrupt circadian rhythm and lead to feelings of depression, as well as sleep problems... Vitamin D Deficiency – Vitamin D helps the body absorb calcium, magnesium, and other nutrients, and also helps balance serotonin levels. Humans receive most of their Vitamin D from a synthesis process that depends on natural light. When natural light decreases, less Vitamin D is synthesized; this often affects serotonin levels, which in turn can cause one’s mood to drop... Geographical Location: Those who live further from the equator in places where seasonal changes are more prominent are more susceptible to SAD than those who reside in warm, tropical places with less distinct seasonal transitions. For example, the NIMH notes that 9% of New Englanders experience SAD symptoms, compared to 1% of Floridians."

- "Light therapy is a way to treat seasonal affective disorder (SAD) and certain other conditions by exposure to artificial light. SAD is a type of depression that occurs at a certain time each year, usually in the fall or winter. During light therapy, you sit or work near a device called a light therapy box. The box gives off bright light that mimics natural outdoor light. Light therapy is thought to affect brain chemicals linked to mood and sleep, easing SAD symptoms. Using a light therapy box may also help with other types of depression, sleep disorders and other conditions. Light therapy is also known as bright light therapy or phototherapy."

- "Sneaky SAD: How Seasonal Affective Disorder sneaked up on me, symptom by symptom... I have seasonal affective disorder (SAD). That’s what’s wrong. It just didn’t hit me all at once this season. Amazing how a condition you’ve had for years can still surprise you. I usually expect to feel depressed and lethargic in mid-November; this year, it took me longer, but I got there eventually. The good news is, I have a light box and I know how to use it. Unfortunately, according to my self-assessment I needed to get up at 6:00 am to use it, but I’ll do whatever it takes to feel better. So I reset my alarm clock and started using the light box, initially 15 minutes and increasing the dose as needed. After about five days, it was easy to get out of bed and start my day. I didn’t worry about falling asleep during long afternoon meetings, and making eye contact and smiling at my co-workers was comfortable again."

- "Bright Light for Weight Loss: Results of a Controlled Crossover Trial... Objective: To investigate whether bright light treatment can reduce body mass in overweight subjects irrespective of their seasonal (= light) dependence. Methods: A crossover, placebo-controlled, randomized clinical trial was performed between November and April in Novosibirsk, Russia (55° N). The trial comprised a 3-week in-home session of morning bright light treatment using a device of light-emitting diodes and a 3-week placebo session by means of a deactivated ion generator, separated by an off-protocol period of at least 23 days. The number of placebo and light sessions was matched with respect to season. Data were obtained from 34 overweight women, aged 20-54 years, 10 were seasonal-dependent according to the Seasonal Pattern Assessment Questionnaire. Weekly measures included body weight, percentage body fat by bioimpedancemetry, and subjective scores (appetite, mood, energy levels). Results: Motivation and expectation towards weight loss were similar for the two intervention sessions. With light, compared to the placebo session, weight did not reduce significantly, but percentage fat, fat
mass, and appetite were significantly lower (average fat reduction 0.35 kg). The latter two results remained significant after excluding seasonal-dependent subjects from the analysis. Irrespective of the type of intervention, seasonal-dependent subjects had greater weight and fat mass changes during treatment (decline p < 0.036) or between sessions (regain p < 0.003). Photoperiod (p = 0.0041), air temperature to a lesser extent (p = 0.012), but not sunshine (p = 0.29) was associated with the weight change (greater weight reduction if the second session was in spring). Conclusion: Morning bright light treatment reduces body fat and appetite in overweight women and may be included in weight control programs."
Altitude Diseases: Oxidative Stress

- “High altitude and oxidative stress...Exposure to high altitude, which is associated with decreased oxygen pressure, could result in oxidative/reductive stress, enhanced generation of reactive oxygen and nitrogen species (RONS), and related oxidative damage to lipids, proteins, and DNA. The severity of oxidative challenge is related to the degree of altitude. A wide range of RONS generating systems are activated during exposure to high altitude, including the mitochondrial electron transport chain, xanthine oxidase, and nitric oxide synthase. High altitude appears to weaken the enzymatic and non-enzymatic antioxidant systems, and increased nutritional uptake of antioxidant vitamins are beneficial to reduce the altitude-induced oxidative damage. The pattern of high altitude exposure-associated oxidative damage resembles ischemia/reperfusion injury. The adaptive process to this oxidative challenge requires a relatively long period of time. Physical exercise or an enhanced level of physical activity at high altitude, exacerbates the extent of the oxidative challenge. Therefore, special attention is necessary to curb the degree of oxidative stress.” [https://www.sciencedirect.com/science/article/pii/S1569904807001103](https://www.sciencedirect.com/science/article/pii/S1569904807001103)

- “High altitude and free radicals...High altitude exposure results in decreased oxygen pressure and an increased formation of reactive oxygen and nitrogen species (RONS), which is often associated with increases in oxidative damage to lipids, proteins and DNA. Exposure to high altitude appears to decrease the activity and effectiveness of antioxidant enzymes system. Moreover, during high altitude exposure several RONS generating source are activated, including mitochondrial electron transport chain, xanthine oxidase, and nitric oxide synthase (NO). Physical exercise at high altitude can further enhance the oxidative stress. The available information suggests that RONS are involved and are even a causative factor of acute mountain sickness. Supplementation of antioxidant seems to be a necessary step to prevent or decrease to high altitude exposure associated oxidative stress.” [http://europepmc.org/article/PMC/3899533](http://europepmc.org/article/PMC/3899533)
Altitude Diseases: DNA damage (naturally occurring)

- “DNA damage (naturally occurring)...DNA damage is distinctly different from mutation, although both are types of error in DNA. DNA damage is an abnormal chemical structure in DNA, while a mutation is a change in the sequence of standard base pairs. DNA damages cause changes in the structure of the genetic material and prevents the replication mechanism from functioning and performing properly.[1] DNA damage and mutation have different biological consequences. While most DNA damages can undergo DNA repair, such repair is not 100% efficient. Un-repaired DNA damages accumulate in non-replicating cells, such as cells in the brains or muscles of adult mammals, and can cause aging.[2][3][4] (Also see DNA damage theory of aging.) In replicating cells, such as cells lining the colon, errors occur upon replication past damages in the template strand of DNA or during repair of DNA damages. These errors can give rise to mutations or epigenetic alterations.[5] Both of these types of alteration can be replicated and passed on to subsequent cell generations. These alterations can change gene function or regulation of gene expression and possibly contribute to progression to cancer. Throughout the cell cycle there are various checkpoints to ensure the cell is in good condition to progress to mitosis. The three main checkpoints are at G1/s, G2/m, and at the spindle assembly checkpoint regulating progression through anaphase. G1 and G2 checkpoints involve scanning for damaged DNA.[6] During S phase the cell is more vulnerable to DNA damage than any other part of the cell cycle. G2 checkpoint checks for damaged DNA and DNA replication completeness. DNA damage is an alteration in the chemical structure of DNA, such as a break in a strand of DNA, a base missing from the backbone of DNA, or a chemically changed base such as 8-OHdG. DNA damage can occur naturally or via environmental factors. The DNA damage response (DDR) is a complex signal transduction pathway which recognizes when DNA is damaged and initiates the cellular response to the damage.[7]...Damage to DNA that occurs naturally can result from metabolic or hydrolytic processes. Metabolism releases compounds that damage DNA including reactive oxygen species, reactive nitrogen species, reactive carbonyl species, lipid peroxidation products and alkylating agents, among others, while hydrolysis cleaves chemical bonds in DNA.[8] Naturally occurring oxidative DNA damages arise at least 10,000 times per cell per day in humans and 50,000 times or more per cell per day in rats,[citation needed] as documented below. Oxidative DNA damage can produce more than 20 types of altered bases[9][10] as well as single strand breaks.[11] Other types of endogeneous DNA damages, given below with their frequencies of occurrence, include depurinations, depyrimidinations, double-strand breaks, O6-methylguanines and cytosine deamination. DNA can be damaged via environmental factors as well. Environmental agents such as UV light, ionizing radiation, and genotoxic chemicals. Replication forks can be stalled due to damaged DNA and double strand breaks are also a form of DNA damage.[12]”

https://en.wikipedia.org/wiki/DNA_damage_%28naturally_occuring%29
Altitude Diseases: DNA Mutations

- “High Altitude and Free Radicals...High altitude exposure results in decreased oxygen pressure and an increased formation of reactive oxygen and nitrogen species (RONs), which is often associated with increases in oxidative damage to lipids, proteins and DNA. Exposure to high altitude appears to decrease the activity and effectiveness of antioxidant enzymes system. Moreover, during high altitude exposure several RONs generating source are activated, including mitochondrial electron transport chain, xanthine oxidase, and nitric oxide synthase (NO). Physical exercise at high altitude can further enhance the oxidative stress. The available information suggests that RONS are involved and are even a causative factor of acute mountain sickness. Supplementation of antioxidant seems to be a necessary step to prevent or decrease to high altitude exposure associated oxidative stress.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3899533/]
- “Cooler temperatures slow the repair of DNA damage in tadpoles exposed to ultraviolet radiation: Implications for amphibian declines at high altitude...Ultraviolet B radiation (UVBR) damages the DNA of exposed cells, causing dimers to form between adjacent pyrimidine nucleotides. These dimers block DNA replication, causing mutations and apoptosis. Most organisms utilize biochemical or biophysical DNA repair strategies to restore DNA structure; however, as with most biological reactions, these processes are likely to be thermally sensitive. Tadpoles exposed to elevated UVBR at low environmental temperatures have significantly higher rates of mortality and developmental deformities compared with tadpoles exposed to the same levels of UVBR at higher environmental temperatures. We hypothesized that low environmental temperatures impair the primary enzymatic (photolyase) DNA repair pathway in amphibians, leading to the accumulation of DNA damage. To test this hypothesis, we compared DNA repair rates and photolyase gene expression patterns in Limnodyastes peronii. Tadpoles were acutely exposed to UVBR for 1 hr at either 20 or 30°C, and we measured DNA damage and photolyase expression levels at intervals following this exposure. Temperature had a significant effect on the rate of DNA repair, with repair at 30°C occurring twice as fast as repair at 20°C. Photolyase gene expression (6-4 PP and CPD) was significantly upregulated by UVBR exposure, with expression levels increasing within 6 hr of UVBR exposure. CPD expression levels were not significantly affected by temperature, but 6-4 PP expression was significantly higher in tadpoles in the 30°C treatment within 12 hr of UVBR exposure. These data support the hypothesis that DNA repair rates are thermally sensitive in tadpoles and may explain why enigmatic amphibian declines are higher in montane regions where UVBR levels are naturally elevated and environmental temperatures are lower.” [https://research.monash.edu/en/publications/cooler-temperatures-slow-the-repair-of-dna-damage-in-tadpoles-exp]
- “High altitude exposure alters gene expression levels of DNA repair enzymes, and modulates fatty acid metabolism by SIRT4 induction in human skeletal muscle...High altitude exposure results in oxidative stress to human skeletal muscle. High altitude exposure alters gene expression of DNA repair enzymes. SIRT4 can mediate the shift to carbohydrate metabolism at high altitude...We hypothesized that high altitude exposure and physical activity associated with the attack to Mt Everest could alter mRNA levels of DNA repair and metabolic enzymes and cause oxidative stress-related challenges in human skeletal muscle. Therefore, we have tested eight male mountaineers (25–40 years old) before and after five weeks of exposure to high
altitude, which included attacks to peaks above 8000 m. Data gained from biopsy samples from vastus lateralis revealed increased mRNA levels of both cytosolic and mitochondrial superoxide dismutase. On the other hand 8-oxoguanine DNA glycosylase (OGG1) mRNA levels tended to decrease while Ku70 mRNA levels and SIRT6 decreased with altitude exposure. The levels of SIRT1 and SIRT3 mRNA did not change significantly. However, SIRT4 mRNA level increased significantly, which could indicate decreases in fatty acid metabolism, since SIRT4 is one of the important regulators of this process. Within the limitations of this human study, data suggest that combined effects of high altitude exposure and physical activity climbing to Mt. Everest, could jeopardize the integrity of the particular chromosome.”

“The Effects of Radiation on DNA Mutations...The information contained in DNA is used by each cell to create the proteins needed for life, which support the cells of the body and help govern cell behavior. Mutations to DNA lead to changes in the proteins the cell produces, which modify the way the cell behaves, and can ultimately lead to diseases such as cancer. Exposure to radiation is considered a mutagen, meaning that it causes mutations in DNA. This is why exposure to radiation increases the risk of cancer. There are many different forms of radiation, which differ in the ways they lead to mutations in cells.”

“Genetic Effects of Radiation...It must be emphasized again that virtually all mutations have harmful effects. Some mutations have drastic effects that are expressed immediately, and these are eliminated from the population quite rapidly. Other mutations have milder effects and persist for many generations, spreading their harm among many individuals in the distant future. However, many of the long-term effects are impossible to estimate given present data and understanding, and for this reason the present committee emphasizes the effects of mutations that manifest themselves in the first generation, since these are of immediate concern and can be estimated with some confidence. The effects in the first generation are primarily those caused by simple Mendelian dominant and X chromosome-linked recessive traits because of their high heritabilities. Other kinds of mutations may be more important in the long run and constitute a significant burden for future generations.”

“What long-term effects can radiation have?...The effect of the radiation may not be to kill the cell, but to alter its DNA code in a way that leaves the cell alive but with an error in the DNA blueprint. The effect of this mutation will depend on the nature of the error and when it is read. Since this is a random process, such effects are now called stochastic.[100] Two important stochastic effects of radiation are cancer, which results from mutations in nongerm cells (termed somatic cells), and heritable changes, which result from mutations in germ cells (eggs and sperm).”

“What We Know About the Chernobyl Animal Mutations...You may wonder how, exactly, radioisotopes (a radioactive isotope) and mutations are connected. The energy from radiation can damage or break DNA molecules. If the damage is severe enough, cells can't replicate and the organism dies. Sometimes DNA can't be repaired, producing a mutation. Mutated DNA may result in tumors and affect an animal's ability to reproduce. If a mutation occurs in gametes, it can result in a nonviable embryo or one with birth defects. Additionally, some radioisotopes are both toxic and radioactive. The chemical effects of the isotopes also impact the health and reproduction of affected species...Examples of defects included facial malformations, extra appendages, abnormal coloring, and reduced size.”
“What is a gene mutation and how do mutations occur?...Acquired (or somatic) mutations occur at some time during a person’s life and are present only in certain cells, not in every cell in the body. These changes can be caused by environmental factors such as ultraviolet radiation from the sun, or can occur if an error is made as DNA copies itself during cell division. Acquired mutations in somatic cells (cells other than sperm and egg cells) cannot be passed to the next generation.”

“Effects of Ionizing Radiation on DNA...Ionizing radiation affects living things on an atomic level, by ionizing molecules inside the microscopic cells that make up your body. When ionizing radiation comes in contact with a cell any or all of the following may happen: It may pass directly through the cell without causing any damage. It may damage the cell but the cell will repair itself. It may affect the cell’s ability to reproduce itself correctly, possibly causing a mutation. It may kill the cell. The death of one cell is of no concern but if too many cells in one organ such as the liver die at once, the organism will die.”

“Acclimatization to chronic intermittent hypoxia in mine workers: a challenge to mountain medicine in Chile...Little is known about the level of real oxidative damage suffered by cell structures of the organs and tissues exposed to a situation of high altitude. Moller et al., (2001) exposed 12 healthy individuals to an altitude of 4,559 m, which caused a significant increase in the rupture of the DNA chain measured in the urine. The damage was prominent in endonuclease-III sites. Also, when a group of humans were exposed simultaneously to an altitude of 2,700 m and cold conditions, the peroxide lipid levels and the DNA damaged chain in the urine increased up to 23% at 6,000 m and up to 79% at 8,848 m, indicating that the oxidative stress increases with escalating altitude (Joanny et al., 2001). Thus, studies performed on humans consistently describe that high altitude hypoxia causes oxidative damage to lipids, proteins, and DNA chains. This damage may be due to the increase in the production of ROS and/or to the reduced antioxidant capacity. Given their high content in unsaturated fatty acids, cell membranes constitute a main target of ROS, with lipoperoxidation being usually observed upon exposure to hypoxia (Behn et al., 2007). In animal models, CIH (12 hrs per day, simulated 4,000 m altitude for 6 months) increases lipoperoxidation and carbonyl derivatives in skeletal muscle (Radak et al., 1994, 1997). However, short exposure for 5 days to 7,576 m elevation causes an increase in lipoperoxidation in plasma in rats (Kumar et al., 1999). Maiti et al. (2006) also reported that exposure of 3 and 7 days to 6,100 m significantly increases ROS levels and lipoperoxidation in various brain regions. It appears that the effects of oxidative stress are systemic, as suggested by Nakanishi et al. (1995), who reported that exposure to 5,000 m resulted in increased serum levels of malondialdehyde in lungs, liver, heart and kidneys in rats, whereas exposition to a simulated altitude of 9,000 m causes increases in lipid peroxidation of selected rat brain membranes (Rauchová et al., 2012).”
Altitude Diseases: Genetic Adaptation to High Altitudes

- “High elevations are challenging for humans because of low oxygen levels, but Tibetans spend their lives above 13,000 feet with little issue. They are better suited when compared to short-term visitors from low altitude due to physiological traits such as relatively low hemoglobin concentrations at altitude. Unique to Tibetans are variants of the EGLN1 and EPAS1 genes, key genes in the oxygen homeostasis system at all altitudes.”
  http://www.uchospitals.edu/news/2014/20140210-genetics.html

- “High-altitude adaptation in humans is an instance of evolutionary modification in certain human populations, including those of Tibet in Asia, the Andes of the Americas, and Ethiopia in Africa, who have acquired the ability to survive at extremely high altitudes. This adaptation means irreversible, long-term physiological responses to high-altitude environments, associated with heritable behavioural and genetic changes. While the rest of the human population would suffer serious health consequences, the indigenous inhabitants of these regions thrive well in the highest parts of the world. These people have undergone extensive physiological and genetic changes, particularly in the regulatory systems of oxygen respiration and blood circulation, when compared to the general lowland population.”

- “high-altitude adaptation means irreversible, evolved physiological responses to high-altitude environments, associated with heritable behavioural and genetic changes. Among animals, only few mammals (such as yak, ibex, Tibetan gazelle, vicunas, llamas, mountain goats, etc.) and certain birds are known to have completely adapted to high-altitude environments...The physiological and genetic adaptations in native highlanders involve modification in the oxygen transport system of the blood, especially molecular changes in the structure and functions of hemoglobin, a protein for carrying oxygen in the body. This is to compensate for perpetual low oxygen environment. This adaptation is associated with developmental patterns such as high birth weight, increased lung volumes, increased breathing, and higher resting metabolism...The genome sequence of Tibetans in 2010 provided the first clue to the molecular evolution of high-altitude adaptation. Genes such as EPAS1, PPARA and EGLN1 are found to have significant molecular changes among the Tibetans, and the genes are involved in hemoglobin production. These genes function in concert with another gene named hypoxia inducible factors (HIF), which in turn is a principal regulator of red blood cell production in response to oxygen metabolism. Further, the Tibetans are enriched for genes in the disease class of human reproduction (such as genes from the DAZ, BPY2, CDY, and HLA-DQ and HLA-DR gene clusters) and biological process categories of response to DNA damage stimulus and DNA repair (such as RAD51, RAD52, and MRE11A), which are related to the adaptive traits of high infant birth weight and darker skin tone and, are most likely due to recent local adaptation...several genes appear to be involved in Ethiopians, including CBARA1, VAV3, ARNT2 and THRAB, which are known to play a role in HIF genetic functions.”
  https://en.wikipedia.org/wiki/Organisms_at_high_altitude

- “Human Genetic Adaptation to High Altitude.”
  http://online.liebertpub.com/doi/abs/10.1089/152702901750265341

- “Human high-altitude adaptation: forward genetics meets the HIF pathway...Humans have adapted to the chronic hypoxia of high altitude in several locations, and recent genome-wide studies have indicated a genetic basis. In some populations, genetic signatures have been
identified in the hypoxia-inducible factor (HIF) pathway, which orchestrates the transcriptional response to hypoxia. In Tibetans, they have been found in the HIF2A (EPAS1) gene, which encodes for HIF-2α, and the prolyl hydroxylase domain protein 2 (PHD2, also known as EGLN1) gene, which encodes for one of its key regulators, PHD2. High-altitude adaptation may be due to multiple genes that act in concert with one another. Unraveling their mechanism of action can offer new therapeutic approaches toward treating common human diseases characterized by chronic hypoxia.”

“NASA has announced some preliminary results from its Twins Study, an effort to study the effects of space travel on human health. The early findings suggest space travel boosts methylation, the process of switching genes on and off.”

“Twins Study: Space travel changes our genes...Researchers performing genome sequencing on the twins also found more than 200,000 RNA molecules that were expressed differently between the twins.”

“Scott Kelly: NASA Twins Study Confirms Astronaut's DNA Actually Changed in Space...After landing, 93 percent of Scott Kelly’s genes returned to normal, the researchers found. The altered 7 percent, however, could indicate long-term changes in genes connected to the immune system, DNA repair, bone formation networks, oxygen deprivation and elevated carbon dioxide levels.”

“chronic mountain sickness (CMS) or Monge’s disease... The disease is characterized by an array of neurologic symptoms, including headache, fatigue, sleepiness and depression. Often, people with CMS suffer from strokes or heart attacks in early adulthood because of increased blood viscosity (resistance to blood flow that can result in decreased oxygen delivery to organs and tissues)...They identified two genes, ANP32D and SENP1, with significantly increased expression in the CMS individuals when compared to the non-CMS individuals, and hypothesized that down-regulating these genes could be beneficial in coping with hypoxia.”

“Adapting to High Altitude...There is considerable variability between individuals and between populations in their ability to adjust to the environmental stresses of high mountain regions. Usually, the populations that are most successful are those whose ancestors have lived at high altitudes for thousands of years.”

“The Genetic Strategies of Dealing with High Altitude. Andean highlander genomes possess cardiovascular-related variants, while populations from other regions evolved different solutions to manage the lack of oxygen...People who both travel to and live at high altitudes typically cope with lower oxygen levels by increasing red blood cell production, which can help get more oxygenated blood to organs and tissues. But the increase in red blood cells also makes blood thicker, stickier, and more difficult to pump, putting a strain on the cardiovascular system and leading to health issues, including heart failure and high blood pressure.”

“Oxygen therapy for eczema and allergies...we now know that oxygen controls over 8000 genes and a course of 20 sessions increases stem cells eightfold.”
prolonged time at high altitudes.” Steven Magee CEng MIET - Q

- “Altitude Roaming Range (ARR): The human appears to have a range of plus or minus 4,900 feet from the altitude that it grew up at before it may see abnormally high or low altitude health issues that may trigger genetic adaption processes. For humans with genetic adaptation above 10,000 feet, the ARR reduces to plus or minus 2,500 feet due to high levels of changes in environmental radiation levels. For most humans, ARR has the lower end limit of sea level (0’) and the upper end limit of ten thousand (10,000’) feet that should never be exceeded.” Steven Magee CEng MIET

- “Genetic Altitude Adaptation Of Humans (GAAH): Sea level adapted genetics with altitude roaming range (ARR) of 0’ to 4,900’. 8,000’ High altitude adapted genetics with ARR of 3,100’ to 10,000’. 13,000’ Very high altitude adapted genetics with ARR of 10,500’ to 15,500’.

- “Genetic Adaptation To Very High Altitude (GAVHA): Populations that have lived for generations at very high altitude are the only people known to function effectively there.” Steven Magee CEng MIET

- “No amount of acclimatization to very high altitude will prevent long term health problems and genetic adaptation processes from developing in the sea level adapted human.” Steven Magee CEng MIET - Q
Altitude Diseases: Dermatology

- “High Altitude Dermatology...Approximately, 140 million people worldwide live permanently at high altitudes (HAs) and approximately another 40 million people travel to HA area (HAA) every year for reasons of occupation, sports or recreation. In India, whole of Ladakh region, part of Northwest Kashmir, Northern part of Sikkim and Tenga valley of Arunachal are considered inhabited areas of HAA. The low quantity of oxygen, high exposure of ultraviolet (UV) light, very low humidity, extreme subzero temperature in winter, high wind velocity, make this region difficult for lowlanders as well as for tourists. Acute mountain sickness, HA pulmonary edema, HA cerebral edema, and thromboembolic conditions are known to occur in HA. However, enough knowledge has not been shared on dermatoses peculiar to this region. Xerosis, UV-related skin disorders (tanning, photomelanosis, acute and chronic sunburn, polymorphic light eruption, chronic actinic dermatitis, actinic cheilitis, etc.), cold injuries (frostbite, chilblains, acrocyanosis, erythrocyanosis, etc.) nail changes (koilonychias), airborne contact dermatitis, insect bite reaction, and skin carcinoma (basal cell carcinomas, squamous cell carcinomas, and also rarely malignant melanoma) are the dermatoses seen in HAA. Early diagnosis and knowledge of HA dermatoses may prevent serious consequences of disease and improve the quality of life for the visitors as well as for native of the place.”

- “The Lowdown on Elevation in Show Low During the Summer...Why is it that you’re more likely to get a bad sunburn in Show Low than while sitting on a sunny beach in Southern California? One word: elevation. The city of Show Low sits at an elevation of 6,400 feet above sea level. At that altitude, the sun’s rays aren’t filtered as well by the atmosphere as they are at sea level—so the sun is much more intense. Even worse, the effects of the sun on your skin are very subtle, so you could be developing a severe sunburn without even realizing it until it’s too late...Your exposure to Ultraviolet (UV) rays actually increases by 10% for every 3,000 feet in altitude you ascend. This means in Show Low, where you’re a little more than twice that at 6,400 feet, you’re exposed to 25% greater UV radiation than you are at sea level!”

- “SUNSHINE ISN’T SEASONAL – REMEMBER TO BRING YOUR SUNSCREEN...Our high elevation is a major cause for increased chance for sun exposure, but probably not for the reason you are thinking. The reason you are more likely to get sunburned here is due to UV rays having less atmosphere to travel through. Even though Florida is closer to the equator (and technically in more direct sunlight), you are more likely to get sunburned in Colorado because there are physically less particles to deflect light on its way from the sun. A study conducted here found that a person with average complexion at noon in Vail, Colorado at 11,000 feet would burn in six minutes without protection. Six minutes! Furthermore, it does not have to be a hot day to burn your skin at altitude. A mild temperature does not mean you cannot burn and can be misleading to the Vail Valley resident. Sunburns can occur at 70-80 degree weather in the Vail Valley if sunscreen is not applied.”

- “Why Higher Altitudes are So Hard on Your Skin...In the Mile High City, we’re already at a higher altitude, but a short drive away puts you in the heart of the Rocky Mountains and elevations between 12,000-14,000+ feet. Along with world-class skiing, climbing, hiking, rafting, and other alpine recreation, higher mountain altitudes can wreak havoc on the skin...at
the highest elevations of the Colorado Rockies, UV radiation can be more than twice as intense as it would be at sea level… At very high altitudes of 14,000+ feet, extra stress hormone and reduced ability to deliver oxygen to skin tissue makes it even harder for the skin to heal. And this increased healing time inevitably leads to a higher risk of skin infections. Dry, cracked skin is also susceptible to opportunistic infections. Similarly, lungs and sinuses may be prone to secondary infections resulting from continuously breathing in dry, mountain air.”

- “Snow, sun and high altitude puts ski resort employees, patrons at greater risk for skin cancer...Data collected by local researchers show there is an important reason to minimize exposure to potentially harmful ultraviolet rays, especially at the higher altitudes of Utah's ski resorts. "It's not just unique to ski areas, but a lot of the recreational things we do in Utah," said Dr. Christopher Hull, a dermatologist with University of Utah Health Care. A combination of the higher elevation and the reflection of sun on the snow makes for higher UV exposure "in the dead of winter, even with cloud cover," Hull said. Dan Steffen, a ski instructor at Deer Valley for 23 years, said he was diagnosed "out of the blue" with late-stage metastatic melanoma in 2005 and went through a rigorous and side-effect-filled treatment regimen, only to have the cancer return 10 years later. "It's a pretty trying experience. I wouldn't wish it on anybody," he said.”

- “Wilderness dermatology: mountain exposures...Exploring the mountains is a highly rewarding pastime; however, certain high-altitude exposures can lead to dermatologic manifestations. In this review article, the authors will describe cold, solar, and severe weather that one may experience when spending time outdoors. Factors such as increased ultraviolet radiation, temperature extremes, and low partial pressure of oxygen, along with human physiologic parameters also contribute to disease severity and presentation. This review article will address the diagnosis, treatment, and prevention of high-altitude dermatology exposures.”

- “High altitude and the skin...The 23 members of the expedition spent 3 months at or above 17000 feet. The highest altitude reached was 25750 feet. Several skin conditions were encountered: frostbite, chillblains, fissuring of finger pulps, dry skin, eczema, folliculitis, sunburn and polymorphic light eruption. The most interesting finding was that six members developed numerous splinter haemorrhages. This may reflect a more widespread capillary fragility which occurs at high altitudes,1 and may be important in the pathogenesis of high-altitude pulmonary and cerebral oedema.”

- “The 7 Worst Jobs for Your Skin...1) Office workers Why? Regular 9-to-5ers with indoor corporate jobs seem unlikely candidates for being at high risk for skin cancer, but research shows that melanoma occurs when people are exposed to bursts of sun. For those who are indoors all week, that burst of sun on the weekends could be dangerous. 2) Pilots and flight attendants Why? It may be the radiation from the high altitude in-flight that ups your risk similar to an indoor tanning bed session, reports a new study in JAMA Dermatology. In fact, air crew members have "approximately twice the incidence of melanoma compared to the general population." 3) Firefighters Why? Exposure to noxious fumes from flames.”

- “Polymorphic light eruption...PMLE generally affects adult females aged 20–40, although it sometimes affects children and males in 25% of cases. It is particularly common in places
where sun exposure is uncommon, such as Northern Europe, where it is said to affect 10–20% of women holidaying in the Mediterranean area. It is less common in Australasia. It has also been reported to be relatively common at higher altitudes compared to sea level. PMLE can affect all skin phototypes, though it is more often diagnosed in white skin than in skin of colour. There is a genetic tendency to PMLE, and it is sometimes associated with or confused with photosensitivity due to lupus erythematosus, which generally is more persistent than PMLE. Some patients experience PMLE during phototherapy, which is used to treat skin conditions such as psoriasis and dermatitis.”

“Skin with Altitude. Maintaining healthy skin a mile high above the sea...Maintaining healthy skin at altitude takes vigilance and is important not just to stave off wrinkles, but also to prevent deadly skin cancers. According to the World Health Organization, the risk of skin cancer rises with altitude...“The 20 percent increase in UV exposure at our altitude leads to photoaging, which is premature aging of the skin from UV damage,” Hobbs said. “The UV exposure from both UVA and UVB radiations play a role in photoaging by damaging the elastin fibers and the extracellular matrix that composes our skin, which, ultimately, leads to increased wrinkles and loss of elasticity.” Aside from aging, Hobbs added, “UV radiation causes increased pigmentation, or lentigos, precancerous growths called actinic keratoses, and skin cancers, including basal and squamous cell carcinomas, and melanoma.”

“What I Wish I Knew About Skin Care Before Moving to the Mountains...what I didn’t expect was for my skin to dry out, new wrinkles to form, and even my nipples to start flaking. I also noticed small, itchy, dry patches around my mouth and chin that had never been there before. And I really started to worry when, in a matter of months, two horizontal wrinkles on opposite ends of my forehead finally connected into one line, taunting me. It was time for a change.”

“Skin Cancer in Military Pilots: A Special Population With Special Risk Factors...Military pilots may be at greater risk for skin cancer, particularly melanoma. Military-specific studies are limited, but skin cancer rates in civilian pilots and aircrews have previously been examined. Risk factors for all pilots may include exposure to UV radiation (UVR) at higher altitudes, cosmic radiation, and electromagnetic energy from cockpit instruments, as well as altered sleep-wake cycles...Military and civilian pilots have an increased risk for melanoma and nonmelanoma skin cancer, likely due to unique occupational exposures. We recommend annual skin cancer screening for all pilots to help assess their individual risk.”

“Is High Altitude a Risk Factor in Development of Herpes Zoster?... Lowlanders working at high altitude are at high risk to develop HZ in comparison with persons working at plains.”

“Sun Protection at High Altitude...here in Colorado Springs, which is about 6,000 feet above sea level, the UV exposure is 36 percent higher than at sea level. If you’re skiing on the slopes at around 9,000 feet above sea level, the UV exposure jumps to about 42 percent more exposure...Do not let the higher SPF sunscreen lull you into a false sense of security. Even with a strong sunscreen, you are still at risk for UV exposure...Remember that sun protection is just as important during the winter, especially since the rays of the sun reflect off the snow.”
“SUN PROTECTION AT HIGHER ALTITUDES...Benefits of moderate sun exposure may include stronger bones, improved moods during all seasons, and a more robust immune system. Unfortunately, living at a higher elevation also exposes us to approximately 25 percent more ultraviolet radiation when compared to sea level. Hence, while we enjoy a high number of sun-filled days here in Colorado, it is important to be aware of the increased long-term risks to our skin and health that come with high altitude sun exposure. Exposure to ultraviolet radiation from the sun is the primary cause of all skin cancers. Moreover, through years of sun exposure our skin becomes wrinkled, hyper-pigmented and thin. Ninety percent of wrinkles are caused by sun exposure alone.”

“high altitude skin care advice from our boulder dermatologists... If you’ve never lived in a high altitude before, it can wreak havoc on your skin. Higher altitudes mean increased UV exposure, which can damage your skin and even cause skin cancer if you are not properly protected. Our climate also includes low humidity levels, which can leave your skin feeling dry, flaky, and more sensitive. In the winter, humidity levels drop further right along with the temperatures, and keeping your skin properly moisturized may feel downright impossible.”
Altitude Diseases: Infertility

- “Frequent flyers, skiing, and hiking: high altitude’s links to fertility...The management consultant from a major Chicago-area printing company stepped forward to address a convention of book sellers, artisans, and production staffers at a recent convention held in the high Colorado ski town of Vail (elevation 8,022’ above sea level). Though adjusting to altitude typically takes 24 to 48 hours for sea-level dwellers -- he’d been in the mountains for less than an hour – the consultant valiantly delivered his pitch for all of 60 seconds before succumbing to the effects of altitude sickness. A host of research studies indicate that the effects of high altitude, where oxygen is scarcer and dehydration processes operate faster, could extend to male fertility. Both legend and science seem to agree on this point.”

- “Effect of high altitude exposure on spermatogenesis and epididymal sperm count in male rats...Epididymal sperm count was significantly reduced at day 7 of exposure to high altitude and maintained low levels with respect to sea level up to 42 days. In conclusion, high altitude exposure affects spermatogenesis, particularly onset of mitosis and spermiation. This in turn affects epididymal sperm count.”

- “Sperm forward motility is negatively affected by short-term exposure to altitude hypoxia...During the ascent, blood oxygen saturation at 3.848 m above sea level was found to be decreased when compared to sea level (P < 0.02). The sperm forward motility at sea level after the expedition showed a significant reduction (P < 0.02)...luteinising hormone levels after altitudes trekking significantly increased compared to levels before the expedition (P < 0.05). Because of the short-term exposure, we can assume that the reduced forward motility described here may result from the effects of the acute altitude hypoxia on spermatozoa during the epididymal transit where they mature acquiring their motility.”

- “Exposure to Hypoxia at High Altitude (5380 m) for 1 Year Induces Reversible Effects on Semen Quality and Serum Reproductive Hormone Levels in Young Male Adults…This study investigated the effect of hypoxia at high altitude on the semen quality and the serum reproductive hormone levels in male adults. A total of 52 male soldiers were enrolled in this cohort study. They were exposed to hypoxia at high altitude (5380 m) for 12 months when undergoing a service. After exposure, they were followed up for 6 months. The samples of semen and peripheral blood were collected at 1 month before exposure (M0), 6 months of exposure (M6), 12 months of exposure (M12), and 6 months after exposure (M18). The semen quality was assessed with computer-assisted analysis system, and the serum levels of reproductive hormones, including prolactin (PRL), luteinizing hormone (LH), follicle-stimulating hormone (FSH), and testosterone were analyzed by ELISA. Compared with those at M0, total sperm count, sperm density, motility, survival rate, and serum levels of LH, PRL and testosterone were significantly decreased, whereas the liquefaction time was significantly prolonged and serum FSH level was significantly increased at M6 (p<0.05). At M12, total sperm count and sperm density increased, whereas sperm motility, survival rate, and the liquefaction time further decreased. Sperm velocities, progression ratios, and lateral head displacements were also decreased. Serum FSH level decreased while serum LH, PRL, and testosterone levels increased. Compared with those at M6, the changes in these detected parameters of semen and hormone at M12 were significant (p<0.05). At M18, all these detected
parameters except testosterone level returned to levels comparable to those before exposure. In conclusion, hypoxia at high altitude causes adverse effects on semen quality and reproductive hormones, and these effects are reversible.” https://www.ncbi.nlm.nih.gov/pubmed/26288097

- “Fertility in a high-altitude environment is compromised by luteal dysfunction: the relative roles of hypoxia and oxidative stress...Exposure of the sheep to high-altitude hypobaric hypoxia for short or long time periods affects the development and function of the corpus luteum. Moreover, the observed association of oxidative stress with hypoxia and the absence of any significant effect of antioxidant vitamins on most anatomical and functional corpus luteum traits suggests that the effects of high altitude on this ovarian structure are mainly mediated by hypoxia. Thus, these findings may help explain the decrease in sheep fertility at a high altitude.”
  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3614875/

- “Effect of high altitude exposure on spermatogenesis in male military personnel... The Ganbala group had the lowest semen volume (2.72 mL), which was significantly lower than that of the other 3 groups. The sperm density in the Ganbala group (33.89×106/mL) was markedly lower than that of the other three groups. The total sperm count was the lowest in the Golmud group (80.61×106). The percentage of grade A sperms in the Lhasa group (12.04%) and the Ganbala group (12.31%) was significantly lower than that of the Golmud group (18.63%) and Chengdu group (18.73%). The percentage of grade A+B sperms in the Lhasa group (24.50%) and the Ganbala group (24.93%) was significantly lower than that of the Golmud group (29.35%) and Chengdu group (30.54%). Conclusion High altitude (> 3650 m) has marked impact on semen quality.”

- “Altitude and Fertility...CLINICIANS OFTEN REMARK that aircraft personnel seem to form a disproportionately large percentage of infertile men...The Spanish conquerors at 14,000 feet (Potosi, Bolivia) did not have offspring until 58 years after the city was founded. In 1535 the capital of Peru was transferred from Fauja (11,500 ft.) to Lima (sea level) because the horses, fowl and pigs did not reproduce. Monge speaks of the loss of libido and of the increased risk of miscarriage and stillbirth which lowlanders undergo when transferred to high altitudes. Only the unacclimatized individual loses fertility at high altitudes; the native populations experience no difficulty.”
Altitude Diseases: Pregnancy Damage

- “I am aware of development problems in the offspring of high altitude workers. However, I have never been able to find any research papers that document how extensive this is.” Steven Magee CEng MIET - Q
- “Pregnancy and high altitude” https://www.bmj.com/rapid-response/2011/11/03/pregnancy-and-high-altitude
- “Is It Safe To Be At A High Altitude During Pregnancy?...There is limited data on the actual impact of high altitude in pregnancy and what's available suggests that this may aggravate complications of pregnancy and prenatal life such as: Fetal growth retardation. An increased incidence of the complications of pre-eclampsia. Neonatal hyperbilirubinemia. Short-term abnormalities in fetal heart rate.” https://www.babymed.com/daily-living/high-altitude-elevation-during-pregnancy-and-complications
- "A 1978 study examined the effect of sunlight on folate—a vitamin B complex—levels. The study found that even short periods of intense sunlight are able to halve folate levels if someone has light skin. Low folate levels are correlated with neural tube defects, such as anencephaly and spina bifida. UV rays can strip away folate, which is important to the development of healthy foetuses. In these abnormalities children are born with an incomplete brain or spinal cord. Nina Jablonski, a professor of anthropology and expert on evolution of human skin coloration,[33] found several cases in which mothers' visits to tanning studios were connected to neural tube defects in early pregnancy. She also found that folate was crucial to sperm development; some male contraception drugs are based on folate inhibition." https://en.wikipedia.org/wiki/Dark_skin
- "Neural tube defects (NTDs) are a group of birth defects in which an opening in the spine or cranium remains from early in human development. In the third week of pregnancy called gastrulation, specialized cells on the dorsal side of the embryo begin to change shape and form the neural tube. When the neural tube does not close completely, an NTD develops. Specific types include: spina bifida which affects the spine, anencephaly which results in little to no brain, encephalocele which affects the skull, and iniencephaly which results in severe neck problems.[1] NTDs are one of the most common birth defects, affecting over 300,000 births each year worldwide.[2] For example, spina bifida affects approximately 1,500 births annually in the United States, or about 3.5 in every 10,000 (0.035% of US births),[1][3] which has decreased from around 5 per 10,000 (0.05% of US births) since folate fortification of grain products was started.[3] The number of deaths in the US each year due to neural tube defects also declined from 1,200 before folate fortification was started to 840...Inadequate levels of folate (vitamin B9) and vitamin B12 during pregnancy have been found to lead to increased risk of NTDs.[13][14] Although both are part of the same biopathway, folate deficiency is much more common and therefore more of a concern....There have been studies showing the relationship between NTDs, folate deficiency and the difference of skin pigmentation within human populations across different latitudes. There are many factors that would influence the folate levels in human bodies: (i) the direct dietary intake of folic acid through fortified products, (ii) environmental agents such as UV radiation. In concern with the latter, the UV radiation-induced folate photolysis has been shown via in vitro and in vivo studies to decrease the folate level and implicate in etiology of NTDs not only in humans but other amphibian species. Therefore, a protection against the UV radiation-induced photolysis of folate is
imperative for the evolution of human populations living in tropical regions where the exposure to UV radiation is high over the year. One body natural adaptation is to elevate the concentration of melanin inside the skin. Melanin works as either an optical filter to disperse the incoming UV radiation rays or free radical to stabilize the hazardous photochemical products. Multiple studies have demonstrated the highly melanized integument as a defense against folate photolysis in native Americans or African Americans correlates with lower occurrence of NTDs in general.[23][24] A deficiency of folate itself does not cause neural tube defects. The association seen between reduced neural tube defects and folic acid supplementation is due to a gene-environment interaction such as vulnerability caused by the C677T Methylenetetrahydrofolate reductase (MTHFR) variant. Supplementing folic acid during pregnancy reduces the prevalence of NTDs by not exposing this otherwise sub-clinical mutation to aggravating conditions.[25] Other potential causes can include folate antimetabolites (such as methotrexate), mycotoxins in contaminated corn meal, arsenic, hyperthermia in early development, and radiation.[26][27][28] Maternal obesity has also been found to be a risk factor for NTDs.[29] Studies have shown that both maternal cigarette smoking and maternal exposure to secondhand smoke increased the risk for neural tube defects in offspring...Women who may become pregnant are advised to get 400 micrograms of folic acid daily. Women who have previously given birth to a child with a neural tube defect may benefit from a supplement containing 4.0 mg/5.0 mg in the UK mg daily, following advice provided by their doctor."

"Facts about Neural Tube Defects...If you have already had an NTD-affected pregnancy, CDC recommends consuming 400 mcg of folic acid each day, even if you are not planning to become pregnant. When planning to become pregnant, CDC recommends consuming 4,000 mcg of folic acid each day starting 1 month before becoming pregnant and during the first 3 months of pregnancy. This recommendation to take a higher dose of folic acid is based on data from the most rigorous type of scientific study involving women with a previous NTD-affected pregnancy. Dosages lower than 4,000 mcg of folic acid have not been studied in women who have had a previous NTD-affected pregnancy." [https://www.cdc.gov/ncbddd/birthdefects/facts-about-neural-tube-defects.html](https://www.cdc.gov/ncbddd/birthdefects/facts-about-neural-tube-defects.html)

"Light-skinned people who live near the equator with high sunlight are at an increased risk of folate depletion. As consequence of folate depletion, they are at a higher risk of DNA damage, birth defects, and numerous types of cancers, especially skin cancer....Folate deficiency in pregnant women can be detrimental to the health of their newborn babies in the form of neural tube defects, miscarriages, and spina bifida, a birth defect in which the backbone and spinal canal do not close before birth.[60] The peak of neural tube defect occurrences is the highest in the May–June period in the Northern Hemisphere.[3] Folate is needed for DNA replication in dividing cells and deficiency can lead to failures of normal embryogenesis and spermatogenesis." [https://en.wikipedia.org/wiki/Light_skin](https://en.wikipedia.org/wiki/Light_skin)

"Folate Degradation Due to Ultraviolet Radiation: Possible Implications for Human Health and Nutrition...Folate is essential for human health in the prevention of megaloblastic anemia and neural tube birth defects and plays important roles in cardiovascular disease and cancer. Therefore, research into environmental factors that may impact folate status, such as solar ultraviolet (UV) radiation, is of great health significance. In vitro studies have shown that UV radiation can degrade folate and folic acid in human blood and this has been confirmed in several human studies. Despite these findings, there is a dearth of epidemiological research into investigating the relationship between folate status and the links to solar UV exposure."
"Women with folate deficiency who become pregnant are more likely to give birth to low birth weight premature infants, and infants with neural tube defects. In infants and children, folate deficiency can lead to failure to thrive or slow growth rate, diarrhea, oral ulcers, megaloblastic anemia, neurological deterioration. An abnormally small head, irritability, developmental delay, seizures, blindness and cerebellar ataxia can also be observed.[4] Research. Folate deficiency during gestation or infancy due to development by the fetus or infant of autoantibodies to the folate receptor might result in various developmental disorders.[36] Studies suggest that insufficient folate and vitamin B12 status may contribute to major depressive disorder and that supplementation might be useful in this condition.[37] The role of vitamin B12 and folate in depression is due to their role in transmethylation reactions, which are crucial for the formation of neurotransmitters (e.g. serotonin, epinephrine, nicotinamides, purines, phospholipids).[37][38] The proposed mechanism, is that low levels of folate or vitamin B12 can disrupt transmethylation reaction, leading to an accumulation of homocysteine (hyperhomocysteinemia) and to impaired metabolism of neurotransmitters (especially the hydroxylation of dopamine and serotonin from tyrosine and tryptophan), phospholipids, myelin, and receptors. High homocysteine levels in the blood can lead to vascular injuries by oxidative mechanisms which can contribute to cerebral dysfunction. All of these can lead to the development of various disorders, including depression."

"Folate...Health effects. Folate is especially important during periods of frequent cell division and growth, such as infancy and pregnancy. Folate deficiency hinders DNA synthesis and cell division, affecting hematopoietic cells and neoplasms the most because of their greater frequency of cell division. RNA transcription and subsequent protein synthesis are less affected by folate deficiency, as the mRNA can be recycled and used again (as opposed to DNA synthesis, where a new genomic copy must be created)....Folate deficiency may lead to glossitis, diarrhea, depression, confusion, anemia, and fetal neural tube and brain defects.[29] Other symptoms include fatigue, gray hair, mouth sores, poor growth, and swollen tongue.[27] Folate deficiency is diagnosed by analyzing a complete blood count (CBC) and plasma vitamin B12 and folate levels. A serum folate of 3 μg/L or lower indicates deficiency.[29] Serum folate level reflects folate status, but erythrocyte folate level better reflects tissue stores after intake. An erythrocyte folate level of 140 μg/L or lower indicates inadequate folate status. Serum folate reacts more rapidly to folate intake than erythrocyte folate....Fertility. Folate contributes to spermatogenesis.[45] In women, folate is important for oocyte quality and maturation, implantation, placentation, fetal growth and organ development....Folic acid, B12 and iron. A complex interaction occurs between folic acid, vitamin B12, and iron. A deficiency of folic acid or vitamin B12 may mask the deficiency of iron; so when taken as dietary supplements, the three need to be in balance...Wills demonstrated that anemia could be reversed with brewer's yeast.[15][137] In the late 1930s, folate was identified as the corrective substance in brewer's yeast."

"Women with insufficient folate intakes are at increased risk of giving birth to infants with NTDs [2]. Inadequate maternal folate status has also been associated with low infant birth weight, preterm delivery, and fetal growth retardation."
The study found that 32 percent of children whose mothers took epilepsy drugs but did not take folic acid showed autism traits at 18-months of age, and 26 percent showed these traits at 36 months. Among children whose mothers took drugs for epilepsy and also took folic acid, only nine percent showed autism traits at 18 months and 6 percent at 36 months."

"Could Folic Acid Fight a Cause of Autism?...By taking folic acid around the time of conception, mothers-to-be may reduce their child's risk of pesticide-related autism, a new study suggests. "We found that if the mom was taking folic acid during the window around conception, the risk associated with pesticides seemed to be attenuated," said study first author Rebecca Schmidt. "Mothers should try to avoid pesticides. But if they live near agriculture, where pesticides can blow in, this might be a way to counter those effects," said Schmidt. She is an assistant professor of public health sciences at the University of California, Davis."

"Science Update: Folic acid, multivitamins before and during pregnancy may reduce autism risk, suggests NIH-funded study...Children born to women who took either folic acid or a daily multivitamin before or during pregnancy were less likely to have a child diagnosed with an autism spectrum disorder, compared to children whose mothers did not take any prenatal vitamins, according to researchers funded in part by the National Institutes of Health. The findings are the latest in a body of research suggesting that folic acid and multivitamins before and during pregnancy may reduce autism risk."

"Efficacy of Folic Acid Supplementation in Autistic Children Participating in Structured Teaching: An Open-Label Trial...Autism spectrum disorders (ASD) are recognized as a major public health issue. Here, we evaluated the effects of folic acid intervention on methylation cycles and oxidative stress in autistic children enrolled in structured teaching. Sixty-six autistic children enrolled in this open-label trial and participated in three months of structured teaching. Forty-four children were treated with 400 μg folic acid (two times/daily) for a period of three months during their structured teaching (intervention group), while the remaining 22 children were not given any supplement for the duration of the study (control group). The Autism Treatment Evaluation Checklist (ATEC) and Psychoeducational Profile-third edition (PEP-3) were measured at the beginning and end of the treatment period. Folic acid, homocysteine, and glutathione metabolism in plasma were measured before and after treatment in 29 autistic children randomly selected from the intervention group and were compared with 29 age-matched unaffected children (typical developmental group). The results illustrated folic acid intervention improved autism symptoms towards sociability, cognitive verbal/preverbal, receptive language, and affective expression and communication. Furthermore, this treatment also improved the concentrations of folic acid, homocysteine, and normalized glutathione redox metabolism. Folic acid supplementation may have a certain role in the treatment of children with autism."

"Folic acid, autism, . . . and other stories...Folic acid supplements taken before conception or early in pregnancy reduce the incidence of neural tube defects in the offspring. It looks as if they might reduce rates of autism spectrum disorder too. A Californian study investigated 300 families in which one child had already received a diagnosis of autism (JAMA Psych doi:10.1001/jamapsychiatry.2018.3901). Among children born subsequently, those whose mothers had taken vitamin supplements during the first month of pregnancy were half as likely to have autism."
"Folic Acid (Folate) Deficiency...Folate is an essential water-soluble vitamin, naturally present in food, especially in fruits, green leafy vegetables, and liver[1][2] Folic acid is the synthesized form of folate present in fortified foods and supplements and has a higher bioavailability than naturally occurring folate. Folate has been added to grains in the United States to prevent congenital disabilities, especially neural tube defects, as it is necessary for the formation of several coenzymes in many metabolic systems, particularly for purine and pyrimidine synthesis, nucleoprotein synthesis and maintenance in erythropoiesis[1]. Folate like vitamin B12 is a provider of 1-carbon residues for DNA and RNA synthesis. The potent form of folic acid is tetrahydrofolate. Some of the latest research reveals the following about folic acid deficiency: There may be a link between elevated homocysteine (a marker for an increased risk for arteriosclerosis) and folate deficiency. A lowering of the risk of stroke but not adverse cardiac event when hyperhomocysteinemia is corrected with folic acid. Reduction in the incidence of neural tube defects with folic acid supplementation during pregnancy. Lack of folic acid during pregnancy may increase the risk of diabetes-associated congenital disabilities and autism. Maternal folic acid during pregnancy may lower the risk of childhood leukemia. Folic acid supplementation may increase the risk of cancer."

https://www.ncbi.nlm.nih.gov/books/NBK535377/
Altitude Diseases: Subacute Infantile Mountain Sickness (SIMS)

- “A Case of Subacute Infantile Mountain Sickness in a Kyrgyz Child…Subacute infantile mountain sickness (SIMS) is a syndrome of severe pulmonary hypertension and right heart failure that develops in infants born in the lowlands and subsequently brought to live at high altitudes. Earlier postmortem studies have demonstrated significant remodeling of small pulmonary arteries as well as right ventricular hypertrophy and dilatation. In this report, we present a case of SIMS in a Kyrgyz child born to a native highlander mother evaluated by conventional echocardiography and tissue Doppler imaging. An echocardiogram showed severe pulmonary hypertension, a markedly dilated right ventricle with flattening of interventricular septum, and right ventricular dysfunction. To our knowledge, this is the first report of noninvasive imaging of pulmonary circulation and right ventricle in an infant with SIMS and confirmed the diagnosis using echocardiography.”

- “Children at High Altitude: An International Consensus Statement by an Ad Hoc Committee of the International Society for Mountain Medicine, March 12, 2001…In addition to the studies of AMS in children that are outlined in Table 1, members of the consensus group are aware of a number of anecdotes in which altitude may have been a contributing factor to significant illness and death. These cases include children with no underlying disease, children with a history of perinatal pulmonary disorders, children with respiratory infections, and children with underlying cardiac conditions. Some of these case reports are sketched in Table 2.”

- “Up to which altitude above sea level a potential risk of hypoxia is negligible for infants? Under which circumstances?... Unfortunately, the particular risks of exposure of children to high altitude have been little studied and much of the advice must necessarily be extrapolated from adult data with due consideration of the influence of growth and development...In circumstances where the child is traveling above 2500m altitude because of parental occupation and prolonged altitude residence is anticipated, slow graded ascent should be undertaken. For infants (<1 year) planning to reside permanently at altitude, delaying ascent to altitude until beyond the first year of life is recommended because of the slight risk of SIMS (subacute infantile mountain sickness) above 3000m. This is usually impractical if parental separation is to be avoided. Therefore, after a careful physical exam before ascent and initial acclimatization to high altitude, the infant should be followed closely with respect to growth percentiles, pulse oximetry may be useful, especially during sleep, and the ECG should be monitored periodically for the development of right ventricular hypertrophy.”

- “The effects of flight and altitude...Increasing numbers of infants and children journey by aeroplane, or travel to high altitude destinations, for example, on holiday or as part of a population migration. Most are healthy, although increasingly children may be transported by aeroplane or helicopter specifically to obtain treatment for severe illness or injury. It is therefore useful to review the effects of altitude, and their relevance to children who undertake flights or travel to, or at high altitudes, particularly those with acute and chronic medical conditions…Recent recommendations for children included advice to start descent immediately in any child who becomes unwell above 2500 m. Because of the risks of subacute infantile mountain sickness, it was also recommended that children under 2 should sleep no higher than 2000 m,
and children 2–10 years, no higher than 3000 m. In addition, travellers should be aware of the underlying illnesses that increase susceptibility to hypoxia related problems”

https://adc.bmj.com/content/89/5/448

- “Children in the mountains. High mountain trekking holidays are best avoided for the very young...Prolonged exposure to high altitude should be avoided in infants aged under 1 year because of the risk of subacute infantile mountain sickness. This condition is characterised by pulmonary hypertension and consequent fatal right heart failure and occurs in up to 1% of infants of lowland parents who are born at 3000-5000 m or arrive there shortly after birth. It was first described in Tibet, where it almost exclusively affects infants of Han Chinese origin who have recently migrated from low altitude areas.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1112806/

- “Are Children Safe at High Altitudes?...I am planning to go to Lhasa via train with my 3-year-old. The city is at 12,500 feet and the train goes over a pass as high as 16,650 feet. I want to know if it is safe to take children to such a high altitude...the challenge of traveling with toddlers is that they will not be able to communicate if they are having symptoms...My advice is not to take the train to Lhasa with the 3-year-old.”


- “The observatory management team were advised not to allow an infant to stay at the high altitude observatory by their observatory director and the National Optical Astronomical Observatory (NOAO) health and safety manager. They ignored both of them and allowed the infant to stay at the industrialized research facility. The industrial facility was regarded as health and safety risk to the infant and had infestations of rodents and scorpions. It was regularly sprayed with pesticides by pest control.” Steven Magee CEng MIET - Q

- “NOAO is the national center for ground-based nighttime astronomy in the United States and is operated by the Association of Universities for Research in Astronomy (AURA), under cooperative agreement with the National Science Foundation.”

https://www.noao.edu/

- "Pesticides and your baby...Pesticides are more dangerous for babies and children than adults because their bodies are still developing. Some research shows that exposure to pesticides as a baby may be linked to childhood cancer and development or behavior problems."

https://www.marchofdimes.org/pesticides-and-your-baby.aspx

- "Inside Edition Appearance by Scorpion Sweepers...In this clip from Inside Edition you will see the story of a baby that was stung by a scorpion in Oracle, Arizona. The child was rushed to the University of Arizona Medical Center, after five agonizing days she was released having fully recovered." https://www.scorpsweep.com/inside-edition-appearance/

- "Kids, Mice and Rats: The Medical Risks of Rodents in Your Home, & 10 Ways to Get Rid of Them...our kids were exposed to rats in a mobile home we visit on a country property. A few days after the rat exposure, my 11-year-old developed a fever of 103 for six days. I feared the worst– my mom-pediatrician brain knew he could have rat-bite fever or a fatal rodent-borne illnesses...keep the kids away from the rodents. If you have mice in your attic or basement, the kids can’t go there. If there are rats in your shed or crawl space or under your mobile home, you need to keep your kids out of these areas."

Altitude Diseases: Child Development Problems

- “Living at altitude: Exploring the effects on mountain town residents...Throughout her years of treating kids, she noticed a curious trend. A lot of children came in with generic symptoms of a respiratory illness: coughing, shortness of breath, fatigue and other symptoms commonly associated with conditions like pneumonia or asthma. “These kids come in...with acutely low oxygen, just start lying around the house, and parents know something is wrong with them,” Ebert-Santos said. “It shows as an acute illness where they get sick from two to 10 days, then they’re fine, and there are no long-term effects.” None of them had traveled between high and low elevations recently, ruling out what the medical community has known to be the main cause of HAPE: rapid barometric pressure change that causes pulmonary hypertension, or high blood pressure in the arteries and veins surrounding the lungs. “Since we adjust to the chronic low oxygen, we don’t realize it is a constant problem,” Ebert-Santos said. “That’s the trouble with pulmonary hypertension; it evolves slowly over the years.” To check for fluid in the lungs, Ebert-Santos insists on chest X-rays for patients experiencing unexplained pulmonary symptoms. “Of all of the kids I see day after day, about 30 to 40 a year have mountain hypoxia,” Ebert-Santos said. “In the past, they were told they have asthma or pneumonia. But it wasn’t pneumonia, and it wasn’t asthma. They were sick from environmental conditions. If any other kid had oxygen that low, they’d have the same issues...Combined with X-ray images, Ebert-Santos confirmed what she had long suspected: Some residents in Summit County are getting sick with HAPE without any change in elevation. The discovery changes what we know about HAPE and high altitude health. “When I talked to other doctors who have lived and worked here for a long time, they were also seeing this in adults and children. But they were not really talking about it or counting the cases or reporting the cases. Nobody was making the connection,” Ebert-Santos said.”

- “Developmental Delay Alert: Is Mountain Living Dangerous To Your Baby’s Brain?...For children who are born and live in high altitude regions, researchers have discovered a link between extreme altitudes and developmental delays. This may lead to an increased need for speech therapy techniques and practitioners in the affected areas. The study, by Dr. George Wehby, Professor of Health Management and Policy at University of Ohio, analyzed the developmental health of over 2,100 South American children looking for neurodevelopmental issues. The findings were staggering. The study was conducted in South America in countries where altitudes are among the highest in the world. Their research found that for every 100 meter (328 feet) increase in altitude, children were 2% more likely to suffer developmental delays. The results showed that children born and living at altitudes above 8,530 feet were twice as likely to experience learning problems as those living at 2,625 feet and below.”

- “Physical adaptation of children to life at high altitude...Children permanently exposed to hypoxia at altitudes of >3000 m above sea level show a phenotypical form of adaptation. Under these environmental conditions, oxygen uptake in the lungs is enhanced by increases in ventilation, lung compliance, and pulmonary diffusion. Lung and thorax volumes in children growing up at high altitude are increased. The haemoglobin concentration in highlanders is
Environmental Radiation LLC - https://www.environmentalradiation.com

evolved. With respect to the decreased arterial oxygen tension at high altitude, this seems a useful adaptation. Blood viscosity also increases as a result of the increase in red blood cell concentrations however, and this has potentially negative effects on the microcirculation in the tissues. The decreased partial pressure of oxygen in the lungs of highland children is associated with a higher pulmonary artery pressure. Pulmonary hypertension, high altitude pulmonary oedema, and chronic mountain sickness form part of the pathophysiology afflicting highland dwellers. Birth weight at high altitude is decreased. Decreased postnatal growth has been widely reported in populations at high altitude, particularly in early studies from the Andes. Recent studies taking into account the effects of socio-economic deprivation, suggest that long-term exposure to altitudes of 2500–3900 m is associated with a moderate reduction in linear growth in children.” https://link.springer.com/article/10.1007/BF01957359

• “Child health and living at high altitude...The health of children born and living at high altitude is shaped not only by the low-oxygen environment, but also by population ancestry and sociocultural determinants. High altitude and the corresponding reduction in oxygen delivery during pregnancy result in lower birth weight with higher elevation. Children living at high elevations are at special risk for hypoxaemia during infancy and during acute lower respiratory infection, symptomatic high-altitude pulmonary hypertension, persistence of fetal vascular connections, and re-entry high-altitude pulmonary oedema. However, child health varies from one population group to another due to genetic adaptation as well as factors such as nutrition, intercurrent infection, exposure to pollutants and toxins, socioeconomic status, and access to medical care. Awareness of the risks uniquely associated with living at high altitude and monitoring of key health indicators can help protect the health of children at high altitude. These considerations should be incorporated into the scaling-up of effective interventions for improving global child health and survival.” https://www.researchgate.net/publication/23641541_Child_health_and_living_at_high_altitude

• “The physical growth of urban children at high altitude...The physical growth of urban Aymara children residing in La Paz, Bolivia (3,600 m) is described and compared with Amerindian children residing at low and high altitudes and with low-altitude U.S. children. The sample consists of 227 males (10.6–19.7 yr) and 219 females (11.2–19.8 yr). The urban La Paz children were taller at all ages than rural high altitude Amerindian children but similar in stature to urban high altitude children from Peru. The variation in stature among the high altitude populations was considerable, amounting to average differences between the tallest and shortest samples of about 10 cm in males and 8 cm in females. In addition, stature in the two urban high altitude samples was similar to that of rural low-altitude Amerindians. This overlapping of the distributions of stature in high- and low-altitude populations could easily confound comparisons designed to determine the effects of hypoxia on physical growth. La Paz Aymara children had considerably smaller chest sizes relative to stature than high-altitude Quechua children. However, the available data indicates that relative chest sizes are similar in Aymara and Quechua adults, suggesting that the process by which large chests are achieved may differ between these Andean populations.” https://onlinelibrary.wiley.com/doi/abs/10.1002/ajpa.1330650312

• “High altitude and early childhood growth retardation: new evidence from Tibet...Objective: To assess possible effect of high altitude on early childhood growth in Tibet. Method: A cross-sectional survey on child health and nutrition was conducted in Tibet with stratified multistage cluster random sampling technique. Height and weight status of Tibetan children <36 months of
age was measured. A questionnaire was administered to mothers of children for information on family background, child feeding practice and health care and maternal care. A total of 1458 children with complete information were used for analysis. A logistic regression model was used to control for selected potential confounding factors and then observed altitude effect on growth of Tibetan children. Results: Positive association of stunting with altitude was observed for each age group, even after controlling for selected potential affecting factors. Children above 3500 m had two to six times risk of getting stunting compared with those at 3000 m when socioeconomic and other factors were controlled. Effect of altitude on underweight was observed only among children <24 months old and significant increase in odds ratio appeared only above 4000 m after controlling for those confounding factors. Indicator of wasting was not related to altitude. Conclusions: Altitude might result in a delay in height of younger Tibetan children, independent of socioeconomic and other factors operating through nutrition and disease, and took adverse effect persistently through birth to 3 years old. Its adverse effect on weight could be limited. For comparison and assessment of nutritional status of Tibetan children, the effect of altitude on growth should be taken into account.”

“A Surprising Connection between Altitude and ADHD... in 2 large and nationally representative data sets, a clear and consistent association between altitude and ADHD prevalence was evident. This association remained after controlling for multiple other factors linked to variation in state-wide prevalence of ADHD and may help explain the geographic variation in ADHD prevalence that has been reported. While this demonstrated link between ADHD risk and altitude is surprising, there is also a plausible theoretical mechanism, i.e., living at higher altitude promotes increases in dopamine activity, that may explain it.”

https://www.addrc.org/a-surprising-connection-between-altitude-and-adhd/
Altitude Diseases: Organ Damage

- “In what order does the human body shut down without oxygen?...The closest I have come to your question in real live medicine was on the intensive care unit, where in circulatory failure (= Shock (circulatory)), since oxygen is delivered to the organ tissues by circulating blood, not enough circulation means not enough oxygen being delivered. Blood vessels to the brain and the hearts will under these conditions relax the smooth muscles in the vessel walls so opening up the vessels and have more blood (=oxygen) delivered to these two prioritized organs, at the cost of blood flow to the - at the acute moment deemed less important - organ systems like muscles, bowels, and kidneys. If the patient survives the crisis, they might end up with kidney and/or intestinal and/or liver dysfunction/failure which will further complicate their recovery. The more organs fail, the higher the mortality is.” https://www.quora.com/In-what-order-does-the-human-body-shut-down-without-oxygen
- “Overview and Types of Hypoxia...The organs most affected by hypoxia are the brain, the heart, and the liver. If the hypoxia is severe, irreversible damage can begin within four minutes of the onset. Coma, seizures, and death may occur in severe cases. Chronic, milder hypoxia can also cause damage to the major organs of the body. When hypoxia is acute, symptoms often include motor incoordination and impaired judgment. Due to these symptoms, a person with hypoxia is sometimes erroneously thought to be intoxicated with alcohol. Chronic hypoxia tends to have different symptoms, such as fatigue, apathy, a delayed reaction time, or reduced work capacity...Altitude sickness: To prevent hypoxia, the Federal Aviation Administration recommends supplemental oxygen for daytime flights over 10,000 feet and over 5,000 feet at night.” https://www.verywellhealth.com/hypoxia-types-symptoms-and-causes-224892
- “What Are the Effects of Low Oxygen Levels...A low blood oxygen level lasting for several days or longer is called chronic hypoxemia, and symptoms and signs will differ depending upon the seriousness and period. Fatigue, sleepiness and irritability are common symptoms, as is impaired judgment. Breathing patterns might be irregular, and arrhythmias—unusual heart beats—are likewise typically present. Polycythemia, an increase in the number of red blood cells, develops more slowly, accompanied by a ruddy skin. Clubbing, a round appearance to the fingertips and nails, may likewise take place. Pulmonary hypertension—high blood pressure in the lungs—and pulmonary edema, resulting in right heart augmentation or failure, can result from long-term untreated hypoxemia.” https://iytmed.com/effects-low-oxygen-levels/
- “Dangerous Blood Oxygen Levels...In order to live, every cell in your body needs oxygen to properly function. Oxygen is a critical nutrient and the body can die within six minutes without it. Any level below 88 percent is dangerous and incapacitating to your body...Oxygen levels that are too low can result in muscle aches, obesity, headaches, lowered immunity, fatigue, circulation problems, anxiety, high blood pressure and depression. You may also experience more serious symptoms, including congestive heart failure, heart attack and stroke.” https://healthfully.com/dangerous-blood-oxygen-levels-5514172.html
- “The Need For Supplemental Oxygen...When a person isn't getting enough oxygen, all organs of the body can be affected, especially the brain, heart and kidneys. Wearing supplemental oxygen keeps these organs, and many others, healthy. There is evidence that, for people who are hypoxemic, supplemental oxygen improves quality of life, exercise tolerance and even survival. Supplemental oxygen can also help relieve your symptoms. You may feel relief from shortness of breath, fatigue, dizziness and depression. You may be more alert, sleep better and be in a
better mood. You may be able to do more activities such as traveling, including traveling to high altitudes.”  

- "In July 2020 at the age of 50, my eGFR blood test was at 54 which indicates mild to moderate loss of kidney function."  Steven Magee CEng MIET

- "Estimated Glomerular Filtration Rate (eGFR)...A eGFR below 60 for three months or more or a eGFR above 60 with kidney damage (marked by high levels of albumin in your urine) indicates chronic kidney disease. Your doctor will want to investigate the cause of your kidney disease and continue to check your kidney function to help plan your treatment. Typically, a simple urine test will also be done to check for blood or albumin (a type of protein) in the urine. When you have albumin in your urine it is called albuminuria. Blood or protein in the urine can be an early sign of kidney disease. People with a high amount of albumin in their urine are at an increased risk of having chronic kidney disease progress to kidney failure."  

https://www.kidney.org/atoz/content/gfr
Altitude Diseases: Brain Damage

- “Mountain Climbing Bad for the Brain...Overall, the researchers found that the cognitive abilities that were most likely to be affected were the climbers’ executive function and memory...are most likely to be due to progressive, subtle brain insults caused by repeated high-altitude exposure.” [https://well.blogs.nytimes.com/2008/10/20/mountain-climbing-bad-for-the-brain/](https://well.blogs.nytimes.com/2008/10/20/mountain-climbing-bad-for-the-brain/)

- “Evidence of Brain Damage after High-altitude Climbing by Means of Magnetic Resonance Imaging...We conclude that there is enough evidence of brain damage after high altitude climbing; the amateur climbers seem to be at higher risk of suffering brain damage than professional climbers.” [http://www.amjmed.com/article/S0002-9343(05)00674-1/fulltext](http://www.amjmed.com/article/S0002-9343(05)00674-1/fulltext)
Altitude Diseases: Lung Damage

- “Lung testing has shown that I have an above average lung volume which is consistent with a decade of high altitude work.” Steven Magee CEng MIET - Q
- “The lung at high altitude...A new classification of altitude levels based on the effects on performance and well-being has been recently proposed [1]: the decrease in partial pressure of oxygen reduces maximal oxygen uptake and impairs "aerobic" performance by reducing maximal aerobic power. Submaximal exercise performance is also impaired at altitude. When the acclimatization is not adequate, hypoxia triggers maladaptive responses that lead to various forms of high altitude illness or acute mountain sickness (AMS), characterized by headache plus gastrointestinal symptoms (anorexia, nausea) and sleep disturbances. AMS is present in 10-30% of subjects at altitudes between 2500 and 3000 m a.s.l. and is usually due to a fast ascent. It is well defined by the short phrase: "Too fast, too high". Less frequent, but much more serious, consequences are high-altitude cerebral edema (HACE), and high-altitude pulmonary edema (HAPE).” [https://mrmjournal.biomedcentral.com/articles/10.1186/2049-6958-6-1-14]
- “Lung Disease at High Altitude...hypoxia triggers maladaptive responses that lead to various forms of acute and chronic high altitude illness, such as high-altitude pulmonary edema or chronic mountain sickness. Because the respiratory system plays a critical role in these adaptive and maladaptive responses, patients with underlying lung disease may be at increased risk for complications in this environment and warrant careful evaluation before any planned sojourn to higher altitudes. In this review, we describe respiratory disorders that occur with both acute and chronic exposures to high altitudes. These disorders may occur in any individual who ascends to high altitude, regardless of his/her baseline pulmonary status. We then consider the safety of high-altitude travel in patients with various forms of underlying lung disease. The available data regarding how these patients fare in hypoxic conditions are reviewed, and recommendations are provided for management prior to and during the planned sojourn.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4798974/]
- “Effects of high altitude exposure on the lungs of young rats...Month-old male rats were exposed in a hypobaric chamber to a simulated altitude of 4200 m (Pb = 450 mm Hg). After 20–21 days, exposed animals had significantly greater lung volumes and alveolar surface areas than controls. Animals sacrificed after 7 days of exposure had lungs that were abnormally heavy relative to their volume; this increase in lung density was due to an increase in non-blood lung water, presumably as edema fluid. After 20–21 days, lung density and water content had returned essentially to normal. The volume of blood remaining in the lungs after removal from the animal was not influenced by high altitude exposure. The findings indicate that young rats exposed to high altitude undergo an initial period of mild pulmonary edema; during this period the rate of alveolar development is probably not increased above normal. With continued exposure, the edema subsides and alveolar proliferation occurs at a faster rate than in control animals. This results eventually in increased lung volumes and alveolar surface areas in high altitude animals, a change which probably has adaptive significance.” [https://www.sciencedirect.com/science/article/pii/0034568771900685]
- "Pulmonary Hypertension...Mountain climbers all develop the condition" [http://www.mountsinai.org/patient-care/health-library/diseases-and-conditions/pulmonary-hypertension]
- “Pulmonary Hypertension - This condition of high blood pressure in the lungs can occur from
many causes. Since high blood pressure in the pulmonary vessels is a main mechanism that leads to HAPE, persons with pulmonary hypertension have a much higher risk of developing HAPE and need to consider this risk before coming to altitude.”
http://www.altitudemedicine.org/altitude-and-pre-existing-conditions/

- "The finding that the lung, not the heart, is the limiting factor at high altitude is reassuring to older persons, but cautionary for those with minor lung problems." Going Higher. Oxygen, Man, And Mountains.
Altitude Diseases: Heart Damage

- “I routinely encountered people in high altitude observatories that openly stated that they had medically diagnosed heart issues. A high altitude observatory is a place where these people probably should not have been working due to the increased risk of heart attacks.” Steven Magee CEng MIET - Q
- “Effect of Altitude on the Heart and the Lungs...patients with cardiovascular disease seek advice from their physician about journeying to high altitude. We have attempted to make some reasonable recommendations on the basis of published evidence and pathophysiology. High-altitude exposure may unpredictably precipitate an acute coronary syndrome or death. Not only will sea level exercise capacity be reduced on account of physiological changes, but angina may worsen at least for the first few days in association with increased heart rate and systolic blood pressure. In addition, the symptoms of high-altitude illnesses may be confused with those of cardiopulmonary disease such as myocardial infarction, acute pulmonary embolism, and heart failure. Exposure to high altitude may unmask coronary artery disease, left ventricular dysfunction, or pulmonary hypertension that was asymptomatic at sea level.”
  https://www.ahajournals.org/doi/full/10.1161/circulationaha.106.650796
- “Why heart function is reduced at high altitude...For over a century, we have known that high altitude reduces the amount of blood the heart pumps around the body with each beat. New research has unearthed why this is the case and the findings will be important for people who live, travel and exercise at high altitudes.”
  https://www.sciencedaily.com/releases/2018/05/180529092127.htm
- “Physically Unprepared Skiers Face Heart Risk. High Altitudes and Low Temperatures Add to Risk of a Heart Attack on the Slopes...Altitude may also play a role, he tells WebMD. The heart attacks occurred at an average altitude of 4,429 feet, while the patients lived at an average of only 557 feet above sea level....American Heart Association spokesman Ray Gibbons, MD, professor of medicine at the Mayo Clinic in Rochester, Minn., tells WebMD that inadequate physical preparation, high altitudes, and cold temperatures create a "perfect storm" for heart attacks.”
  https://www.webmd.com/heart/news/20100901/physically_unprepared_skiers_face_heart_risk
- “Heart risks for climbers at altitude...in a team of 16 healthy mountaineers, without a previous history of heart disease, more than half (56.3%) experienced rhythm disturbances at altitudes of 4,100 metres or above. These were either significant pauses in their heart beat – where the heart stops for three seconds or more – or very fast or irregular heartbeats. The pauses generally took place at night, while the climbers were asleep. All identified abnormalities disappeared once climbers descended below 4100m...going above 4000m could potentially exacerbate any pre-existing conditions which climbers may, or may not already be aware of, and this should be taken into account when planning expeditions.”
- "A high prevalence of patent ductus arteriosus and atrial septal defect was found at the three high altitude sites and the effect of altitude was progressive."
- “Minor heart feature may mean trouble at high altitude. Small opening in heart that doesn't close in infancy is linked to potentially serious health complications...Most surprising to researchers was that, even after two weeks of living at 17,000 feet, the PFO subjects didn't
increase ventilation to the same extent as the subjects without PFO. Forty percent of the PFO subjects were still suffering from acute mountain sickness after five days at altitude, whereas 10 percent of subjects without PFO still had acute mountain sickness at five days.”

https://www.sciencedaily.com/releases/2015/06/150630100458.htm

- "ECGs of immigrants to high altitude demonstrate an increase in RV hypertrophy with increased duration of high-altitude residence. Loss of normal circadian rhythm and QTc prolongation have been described in both infants and adults."

- "The amount of people I met that had heart problems surprised me in high altitude astronomy. I had not seen it in other fields. After a decade of working at high altitudes, I was also diagnosed with a heart problem." Steven Magee CEng MIET - Q

- “Relationship of Hypoxia to Arrhythmia and Cardiac Conduction Hemorrhage”
  http://circ.ahajournals.org/content/circulationaha/27/4/742.full.pdf

- “The hypoxemia (lowering of SpO2) is the independent risk factor leading to arrhythmia...Compared with the non-cardiac disease group, patients in cardiac disease group has significantly lower toleration ability against hypoxia, and its SpO2 warning value is lower than 0.95.”

- "Study shows increased risk of heart attack from physical exertion at altitude and low temperatures during winter sports vacations...The research shows that inadequate preparation for the intense physical exertion required, combined with the effects of altitude and low temperature, leads to an increase in heart attack incidents, particularly during the first two days of vacation...sudden cardiac death accounts for a staggering 40 percent of the total fatalities amongst winter sport tourists in the Austrian Alps and, of these, acute myocardial infarction is the leading cause.”

- “Sleeping Altitude and Sudden Cardiac Death..The study found the risk of dying of (sudden cardiac death) on the first day of vigorous mountain exercise was more than five times as high in individuals who had slept at lower elevations on the previous evening as in those who slept at higher elevations...Spending the first night at a higher altitude may have resulted in some degree of acclimatization by reducing the effects of myocardial ischemia, or reduced blood flow to heart tissue, and other triggers of sudden cardiac death.”

- “How to Protect Your Heart While Hiking...Cardiac arrest is the number three killer in the outdoors, and it's responsible for half of all mountain-climbing fatalities. What's more, the typical victim isn't collecting Social Security: He's a 45-year-old weekend warrior bent on matching his youthful pace. ..That's because intense exertion, cold weather, and altitude increase stress on the heart, exacerbating key factors like family history, obesity, and smoking.”
  https://www.backpacker.com/survival/how-to-protect-your-heart-while-hiking

- "Chronic exposure to the low oxygen levels found at high altitude can have harmful effects on the cardiovascular system, including elevated pulmonary artery pressure and excessive production of red blood cells...the constellation of symptoms caused by chronic exposure to low oxygen includes either heart failure or a high risk of developing heart failure – in particular, failure of the right ventricle, which pumps blood into the lungs." Going Higher. Oxygen, Man, And Mountains.
Altitude Diseases: Kidney Damage

- “Chronic Kidney Disease at High Altitude...With a prevalence of 10 to 11% in the general population, it is likely that many patients with chronic kidney disease will visit or reside in mountainous areas. Little is known, however, about whether short- or long-duration, high-altitude exposure poses a risk in this patient population. Given that many areas of the kidney are marginally oxygenated even at sea level and that kidney disease may result in further renal hypoxia and hypoxia-associated renal injury, there is concern that high altitude may accelerate the progression of chronic kidney disease. In this review, we address how chronic kidney disease and its management is affected at high altitude. We postulate that arterial hypoxemia at high altitude poses a risk of faster disease progression in those with preexisting kidney disease. In addition, we consider the risks of developing acute altitude illness in patients with chronic kidney disease and the appropriate use of medications for the prevention and treatment of these problems. With the increasing popularity of travel to and residence in mountainous regions (E.G., 15% of Colorado citizens live above 2100 m) and the 10 to 11% prevalence rate for adult chronic kidney disease (CKD) in the developed world,1 it is likely that many people with CKD will visit or reside at high altitude. Although the adverse effects of high altitude are well defined for healthy individuals, little is known about the risks and management strategies for patients with CKD. Even in the healthy kidney, regions of marginal oxygenation arise from the complex structure–function relationships of normal renal physiology. Coupled with emerging evidence of a critical role of intrarenal hypoxia in the pathogenesis of CKD,2–4 there is reasonable concern that arterial hypoxemia during long-term high-altitude exposure and its neurohumoral responses could worsen intrarenal oxygenation and accelerate progression of CKD to ESRD. In this review, we discuss what is known about the effects of high altitude on patients with CKD.”

https://jasn.asnjournals.org/content/19/12/2262
Altitude Diseases: Digestive System Damage

- “Oxygen Levels and the Digestive System...It might sound strange, but the respiratory system and the digestive system depend on one another for optimal function...The digestive system is comprised of a complex system of organs, nerves, hormones, bacteria and blood work together to digest food. Digestive organs include the stomach, small intestines, large intestines, liver, pancreas and gall bladder...In many cases, oxygen levels and the digestive system go hand-in-hand. COPD and other chronic lung diseases carry a risk for certain digestive disorders. Because some foods and drinks can cause symptom flare-ups, it’s important to know what to eat and what to avoid. Foods such as dairy and cruciferous vegetables are linked to increased mucus production and gas. Certain foods can also make GERD symptoms worse. GERD or gastroesophageal reflux disease is common among people with COPD. GERD is a digestive disorder in which the stomach valve that keeps stomach acid down weakens or malfunctions, allowing stomach acid into the esophagus. If stomach acid reaches the lungs, it can result in irritation, increased coughing and shortness of breath.” [https://lunginstitute.com/blog/oxygen-levels-digestive-system/]
- “How Do the Digestive, Respiratory and Circulatory Work Together?...Your digestive tract needs smooth muscles to break down food into liquid and for better contractions to help move them throughout your system. Oxygen helps maintain the smoothness of muscles and to make sure that your digestive tract is in tiptop condition. Consequently, your respiratory system cannot function well without the nutrients broken down by your digestive system. You use respiratory muscles including intercostal muscles and diaphragm to inhale. These muscles need nutrients in the form of fat and carbohydrates to contract and allow you to breathe properly. In other words, your digestive system metabolizes food to provide your body with nutrients and at the same time, fuel your respiratory system so that it can produce enough oxygen in your body. This keeps you energized too.” [https://www.enkimd.com/how-do-the-digestive-respiratory-and-circulatory-work-together.html]
- “Gastrointestinal problems at high altitude...Gastrointestinal (GI) problems at high altitude are commonplace. The manifestations differ considerably in short-term visitors, long-term residents and native highlanders. Ethnic food habits and social norms also play a role in causing GI dysfuntion. Symptoms like nausea and vomiting are common manifestations of acute mountain sickness and are seen in 81.4% short-term visitors like mountaineers. Anorexia is almost universal and has a multifactorial causation including effect of hormones like leptin and cholecystokinin and also due to hypoxia itself. Dyspepsia and flatulence are other common symptoms. Diarrhoea, often related to poor hygiene and sanitation is also frequently seen especially at the short-term visitors. Peptic ulceration and upper gastro-intestinal haemorrhage are reported to be common in native highlanders in the' Peruvian Andes (9.6/10000 population per year) and also from Ladakh in India. A high incidence of gastriccarcinoma is also reported, especially from Bolivia (138.2 cases per 10000 population per year). Megacolon and sigmoid volvulus are common lower GI disorders at high altitude. The latter accounted for 79% of all intestinal obstructions at a Bolivian hospital. Thrombosis of the portosystemic vasculature and splenic hematomas has been reported from India. Malnutrition is multifactorial and mainly due to hypoxia. Fat malabsorption is probably significant only at altitudes > 5000m. Neonatal hyperbilirubinemia was found to be four times more common in babies born at high altitude in Colorado than at sea level. Gall stones disease
is common in Peruvian highlands. A high seroprevalence of antibodies to H pylori (95%) has been found in Ladakh but its correlation to the prevalence of upper gastro-intestinal disease has not been proven.” [https://www.ncbi.nlm.nih.gov/pubmed/17542291/]
Altitude Diseases: Weight Loss

- “Want to lose weight? Move to Denver...The initial evidence for this idea came from studies with rats, which found that keeping the animals in low-oxygen chambers led to lower obesity rates. Voss and other researchers subsequently conducted large-scale studies of humans and found that lower obesity rates strongly correlated with higher altitudes. This was true for countries as different as the US and Tibet. Their work showed that for American adults, living at elevations close to sea level made people four to five times more likely to be obese than people living at high altitude” [https://www.vox.com/2014/4/25/5652618/does-living-at-high-altitude-reduce-your-chance-of-obesity]
- “Altitude Causes Weight Loss Without Exercise...Just a week at high altitudes can cause sustained weight loss, suggesting that a mountain retreat could be a viable strategy for slimming down. Overweight, sedentary people who spent a week at an elevation of 8,700 feet lost weight while eating as much as they wanted and doing no exercise. A month after they came back down, they had kept two-thirds of those pounds off.” [https://www.wired.com/2010/02/high-altitude-weight-loss/]
- “Ascent to Altitude as a Weight Loss Method: The Good and Bad of Hypoxia Inducible Factor Activation...Given the epidemic of obesity worldwide there is a need for more novel and effective weight loss methods. Altitude is well known to be associated with weight loss and has actually been used as a method of weight reduction in obese subjects. This review demonstrates the critical role of hypoxia inducible factor (HIF) in bringing about the reduction in appetite and increase in energy expenditure characteristic of hypobaric hypoxia...Here we present a unifying hypothesis suggesting that activation of HIF under conditions of altitude potentially leads to metabolic benefits that are dose dependent, gender and genetic specific, and results in adverse effects if the exposure is extreme.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4091035/]
- “Body Composition and Body Weight Changes at Different Altitude Levels: A Systematic Review and Meta-Analysis...Changes in body composition and weight loss frequently occur when humans are exposed to hypoxic environments. The mechanisms thought to be responsible for these changes are increased energy expenditure resulting from increased basal metabolic rate and/or high levels of physical activity, inadequate energy intake, fluid loss as well as gastrointestinal malabsorption. The severity of hypoxia, the duration of exposure as well as the level of physical activity also seem to play crucial roles in the final outcome. On one hand, excessive weight loss in mountaineers exercising at high altitudes may affect performance and climbing success. On the other, hypoxic conditioning is presumed to have an important therapeutic potential in weight management programs in overweight/obese people, especially in combination with exercise. In this regard, it is important to define the hypoxia effect on both body composition and weight change. The purpose of this study is to define, through the use of meta-analysis, the extent of bodyweight -and body composition changes within the three internationally classified altitude levels (moderate altitude: 1500–3500 m; high altitude: 3500–5300 m; extreme altitude: >5300 m), with emphasis on physical activity, nutrition, duration of stay and type of exposure.” [https://www.frontiersin.org/articles/10.3389/fphys.2019.00430/full]
- “Estimation of body density and lean body weight from body measurements at high altitude...Body density and other anthropometric data were obtained on 101 Indian soldiers who were continuously staying at high altitude (3920 m) for more than 10 months. Use was made of a human body volumeter, and body density was calculated from observed body weight and
volume. Measurements were taken on the body using standard techniques. A stepwise linear regression analysis was performed to establish possible relationships of 36 body measurements with density and lean body weight. Thigh anterior, juxta-nipple skin folds and forearm and ankle circumferences were selected in the regression equation predicting body density. Multiple correlation coefficient (R) equal to 0.765 was obtained for this equation. For the predicted lean body weight, R equalled 0.930. The regression equations included body weight, thigh anterior and juxta-nipple skin fold thicknesses, and forearm circumference. Contribution of other body measurements in the regression of these parameters was not significant. The analysis also revealed that a new set of coefficients is required for the measurements included in the published regression equations.”

- “Partitioned weight loss and body composition changes during a mountaineering expedition: a field study... Weight loss and changes in body composition are recognized phenomena associated with high-altitude mountaineering expeditions. Attempts to partition the weight loss between fat mass (FM) and fat-free mass (FFM) have been inconclusive. Therefore, five male subjects, average age 40.0 ± 5.5 years, were studied prior to, during, and following a 21-day expedition between 2200 m and 4300 m on Mt. McKinley, Alaska. Pre- to postexpedition body composition changes were determined by densitometry, skinfold thickness (12 sites), body girth measurements (14 sites), and cross-sectional area from magnetic resonance imaging (MRI) (three sites). Data analysis by Student's t-test (p < 0.051 tail) indicated decreases in body weight (4.2 ± 2.8 kg, 220 g/day, 5.4% of initial weight), total skinfold thickness (10.8%), total body girth (2.8%), and percentage of fat by densitometry (15%). Total cross-sectional area of the three MRI slices (upper arm + thigh + calf) decreased 4.7%, muscle area decreased 9.1%, and fat area decreased 3.9%. The three methods used to partition the weight loss between FM and FFM did not agree: 77% FM vs 23% FFM by densitometry, 25% FM vs 75% FFM by skinfolds, and 38% FM vs 62% FFM by MRI. Energy intake (3640 ± 1250 kcal/day) was negatively correlated (Pearson r > 0.882 tail) with losses in weight (r = –0.89), skinfolds (r = –0.93), and girths (r = –0.88), ie the greater the intake the less the decline. Therefore, insufficient energy intake appeared primarily responsible for the weight loss and changes in body composition during the expedition.”

- “Endocrine and metabolic responses to extreme altitude and physical exercise in climbers... Chronic hypoxia induces complex metabolic and endocrine adaptations. High-altitude (HA) exposure is a physiological model of hypoxia... In conclusion, the results of the present study in a unique experimental human model demonstrate that extreme HA and strenuous physical exercise are coupled with peculiar endocrine adaptations. Particularly, these include hyperactivity of the GH/IGF-I axis and a low T3 syndrome but no significant change in ghrelin and leptin as was likely to be expected, also taking into account body weight decrease. These findings would contribute to better understanding human endocrine and metabolic physiology in hypoxic conditions.”
Altitude Diseases: Loss Of Body Fat

- “Are Higher Elevations Healthier?...Those stationed at high altitudes (above 6,400 feet, such as Colorado Springs and Cheyenne, Wyoming) were 40 percent less likely to become obese than those at lower altitudes (below 3,200 feet). The study controlled for initial weight, race, age, and certain other factors. Why would differences in elevation influence body weight? The researchers offered some biologically plausible explanations, based on animal and human research. Short-term studies show that people put in low-oxygen environments, as in high-altitude travel, tend to have reduced appetite, in part because higher altitudes may affect hormones such as leptin. They may also lose weight because of the increased metabolic demands (and thus more calorie burning) of high-altitude exertion. Even if future research confirms these findings, mass relocation to high altitudes is obviously not a practical solution to the obesity epidemic. Moreover, high altitude is associated with certain health risks, notably for people with respiratory problems, such as chronic obstructive pulmonary disease (COPD).”
  https://www.berkeleywellness.com/fitness/active-lifestyle/article/are-higher-elevations-healthier

- “Lower Obesity Rate during Residence at High Altitude among a Military Population with Frequent Migration: A Quasi Experimental Model for Investigating Spatial Causation...We sought to evaluate whether residence at high altitude is associated with the development of obesity among those at increased risk of becoming obese. Obesity, a leading global health priority, is often refractory to care. A potentially novel intervention is hypoxia, which has demonstrated positive long-term metabolic effects in rats. Whether or not high altitude residence confers benefit in humans, however, remains unknown. Using a quasiExperimental, retrospective study design, we observed all outpatient medical encounters for overweight active component enlisted service members in the U.S. Army or Air Force from January 2006 to December 2012 who were stationed in the United States. We compared high altitude (>1.96 kilometers above sea level) duty assignment with low altitude (<0.98 kilometers). The outcome of interest was obesity related ICD-9 codes (278.00-01, V85.3x-V85.54) by Cox regression. We found service members had a lower hazard ratio (HR) of incident obesity diagnosis if stationed at high altitude as compared to low altitude (HR 0.59, 95% confidence interval [CI] 0.54–0.65; p<0.001). Using geographic distribution of obesity prevalence among civilians throughout the U.S. as a covariate (as measured by the Centers for Disease Control and Prevention and the REGARDS study) also predicted obesity onset among service members. In conclusion, high altitude residence predicts lower rates of new obesity diagnoses among overweight service members in the U.S. Army and Air Force. Future studies should assign exposure using randomization, clarify the mechanism(s) of this relationship, and assess the net balance of harms and benefits of high altitude on obesity prevention.”
  https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0093493

- “Anthropometric and Body Composition Changes during Expeditions at High Altitude...The purpose of this study is to investigate separately in the two sexes the physical adaptations associated to exposure to high altitude in a sample of 18 nonacclimatized Caucasian subjects (10 males and 8 females, 22–59 years) who participated to scientific expeditions to Himalaya up to the Pyramid Laboratory (5050m, Nepal) or Everest North Base Camp (5300m, Tibet). Anthropometric traits (body height and weight, eight girths and six skinfolds) were collected according to standard procedures, before departure at sea level, during ascent (at altitude >4000m above sea level), and after return to low altitude. Body composition was assessed by..."
means of the skinfold method. Both sexes lost on average 4.0% of initial body mass, corresponding to 7.6% of fat mass and 3.5% of fat free mass in males, and to 5.0% of fat mass and 3.6% of fat free mass in females. Average fat mass loss was greater in males than in females. Initial fat mass percentage was positively correlated to fat mass loss and negatively to FFM loss in males only, thus at HA leanest subjects lost more FFM and less FM than the fattest ones. Adaptations were faster in males than in females. In conclusion, the present research describes significant adaptations to high altitude, in terms of body weight reduction, regardless of the amount of performed physical activity.”


“Hydration and tissue solid content of the lean body on prolonged exposure to altitude...Using densitometric, hydrometric and anthropometric techniques, body fat, tissue solids, water and mineral content were quantitatively measured on two groups each of 26 young and healthy Indian soldiers of mixed ethnic composition. The experimental group was exposed to 3500 m altitude for 2 years and the experiments were carried out after 48 h and 3 weeks rehabilitation in Delhi (300 m). The control group was never exposed to high altitudes. Inspite of the experimental group being fed with superior rations at high altitude, this group showed significantly hyperhydrated lean body with reduced tissue solids in comparison to the control group which was fed with identical rations in Delhi. The calculated mean density of the fat free body had declined to 0.092×103 kg/m3. The 3 week stay at low altitude had little influence on body composition. Hyperhydration, with reduced tissue solids, would cause reduction in the density of fat free body, and would thus interfere with the estimates of total body fat based on densitometric procedures alone. In the hyperhydrated state, Siri's formula overestimated fat by 22.8% of the true value.” [https://link.springer.com/article/10.1007/BF01045894]

“Weight loss and changes in body composition at high altitude...Little is known about weight loss and changes in body composition at extreme altitude. As part of the American Medical Research Expedition to Everest in 1981 we measured body weight, body fat, limb circumferences, dietary intake, 72-h stool fats, and 5-h urine xylose excretion at various altitudes on Caucasian and Sherpa expedition members. In Caucasians, loss of body fat accounted for 70.5% of the mean 1.9-kg weight loss during the approach march at moderate altitude but for only 27.2% of the mean 4.0-kg weight loss during residence above 5,400 m. There was a significant proportionate decrease in arm and leg circumferences during residence above 5,400 m (1.5 and 2.9 cm, respectively). On the other hand, Sherpas, who arrived in Base Camp with half as much body fat as members (9.1% vs. 18.4%), maintained weight and limb circumferences during residence above 5,400 m. Fat absorption decreased 48.5% in three subjects, and xylose excretion decreased 24.3% in six of seven subjects at 6,300 m relative to sea level. It appears that muscle catabolism and malabsorption contribute significantly to weight loss at high altitude. High percent body fat does not protect against loss of muscle tissue. Sherpas do not appear susceptible to some of the changes affecting Caucasians.” [https://journals.physiology.org/doi/abs/10.1152/jappl.1984.57.5.1580]

“Altitude: Body Composition Changes and Nutrition...High altitude is a multi-environmental stressor and it is important to remember that hypoxia is only one of the components. Altitude exposure leads to the development of physiological changes intended to tolerate the drop in the partial pressure of oxygen. All these compensatory changes take place in a process known as
acclimatization…It is well-known that exposure to high altitude leads to body weight loss in humans (2,7). The American Medical Research Expedition to Everest (1981) provided the opportunity to assess the weight loss and changes in body composition occurring in lowlanders during a mountaineering expedition at high altitude. Boyer and Blume (2) reported a mean weight loss of 1.9 kg during the approach march from 1,000 m to Base Camp (5,400 m), and during the first week at 5,400 m (Table 1). The weight loss continued when subjects went on to higher altitude, and a mean reduction in total body weight of 4 kg was observed during the 22 following days. Similar body weight losses were recorded during other mountaineering expeditions with average decrements of 4 to 6.8% (7,12). Weight loss during sojourn at high altitude is highly correlated with initial body fat (2).”

https://www.physiology.org/doi/abs/10.1152/jappl.1984.57.5.1580
Altitude Diseases: Loss Of Muscle

- “Why Do Mountain Climbers Waste Away? What happens at high altitude may help patients in the ICU...Climbers who spend extended periods at high altitude lose weight and eat less while they are there. Two British researchers think this phenomenon is the consequence of an evolutionary adaptation that protects vital organs in cases of severe illness and injury, and may give important insights into the treatment of patients in intensive care units. The effects are shown with mountain climbers who are at high altitude -- 15,000 feet or higher -- for several months, the kind of acclimation climbers develop on Mount Everest expeditions..."It's not just fat that [climbers] are losing; the greatest proportion is muscle loss," Murray said. People climbing to higher altitude also make more red blood cells, the cells that distribute oxygen to the body...Patients in intensive care and those seriously injured -- particularly with head injuries -- show the same kind of weight loss and lower blood oxygen levels that are seen in climbers acclimated to high altitude. Many severely injured patients also have problems producing enough red blood cells to keep the blood oxygen level up, said Montgomery... As climbers ascend a mountain and eat less and less, their bodies produce ketones for protection and fuel. Ketones, posit Murray and Montgomery, could also be useful to protect the brains of patients with severe head injuries. The body's tendency to take such extreme measures appears to be a last-ditch survival attempt that also governs the body in other low-oxygen conditions, such as those encountered by mountain climbers. Murray and Montgomery are testing their concept on laboratory animals in low-pressure chambers.”
Altitude Diseases: Malnutrition

- “Rescarching Magee’s Disease led me to conclude that I was suffering from malnutrition, despite being 30 pounds overweight.” Steven Magee CEng MIET - Q
- “Dieting Can Make You Lose Your Mind...What was it like for them? Well, horrible. They described lethargy, irritability, anxiety that approached each time they were to learn how much they were allowed to eat the following week... They had dizziness, cold intolerance (requesting heavy blankets even in the middle of summer), muscle soreness, hair loss, reduced coordination, edema, and ringing in the ears. Some had to withdraw from their university classes because they did not have the capability to concentrate. Their sex drive disappeared. They became obsessed with food...Two of the men suffered severe psychological stress - one became suicidal, and another cut off three of his fingers in an act of self-mutilation. Both men were taken to a psychiatric hospital...The 3 month refeeding period involved trying several different combinations of protein, vitamins, and levels of calories. Dizziness, apathy and lethargy improved first, but persistent hunger, weakness, and loss of sex drive persisted for several months. The men described "a year long cavity" that needed to be filled. The day after they were finally released from the study, one of the men was hospitalized to have his stomach pumped after binging. In the aftermath of the study, "many, like Roscoe Hinkle, put on substantial weight."

https://www.psychologytoday.com/us/blog/evolutionary-psychiatry/201103/dieting-can-make-you-lose-your-mind
Altitude Diseases: Obesity Risks

- “Obesity as a Conditioning Factor for High-Altitude Diseases...Obesity, a worldwide epidemic, has become a major health burden because it is usually accompanied by an increased risk for insulin resistance, diabetes, hypertension, cardiovascular diseases, and even some kinds of cancer. It also results in associated increases in healthcare expenditures and labor and economic consequences. There are also other fields of medicine and biology where obesity or being overweight play a major role, such as high-altitude illnesses (acute mountain sickness, hypoxic pulmonary hypertension, and chronic mountain sickness), where an increasing relationship among these two morbid statuses has been demonstrated. This association could be rooted in the interactions between obesity-related metabolic alterations and critical ventilation impairments due to obesity, which would aggravate hypobaric hypoxia at high altitudes, leading to hypoxemia, which is a trigger for developing high-altitude diseases. This review examines the current literature to support the idea that obesity or overweight could be major conditioning factors at high altitude.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5644942/]
Altitude Diseases: Altitude Sickness

- "Altitude sickness, the mildest form being acute mountain sickness (AMS), is the negative health effect of high altitude, caused by rapid exposure to low amounts of oxygen at high elevation.[1][2] Symptoms may include headaches, vomiting, tiredness, trouble sleeping, and dizziness.[1] Acute mountain sickness can progress to high altitude pulmonary edema (HAPE) with associated shortness of breath or high altitude cerebral edema (HACE) with associated confusion.[1][2] Chronic mountain sickness may occur after long term exposure to high altitude.[2] Altitude sickness typically occurs only above 2,500 metres (8,000 ft), though some are affected at lower altitudes.[2][3] Risk factors include a prior episode of altitude sickness, a high degree of activity, and a rapid increase in elevation.[2] Diagnosis is based on symptoms and is supported in those who have more than a minor reduction in activities.[2][4] It is recommended that at high-altitude any symptoms of headache, nausea, shortness of breath, or vomiting be assumed to be altitude sickness.[5] Prevention is by gradually increasing elevation by no more than 300 metres (1,000 ft) per day.[1] Being physically fit does not decrease the risk.[2] Treatment is generally by descending to a lower altitude and sufficient fluids.[1][2] Mild cases may be helped by ibuprofen, acetazolamide, or dexamethasone.[2] Severe cases may benefit from oxygen therapy and a portable hyperbaric bag may be used if descent is not possible.[1] Treatment efforts, however, have not been well studied.[3] AMS occurs in about 20% of people after rapidly going to 2,500 metres (8,000 ft) and 40% of people going to 3,000 metres (10,000 ft).[1][2] While AMS and HACE occurs equally frequently in males and females, HAPE occurs more often in males.[1] The earliest description of altitude sickness is attributed to a Chinese text from around 30 BCE which describes "Big Headache Mountains" possibly referring to the Karakoram Mountains around Kilik Pass.[6]"

- "Learn This: Understanding Altitude Illness...High-altitude illness afflicts novices and experienced mountaineers alike. Acute mountain sickness (AMS), high-altitude pulmonary edema (HAPE), and high-altitude cerebral edema (HACE), usually occurring above 2,500 meters (8,202 feet), can lead to an epic. As a climber and nurse, I’ve encountered many ill climbers. Understanding altitude illness will reduce your risk for an emergency in the mountains...High altitude starts at 1,500 meters (4,921 feet). At high altitudes, air pressure decreases (hypobaria), resulting in “thinner” air—that is, oxygen molecules spread farther apart. We take in less oxygen when breathing, resulting in less oxygen being absorbed in the lungs and delivered to the body. A low-oxygen state, whether in ambient air or in the body, is called hypoxia."
Altitude Diseases: Acute Mountain Sickness (AMS)

- “Acute Mountain Sickness...Hikers, skiers, and adventurers who travel to high altitudes can sometimes develop acute mountain sickness. Other names for this condition are altitude sickness or high altitude pulmonary edema. It typically occurs at about 8,000 feet, or 2,400 meters, above sea level. Dizziness, nausea, headaches, and shortness of breath are a few symptoms of this condition. Most instances of altitude sickness are mild and heal quickly. In rare cases, altitude sickness can become severe and cause complications with the lungs or brain.” https://www.healthline.com/health/acute-mountain-sickness

- “Acute mountain sickness...Acute mountain sickness is an illness that can affect mountain climbers, hikers, skiers, or travelers at high altitudes, usually above 8,000 feet (2,400 meters) ....You are at higher risk for acute mountain sickness if: You live at or near sea level and travel to a high altitude. You have had the illness before. You ascend quickly. You have not acclimatized to the altitude. Alcohol or other substances have interfered with acclimatization. You have medical problems involving the heart, nervous system, or lungs.” https://medlineplus.gov/ency/article/000133.htm

- “Acute Mountain Sickness...It is the most common type of high-altitude illness and occurs in more than one-fourth of people traveling to above 3500 m (11 667 ft) and more than one-half of people traveling to above 6000 m (20 000 ft). Symptoms include headache, fatigue, poor appetite, nausea or vomiting, light-headedness, and sleep disturbances. Symptoms usually occur 6 to 12 hours after ascent and can range from mild to severe. Symptoms usually improve after 1 to 2 days if there is no further ascent, but they can sometimes last longer. In less than 1% of cases, symptoms can progress to high-altitude cerebral edema, a life-threatening condition marked by symptoms of wobbly gait, confusion, and decreased consciousness.” https://jamanetwork.com/journals/jama/fullarticle/2662892

- “Acute mountain sickness is a mild form of altitude disease and is the most common form. It usually does not develop unless altitude is at least 8,000 feet (2,440 meters), but it can develop at lower altitudes in highly susceptible people. Symptoms usually develop within 6 to 10 hours of ascent and often include headache and one or more other symptoms, such as light-headedness, loss of appetite, nausea, vomiting, fatigue, weakness, or irritability. Some people describe the symptoms as similar to those of a hangover. Symptoms usually last 24 to 48 hours. Rarely, acute mountain sickness progresses to a more severe form of altitude disease known as high-altitude cerebral edema.” https://www.merckmanuals.com/home/injuries-and-poisoning/altitude-diseases/altitude-diseases

- “Altitude Diseases...As altitude increases, the atmospheric pressure decreases, thinning the air so that less oxygen is available. For example, compared with the air at sea level, the air at 19,000 feet (5,800 meters) contains only half the amount of oxygen. In Denver, which is located about 5,300 feet (1,615 meters) above sea level, the air contains 20% less oxygen. Most people can ascend to 5,000 to 6,500 feet (1,500 to 2,000 meters) in one day without problems, but about 20% of people who ascend to 8,000 feet (2,500 meters) and 40% who ascend to 10,000 feet (3,000 meters) develop some form of altitude disease. The rate of ascent, highest altitude reached, and sleeping altitude all influence the likelihood of developing the disorder. The organs most commonly affected by altitude diseases are the Brain (causing acute mountain sickness and rarely high-altitude cerebral edema) Lungs (causing high-altitude pulmonary edema)” https://www.merckmanuals.com/home/injuries-and-poisoning/altitude-diseases/altitude-diseases
"Risk factors for occupational acute mountain sickness...BACKGROUND: Studies of occupational acute mountain sickness (AMS) have not focused on the more severe end of the spectrum to date. AIMS: To examine risk factors associated with the development of occupational AMS severe enough to receive treatment in a compression chamber. METHODS: A nested case referent study in a cohort of high-altitude (4000 m) mine workers, comparing cases of severe, chamber-treated AMS to matched referents. Using logistic regression, we tested potential risk factors based on premorbid surveillance examinations, including cigarette smoking (current smoking, smoking intensity and exhaled carbon monoxide [CO]). RESULTS: There were 15 cases and 30 controls. In multivariate analysis including age, sex and place of residence, current smoking was associated with increased risk of severe AMS (odds ratio [OR] 10.0; 95% confidence interval [CI] 1.5-67.4), taking into account any prior, less severe AMS event, which was also a potent risk factor (OR 33.3; 95% CI 2.8-390). Smoking intensity (cigarettes per day) and exhaled CO were also statistically significantly associated with severe AMS. CONCLUSIONS: Cigarette smoking is a strong, previously under-appreciated risk factor for severe AMS. Because this is a modifiable factor, these findings suggest that workplace-based smoking cessation should be tested as an intervention to prevent such morbidity."

“Into thin air: Medical problems at new heights. It used to be a problem for the very few, the hardy adventurers who trek or climb at breathtaking heights. But high places continue to beckon, and as travel becomes easier and less expensive, more and more men are responding with their ascent. If you maintain a low profile, you don't have to worry about altitude sickness, but if your travel plans are uplifting, you should know how to handle new heights.”

“The Effects of High Altitude on the Body: A Journey to the Summit of Mount Everest...Climbing at high altitude can have fatal consequences for the human body, presenting a multitude of risks that need to be respected and managed to guarantee the best chances of survival. Around 10 to 20% of people who fly to the likes of Machu Picchu in Peru or to ski resorts in Colorado experience acute mountain sickness every year*, making it a relatively common occurrence. We define 'high altitude' as altitude that’s 2,500m or above, and acute mountain sickness can affect the body within 6 - 12 hours of exposure. Headaches which are accompanied by nausea, dizziness, vomiting and tiredness, and feeling out of breath, are typical symptoms, and while they may sound fairly innocuous in themselves, if the sickness is not managed in its early stages, life-threatening complications can ensue.”
Altitude Diseases: Subacute Mountain Sickness (SMS)

- “A Review of the Physiology and Nutrition in Cold and in High-Altitude Environments by the Committee on Military Nutrition Research...Subacute Mountain Sickness. A new syndrome, termed subacute mountain sickness, was observed in healthy young soldiers who had spent several months at extremely high altitudes of approximately 22,000 ft (6,706 m) (Anand et al., 1990). As described by Anand and Chandrashekhar (see Chapter 18 in this volume), the syndrome appeared to be one of severe systemic and congestive heart failure without pulmonary hypertension. About 20 percent of the group developed shortness of breath, puffiness of the face and eyelids, anasarca (generalized pitting edema), and pericardial fluid accumulation, with a normal heart size and normal pericardium. Left ventricular function was also normal on cardiac catheterization. These accumulations of fluid all disappeared in a few weeks at sea level with no additional therapy.”

https://www.ncbi.nlm.nih.gov/books/NBK232855/
Altitude Diseases: High-Altitude Cerebral Edema (HACE)

- “High-altitude cerebral edema (HACE) is a medical condition in which the brain swells with fluid because of the physiological effects of traveling to a high altitude. It generally appears in patients who have acute mountain sickness and involves disorientation, lethargy, and nausea among other symptoms. It occurs when the body fails to acclimatize while ascending to a high altitude. It appears to be a vasogenic edema (fluid penetration of the blood–brain barrier), although cytotoxic edema (cellular retention of fluids) may play a role as well. Individuals with the condition must immediately descend to a lower altitude or coma and death can occur. Patients are usually given supplemental oxygen and dexamethasone as well. HACE can be prevented by ascending to heights slowly to allow the body more time to acclimatize. Acetazolamide also helps prevent the condition. Untreated patients usually die within 48 hours. Those who receive treatment may take weeks to fully recover. It is a rare condition, occurring in less than one percent of people who ascend to 4,000 metres (13,000 ft). First described in 1913, little was known about the cause of the condition until MRI studies were performed in the 1990s.” [https://en.wikipedia.org/wiki/High-altitude_cerebral_edema](https://en.wikipedia.org/wiki/High-altitude_cerebral_edema)

- “Altitude Illness, Cerebral Syndromes, High Altitude Cerebral Edema (HACE)...High Altitude Cerebral Edema (HACE) is a severe and potentially fatal manifestation of high altitude illness and is often characterized by ataxia, fatigue, and altered mental status. HACE is often thought of as an extreme form/end-stage of Acute Mountain Sickness (AMS). Although HACE represents the least common form of altitude illness, it may progress rapidly to coma and death as a result of brain herniation within 24 hours, if not promptly diagnosed and treated...HACE generally occurs after 2 days above 4000m but can occur at lower elevations (2500m) and with faster onset.” [https://www.ncbi.nlm.nih.gov/books/NBK430916/](https://www.ncbi.nlm.nih.gov/books/NBK430916/)

- “High altitude cerebral edema with a fatal outcome within 24 h of its onset: Shall acclimatization be made compulsory?...HACE presents a serious threat to the life hence, graded, reasonable rate of ascent to high altitude must be done in order to prevent HACE. Early recognition of the symptoms and its treatment, proper oxygenation and descent to lower altitude is the key to surviving this clinical entity. Acclimatization should be made compulsory or a word of caution is warranted to the young, healthy, and enthusiastic tourists to high altitude to hold their nerves before indulging in recreational activities and should give time to adjust to the environment.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3858714/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3858714/)

- “HIGH-ALTITUDE CEREBRAL EDEMA...Injury Prevention. Gradual ascent – Less than 1,000 meters (3,300 feet) per day. Avoid sleeping higher than 300 meters (980 feet) for more than one night. Acetazolamide or dexamethasone can lower the risk of developing HACE.” [https://www.sportsmedtoday.com/highaltitude-cerebral-edema-va-26.htm](https://www.sportsmedtoday.com/highaltitude-cerebral-edema-va-26.htm)

- “Climbers Face Lasting Effects if Brain Swells...HACE typically occurs at altitudes above 7,000 feet and is considered the end stage of severe acute mountain sickness, or altitude sickness. It's long been thought to be a fully reversible condition if the patient survives, but some work suggests that it does leave traces in the brain – particularly, hemosiderin deposits, or remnants of microbleeds. These can be picked up on a very sensitive form of MRI called susceptibility-weighted imaging, Knauth said. So he and colleagues conducted these scans on 36 mountaineers...Overall, Knauth and colleagues found that the microbleeds in the corpus callosum occurred almost exclusively in climbers who'd had HACE -- 8 of the 10 of these mountaineers had definite evidence of microbleeds, while two had "questionable" bleeds. Only
one patient with severe acute mountain sickness also showed evidence of microbleeds, the lone false-positive result, Knauth said. There was one questionable finding in a patient who'd had HAPE and two questionable findings in those who'd been at altitude without becoming ill.”
https://www.medpagetoday.com/meetingcoverage/rsna/36195
Altitude Diseases: High-Altitude Pulmonary Edema (HAPE)

- “High-altitude pulmonary edema (HAPE) is a life-threatening form of non-cardiogenic pulmonary edema (fluid accumulation in the lungs) that occurs in otherwise healthy mountaineers at altitudes typically above 2,500 meters (8,200 ft).[1] However, cases have also been reported at lower altitudes (between 1,500–2,500 metres or 4,900–8,200 feet in highly vulnerable subjects), though what makes some people susceptible to HAPE is currently unknown. HAPE remains the major cause of death related to high-altitude exposure, with a high mortality rate in the absence of adequate emergency treatment.”

- “What Happens to Your Body When You Climb Everest...Lungs. Starting at around 9,000 feet, your lungs may begin to swell due to a constriction of blood vessels, which can cause fluid to leak and accumulate. This can lead to a persistent cough, labored breathing, and greater perceived exertion upon exercise, all of which are common among climbers or even just people traveling from sea level to Colorado. If the swelling in your lungs exacerbates, however, a dangerous condition called high-altitude pulmonary edema (HAPE) can occur. Symptoms to look out for include a bluish discoloration of the skin, abnormally rapid breathing, and fever. Like HACE, the most effective treatment for HAPE is descending immediately, and the best way to prevent it is to ascend slowly and with proper acclimatization.”

- “High altitude pulmonary edema—clinical features, pathophysiology, prevention and treatment...High altitude pulmonary edema (HAPE) is a noncardiogenic pulmonary edema which typically occurs in lowlanders who ascend rapidly to altitudes greater than 2500-3000 m. Early symptoms of HAPE include a nonproductive cough, dyspnoea on exertion and reduced exercise performance. Later, dyspnoea occurs at rest. Clinical features are cyanosis, tachycardia, tachypnoea and elevated body temperature generally not exceeding 38.5°C. Rales are discrete initially and located over the middle lung fields. HAPE mainly occurs due to exaggerated hypoxic pulmonary vasoconstriction and elevated pulmonary artery pressure. It has been observed that HAPE is a high permeability type of edema occurring also due to leaks in the capillary wall (‘stress failure’). Slow descent is the most effective method for prevention; in addition, graded ascent and time for acclimatization, low sleeping altitudes, avoidance of alcohol and sleeping pills, and avoidance of exercise are the key to preventing HAPE. Treatment of HAPE consists of immediate improvement of oxygenation either by supplemental oxygen, hyperbaric treatment, or by rapid descent.”
  [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3617508/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3617508/)

- “High-Altitude Pulmonary Edema Is Initially Caused by an Increase in Capillary Pressure...High-altitude pulmonary edema (HAPE) is characterized by severe pulmonary hypertension and bronchoalveolar lavage fluid changes indicative of inflammation. It is not known, however, whether the primary event is an increase in pressure or an increase in permeability of the pulmonary capillaries...Conclusions—HAPE is initially caused by an increase in pulmonary capillary pressure.”
  [https://www.ahajournals.org/doi/abs/10.1161/01.cir.103.16.2078](https://www.ahajournals.org/doi/abs/10.1161/01.cir.103.16.2078)
Altitude Diseases: Re-Entry High Altitude Pulmonary Edema (RE-HAPE)

- “Living at altitude: Exploring the effects on mountain town residents...Ebert-Santos said HAPE manifests in three ways: “Classic” HAPE occurs when a lowlander ascends too quickly to elevations above 8,000 feet. Within 48 hours of the ascent, the symptoms start presenting themselves. Another type of widely-recognized HAPE is “re-entry” HAPE, which occurs when a high elevation resident travels to lower elevations and comes back home without properly acclimating. A third version of HAPE does not require any change in elevation to be triggered and impacts residents of high elevation communities....In a paper, Ebert-Santos reviewed 48 cases of patients with pulmonary problems that lacked immediate explanation. Of those 48 cases, 33 residents were identified as having HAPE without any recent travel, five had re-entry HAPE after returning to Summit from low elevations, two visitors had classic HAPE, six residents had pneumonia and two had asthma. The diagnosis of high altitude resident pulmonary edema was confirmed. “The reason it took so long to get published is because all of the conferences I went to, pulmonary specialists and high altitude specialists would insist you can’t have HAPE unless you’ve traveled,” Ebert-Santos said. “But my strong point was that these people had not traveled, and you can’t diagnose HAPE without a chest X-ray, which means a lot of patients were being misdiagnosed and HAPE was being underreported.”

- “REENTRY HIGH ALTITUDE PULMONARY EDEMA (HAPE) IN HIGH ALTITUDE RESIDENTS!...When High Altitude Pulmonary Edema (HAPE) is diagnosed, one often thinks of the diagnosis in relation to patients who have lived long term in low/sea level altitudes coming to high altitudes for the first time. However, a new study conducted by Santosh Baniya based out of the Himalayas suggest there is a subset of HAPE in which long term high altitude residents can fall ill to HAPE upon reentry to high altitudes after even a brief stay at lower altitudes....an otherwise healthy pediatric patient who was diagnosed with HAPE after returning to his village of Manag (3500m) after a winter in Besisahar (760m)- a trip that was done multiple times in his life time with no complications. One change surrounding this diagnosis was a recent construction of a road between the two villages that decreased the usual travel time from a span of several days to a single day...Manifestation of this included shortness of breath, respiratory distress, and hypoxia (an oxygen saturation of 44% in this case). Treatment included high-flow oxygen, dexamethasone to help with air way swelling, and descent to lower altitudes which resulted in immediate marked improvement.”
Altitude Diseases: Mountain Resident High-Altitude Pulmonary Edema (MR-HAPE)

- “MOUNTAIN RESIDENT HIGH ALTITUDE PULMONARY EDEMA (MR-HAPE)...For five years I have been writing about children who live above 2500 feet with no history of travel who present with a respiratory illness and hypoxia. Because they do not appear very sick (toxic is the word we use in medical terms), repond to oxygen only, and have inconsistent or poor response to asthma medications, I have decided this is a form of HAPE. Observations by other clinicians support this.” [https://highaltitudehealth.com/2015/01/09/mountain-resident-high-altitude-pulmonary-edema-mr-hape/](https://highaltitudehealth.com/2015/01/09/mountain-resident-high-altitude-pulmonary-edema-mr-hape/)

- “High-Altitude Pulmonary Edema in Mountain Community Residents...High-altitude pulmonary edema (HAPE) affects lowlanders ascending quickly to elevations above 2440 m. Mountain resident children with no travel can sometimes develop HAPE as was observed over 30 years ago (Fasules et al., 1985). This is not well known and children instead are diagnosed as having pneumonia or asthma. In our clinic at 2800 m, we see children presenting with severe hypoxemia, clinical, and radiographic findings consistent with HAPE despite no recent travel. We call this mountain resident HAPE. We reviewed records of 48 patients with pulmonary symptoms. Analysis included vital signs, pulse oximetry, laboratories, physical findings, and clinical course. We identified 33 residents with HAPE and no travel, five with reentry HAPE, two visitors with classic HAPE, six residents with pneumonia, and two with asthma. Also, 48 X-rays on hypoxemic children seen between 2006 and 2017 were reviewed. Five showed definite HAPE with follow-up X-rays within 48 hours confirming rapid clearing on oxygen, 27 showed findings consistent with HAPE or viral pneumonia and no repeat study. Children living at elevation presenting with hypoxemia are commonly misdiagnosed. Rapid improvement with oxygen and little to no improvement with bronchodilators are more consistent with HAPE, and thus, antibiotics and other treatments can be avoided.” [https://www.researchgate.net/publication/319333335_High-Altitude_Pulmonary_Edema_in_Mountain_Community_Residents](https://www.researchgate.net/publication/319333335_High-Altitude_Pulmonary_Edema_in_Mountain_Community_Residents)

- “Summit County doctor says high-altitude sickness can be deadly even for long-term residents. If not diagnosed or treated properly, the results can be fatal...The longtime Summit County pediatrician for several years has been trying to spread the word about an acute altitude illness that even locals can develop — no matter how long they’ve lived in the mountains. If not diagnosed or treated properly, high-altitude pulmonary edema can be fatal...High-altitude pulmonary edema, or HAPE, can be difficult to identify because there’s no specific test for the disorder, which is characterized by the accumulation of fluid in the lungs. The symptoms — a bad cough, congestion, fatigue and/or sudden respiratory issues — often mirror pneumonia or asthma...Ebert-Santos documented 44 cases of HAPE in 2015, 35 of which occurred in long-time Summit County residents. She believes the illness contributed to the deaths of two children last year, ages 6 and 16.” [https://www.denverpost.com/2017/10/12/summit-county-altitude-sickness/](https://www.denverpost.com/2017/10/12/summit-county-altitude-sickness/)
Altitude Diseases: Trauma Related High Altitude Pulmonary Edema (TR-HAPE)

- “TRAUMA RELATED HIGH-ALTITUDE PULMONARY EDEMA”
  https://highaltitudehealth.com/2018/02/16/trauma-related-high-altitude-pulmonary-edema/
Altitude Diseases: Hypoxic Pulmonary Vasoconstriction (HPV)

- “Hypoxic pulmonary vasoconstriction (HPV), also known as the Euler-Liljestrand mechanism, is a physiological phenomenon in which small pulmonary arteries constrict in the presence of alveolar hypoxia (low oxygen levels). By redirecting blood flow from poorly-ventilated lung regions to well-ventilated lung regions, HPV is thought to be the primary mechanism underlying ventilation/perfusion matching. The process might initially seem counterintuitive, as low oxygen levels might theoretically stimulate increased blood flow to the lungs to increase gas exchange. However, the purpose of HPV is to distribute bloodflow regionally to increase the overall efficiency of gas exchange between air and blood. While the maintenance of ventilation/perfusion ratio during regional obstruction of airflow is beneficial, HPV can be detrimental during global alveolar hypoxia which occurs with exposure to high altitude, where HPV causes a significant increase in total pulmonary vascular resistance, and pulmonary arterial pressure, potentially leading to pulmonary hypertension and pulmonary edema. Several factors inhibit HPV including increased cardiac output, hypocapnia, hypothermia, acidosis/alkalosis, increased pulmonary vascular resistance, inhaled anesthetics, calcium channel blockers, positive end-expiratory pressure (PEEP), high-frequency ventilation (HFV), isoproterenol, nitric oxide, and vasodilators.”

- “Hypoxic Pulmonary Vasoconstriction. Increased pulmonary vascular resistance (PVR) and pulmonary artery (PA) pressure upon ascent to high altitude or exposure to normobaric hypoxia universally occur in humans and other mammals. HPV can be detected with elevations in altitude as low as 1600—2500 m or with reductions in FIO2 to 0.15–0.18 (Levine et al., 1997; Smith et al., 2012; Swenson et al., 1994). The magnitude of HPV can vary almost five-fold among individuals (Fig. 1; Gruenig et al., 2000) and among species, in part related to total pulmonary vascular smooth muscle (Fig. 2; Faraci et al., 1984; Tucker et al., 1975), and with time at altitude from minutes to several days (Dorrington et al., 1997; Groves et al., 1987). HPV is the earliest mechanism that elevates PA pressure and PVR with hypoxic or high altitude exposure, but ultimately other mechanisms (perhaps partly in reaction to the initial elevation of pressure initiated by HPV along with greater cardiac output), but also activation of pressure-independent hypoxia-sensitive inflammatory and proliferative pathways (Voelkel et al., 2013) may more importantly contribute to the sustained pulmonary vascular resistance as a consequence of vascular remodeling that is generally established within days to weeks of continuous alveolar hypoxia (Grover, 1985; Sommer et al., 2008). These aspects beyond early HPV are discussed elsewhere in this issue by Welsh and Peacock. Acute HPV progressively diminishes over time with sustained hypoxia in newcomers to high altitude, as assessed by a fall in pressure and resistance with oxygen breathing. As early as 8 hours (Dorrington et al., 1997) through 1–3 days (Kronenberg et al., 1971; Maggiorini et al., 2001), the rise in pressure cannot be quickly and fully reversed with return to normoxia (Fig. 2). Within one to several weeks there is little response to oxygen over the first several hours of inhalation (Dubowitz and Peacock, 2007; Groves et al., 1987; Rotta et al., 1956). Reversibility with oxygen is usually the method to assess acute HPV in subjects already at altitude rather than exposing the subjects to more hypoxia, which of course is the means to test for HPV at low altitude. Whether those that have little vasodilation with oxygen also have little further vasoconstriction with additional hypoxia...
has never been studied.” https://www.liebertpub.com/doi/full/10.1089/ham.2013.1010

- “Hypoxic pulmonary vasoconstriction...Altitude sickness is a commonly used term for syndromes encountered at an altitude >2500 m, comprising acute mountain sickness (AMS), high-altitude cerebral oedema (HACE), and high-altitude pulmonary oedema (HAPE). The high-altitude environment causes hypobaric hypoxia. In this environment HPV is triggered in all lung regions, and the response can become exaggerated and pathological. In HAPE there is increased sympathetic tone and very active HPV, resulting in uneven pulmonary vasoconstriction, leading to over-perfusion of some regions of the pulmonary vascular bed. Increased pulmonary capillary pressure then leads to stress failure of pulmonary capillaries. The end result is a patchy accumulation of extravascular fluid in the alveolar spaces that impairs lung function and can, in severe instances, prove fatal. In people at altitude who are susceptible to HAPE, dexamethasone can reduce the HPV response and be used to prevent and treat HAPE. The calcium channel blocker nifedipine is another drug used to prevent and treat HAPE. However, the most effective and reliable treatment of established HAPE is immediate descent and adequate flow of supplemental oxygen accompanied by rest from strenuous physical activity.” https://academic.oup.com/bjaed/article/17/6/208/3044182

- “Hypoxic Pulmonary Vasoconstriction. From Molecular Mechanisms to Medicine...Hypoxic pulmonary vasoconstriction (HPV) is a homeostatic mechanism that is intrinsic to the pulmonary vasculature. Intrapulmonary arteries constrict in response to alveolar hypoxia, diverting blood to better-oxygenated lung segments, thereby optimizing ventilation/perfusion matching and systemic oxygen delivery. In response to alveolar hypoxia, a mitochondrial sensor dynamically changes reactive oxygen species and redox couples in pulmonary artery smooth muscle cells (PASMC). This inhibits potassium channels, depolarizes PASMC, activates voltage-gated calcium channels, and increases cytosolic calcium, causing vasoconstriction. Sustained hypoxia activates rho kinase, reinforcing vasoconstriction, and hypoxia-inducible factor (HIF)-1α, leading to adverse pulmonary vascular remodeling and pulmonary hypertension (PH). In the nonventilated fetal lung, HPV diverts blood to the systemic vasculature. After birth, HPV commonly occurs as a localized homeostatic response to focal pneumonia or atelectasis, which optimizes systemic Po2 without altering pulmonary artery pressure (PAP). In single-lung anesthesia, HPV reduces blood flow to the nonventilated lung, thereby facilitating thoracic surgery. At altitude, global hypoxia causes diffuse HPV, increases PAP, and initiates PH. Exaggerated or heterogeneous HPV contributes to high-altitude pulmonary edema. Conversely, impaired HPV, whether due to disease (eg, COPD, sepsis) or vasodilator drugs, promotes systemic hypoxemia. Genetic and epigenetic abnormalities of this oxygen-sensing pathway can trigger normoxic activation of HIF-1α and can promote abnormal metabolism and cell proliferation. The resulting pseudohypoxic state underlies the Warburg metabolic shift and contributes to the neoplasia-like phenotype of PH. HPV and oxygen sensing are important in human health and disease.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5310129/
Altitude Diseases: Hypoxic Ventilatory Response (HVP)

- “Hypoxic ventilatory response (HVR) is the increase in ventilation induced by hypoxia that allows the body to intake and process oxygen at higher rates. It is initially elevated in lowlanders who travel to high altitude, but reduces significantly over time as people acclimatize.[1][2] In biological anthropology, HVR also refers to human adaptation to environmental stresses resulting from high altitude.[3] In mammals, HVR invokes several physiological mechanisms. It is a direct result of the decrease in partial pressure of oxygen in arterial blood, and leads to increased ventilation. The body has different ways of coping with acute hypoxia. Mammals that rely on pulmonary ventilation will increase their ventilation to account for the lack of oxygen reaching the tissues.[2] Mammals will also experience decreases in aerobic metabolism and oxygen demand, along with increases in ATP production. The physiological mechanisms differ in effect and in course of time. HVR is time dependent and can be divided into two phases: the first (0–5 minutes) of ventilation increase, and the second (5–20 minutes) of slow decline.[4] The initial increase in ventilation from HVR is initiated by the carotid bodies, which are bilaterally located at the port of brain circulation.[2] Carotid bodies contain oxygen-sensitive cells that become more active in response to hypoxia. They send input to the brainstem which is then processed by respiratory centers. Other mechanisms include hypoxia-inducible factors, particularly HIF1.[2] Hormonal changes have also been associated with HVR, particularly those that affect the functioning of the carotid bodies.[5] As HVR is a response to decreased oxygen availability,[1] it shares the same environmental triggers as hypoxia. Such precursors include travelling to high altitude locations[6] and living in an environment with high levels of carbon monoxide.[7] Combined with climate, HVR can affect fitness and hydration.[2] Especially for lowlanders who traverse past 6000 meters in altitude, the limit of prolonged human exposure to hypoxia, HVR may result in hyperventilation and ultimately the deterioration of the body. Oxygen consumption is reduced to a maximum of 1 liter per minute.[8] Travelers acclimatized to high altitudes exhibit high levels of HVR, as it provides advantages such as increased oxygen intake, enhanced physical and mental performance, and lower susceptibility to illnesses associated with high altitude.[1] Adaptations in populations living at high altitudes range from cultural to genetic, and vary among populations. For example, Tibetans living at high altitudes have a more sensitive hypoxic ventilatory response than do Andean peoples living at similar altitudes,[5][9] even though both populations exhibit greater aerobic capacity compared to lowlanders.[10] The cause of this difference is most likely genetic, although developmental factors may also contribute.[10]”


- “Hypoxic ventilatory response in successful extreme altitude climbers...A very high ventilatory response to hypoxia is believed necessary to reach extreme altitude without oxygen. Alternatively, the excessive ventilation could be counterproductive by exhausting the ventilatory reserve early on. To test these alternatives, 11 elite climbers (2004 Everest-K2 Italian Expedition) were evaluated as follows: 1) at sea level, and 2) at 5,200 m, after 15 days of acclimatisation at altitude. Resting oxygen saturation, minute ventilation, breathing rate, hypoxic ventilatory response, maximal voluntary ventilation, ventilatory reserve (at oxygen saturation = 70%) and two indices of ventilatory efficiency were measured. Everest and K2 summits were reached 29 and 61 days, respectively, after the last measurement. Five climbers summited without oxygen, the other six did not, or succeeded with oxygen (two climbers). At
sea level, all data were similar. At 5,200 m, the five summiters without oxygen showed lower resting minute ventilation, breathing rate and ventilatory response to hypoxia, and higher ventilatory reserve and ventilatory efficiency, compared to the other climbers. Thus, the more successful climbers had smaller responses to hypoxia during acclimatisation to 5,200 m, but, as a result, had greater available reserve for the summit. A less sensitive hypoxic response and a greater ventilatory efficiency might increase ventilatory reserve and allow sustainable ventilation in the extreme hypoxia at the summit.”


- “Analysis of Hypoxic and Hypercapnic Ventilatory Response in Healthy Volunteers...This is the largest study to date reporting the relationship between gender and HVR/ HCVR and the first study assessing the association between genetic polymorphisms in humans and HVR/HCVR. The data suggest that gender has a large effect on hypoxic breathing response.”
  https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0168930

- “Similar hypoxic ventilatory responses in sea-level natives and high-altitude Andean natives living at sea level... it is clear that these migrants from HA had hypoxic sensitivities that were substantially greater than reported for HA subjects resident at HA. This was true not only for the subjects of group A but also for subjects of group B who had been resident at HA from birth for >20 yr and at SL for <5 yr. Particularly for these latter subjects, the evidence from prior studies is persuasive that they should have developed blunting while resident at HA.”
  https://www.physiology.org/doi/full/10.1152/jappl.1998.84.3.1024

- “Reduced hypoxic ventilatory response with preserved blood oxygenation in yoga trainees and Himalayan Buddhist monks at altitude...Caucasian subjects practicing yoga maintain a satisfactory oxygen transport at high altitude, with minimal increase in ventilation and with reduced hematological changes, resembling Himalayan natives. Respiratory adaptations induced by the practice of yoga may represent an efficient strategy to cope with altitude-induced hypoxia.”

- “High altitude respiratory physiology and pathophysiology...At high altitude, reduced atmospheric pressure causes the partial pressure of oxygen to decrease – creating an environment of hypobaric hypoxia which presents a unique set of challenges for the respiratory system. Pulmonary physiological responses such as the hypoxic ventilatory drive are essential for successful acclimatisation, whilst others such as hypoxic pulmonary vasoconstriction may be implicated in the development of altitude illnesses...Hypobaric hypoxia can cause a number of pathophysiological respiratory problems, including some of the most common (e.g. cough) and the most serious (e.g. high altitude pulmonary oedema) altitude related ailments. Hypoxia at altitude can also have significant effects on chronic respiratory conditions such as chronic obstructive pulmonary disease. Further research is required to improve understanding of these conditions and refine treatments. Visitors to altitude should prepare carefully (e.g. planning appropriate ascents and ensuring adequate control of other conditions) before journeying to altitude to minimise risks as much as possible.”
  https://www.shortnessofbreath.it/materiale_cic/872_4_3/7426_high/article.htm
Altitude Diseases: Hypocapnia

- “Hypocapnia or hypocapnea (from the Greek words υπό meaning below normal and καπνός kapnós meaning smoke), also known as hypocarbia, sometimes incorrectly called acapnia, is a state of reduced carbon dioxide in the blood. Hypocapnia usually results from deep or rapid breathing, known as hyperventilation...Symptoms include tingling sensation (usually in the limbs), abnormal heartbeat, painful muscle cramps, and seizures. Acute hypocapnia causes hypocapnic alkalosis, which causes cerebral vasoconstriction leading to cerebral hypoxia, and this can cause transient dizziness, fainting, and anxiety.[1] A low partial pressure of carbon dioxide in the blood also causes alkalosis (because CO2 is acidic in solution), leading to lowered plasma calcium ions and increased nerve and muscle excitability. This explains the other common symptoms of hyperventilation —pins and needles, muscle cramps and tetany in the extremities, especially hands and feet.”

- “Relativity applied to hyperventilation at high altitude...It is well known that the shortfall of PIO2 due to an ascent to high altitude is compensated by hyperventilation that brings about hypocapnia and respiratory alkalosis.”

- “Cerebrovascular Responses to Hypoxia and Hypocapnia in Ethiopian High Altitude Dwellers..The cerebral circulation of Ethiopian high altitude dwellers is insensitive to hypoxia, unlike Peruvian high altitude dwellers. Cerebrovascular responses to PETco2 were greater in Ethiopians than Peruvians, particularly at high altitude. This, coupled with their high PETco2 levels, would lead to high cerebral blood flows, and may be advantageous for altitude living.”

- “Hypoxia, hypocapnia and spirometry at altitude...Both hypoxia and hypocapnia can cause broncho-constriction in humans, and this could have a bearing on performance at high altitude or contribute to altitude sickness. We studied the relationship between spirometry, arterial oxygen saturation and end-tidal carbon dioxide (ETCO2) concentration in a group of healthy lowland adults during a stay at high altitude, and then evaluated the response to supplementary oxygen and administration of a beta 2 agonist. 2. We collected spirometric data from 51 members of the 1994 British Mount Everest Medical Expedition at sea level (barometric pressure 101.2-101.6 kPa) and at Mount Everest Base Camp in Nepal (altitude 5300 m, barometric pressure 53-54.7 kPa) using a pocket turbine spirometer. A total of 205 spirometric measurements were made on the 51 subjects during the first 6 days after arrival at Base Camp. Further measurements were made before and after inhalation of oxygen (n = 47) or a beta 2 agonist (n = 39). ETCO2 tensions were measured on the same day as spirometric measurements in 30 of these subjects. 3. In the first 6 days after arrival at 5300 m, lower oxygen saturations were associated with lower forced expiratory volume in 1 s (FEV1; P < 0.02) and forced vital capacity (FVC; P < 0.01), but not with peak expiratory flow (PEF). Administration of supplementary oxygen for 5 min increased oxygen saturation from a mean of 81%-94%, but there was no significant change in FEV1 or FVC, whilst PEF fell by 2.3% [P < 0.001; 95% confidence intervals (CI) -4 to -0.7%]. After salbutamol administration, there was no significant change in PEF, FEV1 or FVC in 35 non-asthmatic subjects. Mean ETCO2 at Everest Base Camp was 26 mmHg, and a low ETCO2 was weakly associated with a larger drop in FVC at altitude compared with sea level (r = 0.38, P < 0.05). There was no correlation between either ETCO2 or oxygen saturation and changes in FEV1 or PEF compared with sea-level values. 4. In this study, in normal subjects who were acclimatized to hypobaric hypoxia at an altitude of
5300 m, we found no evidence of hypoxic broncho-constriction. Individuals did not have lower PEF when they were more hypoxic, and neither PEF nor FEV1 were increased by either supplementary oxygen or salbutamol. FVC fell at altitude, and there was a greater fall in FVC for subjects with lower oxygen saturations and probably lower ETCO2.”
Altitude Diseases: Respiratory Alkalosis

- “Alkalosis...Your blood is made up of acids and bases. The amount of acids and bases in your blood can be measured on a pH scale. It’s important to maintain the correct balance between acids and bases. Even a slight change can cause health problems. Normally, your blood should have a slightly higher amount of bases than acids. Alkalosis occurs when your body has too many bases. It can occur due to decreased blood levels of carbon dioxide, which is an acid. It can also occur due to increased blood levels of bicarbonate, which is a base...Symptoms of alkalosis can vary. In the early stages of the condition, you may have: nausea, numbness, prolonged muscle spasms, muscle twitching, hand tremors...If alkalosis isn’t treated right away, severe symptoms can develop. These symptoms could lead to shock or coma. Call 911 or go to the nearest emergency room if you experience any of these symptoms: dizziness, difficulty breathing, confusion, stupor, coma” https://www.healthline.com/health/alkalosis

- “Lessons from high-altitude physiology...High-altitude exposure causes a series of normal physiological responses, termed acclimatisation, which mitigate the effects of hypobaric hypoxia. Hypoxic ventilatory stimulation results in improved oxygen uptake but is associated with respiratory alkalosis that may trigger periodic breathing, particularly during sleep, thereby impairing sleep quality. As travelling to high altitude is popular, high-altitude related illnesses that affect subjective wellbeing, reduce physical performance and alter mental status are also frequently observed. They encompass acute mountain sickness (AMS), high-altitude cerebral oedema (HACE) and high-altitude pulmonary oedema (HAPE). Depending on ascent rate and individual susceptibility, symptoms usually occur at altitudes above 2,500 m. Therapeutic options include descent accompanied by administration of oxygen and drugs as required. Prevention is based on appropriate acclimatisation, moderate ascent rate, low sleeping altitude and drugs, including acetazolamide, dexamethasone and nifedipine.” https://breathe.ersjournals.com/content/4/2/122

- “Injurious Effects of Hypocapnic Alkalosis in the Isolated Lung...Mechanical ventilation can worsen morbidity and mortality by causing ventilator-associated lung injury, especially where adverse ventilatory strategies are employed. Adverse strategies commonly involve hyperventilation, which frequently results in hypocapnia. Although hypocapnia is associated with significant lung alterations (e.g., bronchospasm, airway edema), the effects on alveolar-capillary permeability are unknown. We investigated whether hypocapnia could cause lung injury independent of altering ventilatory strategy. We hypothesized that hypocapnia would cause lung injury during prolonged ventilation, and would worsen injury following ischemia–reperfusion. We utilized the isolated buffer-perfused rabbit lung model. Pilot studies assessed a range of levels of hypocapnic alkalosis. Experimental preparations were randomized to control groups (Fi CO2 = 0.06) or groups with hypocapnia (Fi CO2 = 0.01). Following prolonged ventilation, pulmonary artery pressure, airway pressure, and lung weight were unchanged in the control group but were elevated in the group with hypocapnia; elevation in microvascular permeability was greater in the hypocapnia versus control groups. Injury following ischemia–reperfusion was significantly worse in the hypocapnia versus control groups. In a preliminary series, degree of lung injury was proportional to the degree of hypocapnic alkalosis. We conclude that in the current model (1) hypocapnic alkalosis is directly injurious to the lung and (2) hypocapnic alkalosis potentiates ischemia–reperfusion-induced acute lung injury.” https://www.atsjournals.org/doi/full/10.1164/ajrccm.162.2.9911026
“Do Over 200 Million Healthy Altitude Residents Really Suffer from Chronic Acid–Base Disorders?...As the oxygen tension of inspired air falls with increasing altitude in normal subjects, hyperventilation ensues. This acute respiratory alkalosis, induces increased renal excretion of bicarbonate, returning the pH back to normal, giving rise to compensated respiratory alkalosis or chronic hypocapnia. It seems a contradiction that so many normal people at high altitude should permanently live as chronic acid–base patients. Blood gas analyses of 1,865 subjects at 3,510 m, reported a PaCO2 (arterial carbon dioxide tension ± SEM) = 29.4 ± 0.16 mmHg and pH = 7.40 ± 0.005. Base excess, calculated with the Van Slyke sea level equation, is −5 mM (milliMolar or mmol/l) as an average, suggesting chronic hypocapnia. THID, a new term replacing “Base Excess” is determined by titration to a pH of 7.40 at a PaCO2 of 5.33 kPa (40 mmHg) at sea level, oxygen saturated and at 37°C blood temperature. Since our new modified Van Slyke equations operate with normal values for PaCO2 at the actual altitude, a calculation of THID will always result in normal values—that is, zero.”

“High-Altitude Illnesses: Physiology, Risk Factors, Prevention, and Treatment...Hyperventilation accelerates CO2 elimination and produces a respiratory alkalosis by lowering the PaCO2 and raising the pH of the blood. The decrease in PaCO2 and the resulting alkalosis combine to act on the medullary chemoreceptor to decrease ventilation. Consequently, the ventilatory response to hypoxia, the HVR, becomes especially important in maintaining oxygen saturation, since the normal CO2-mediated ventilatory drive is diminished by the hypocapnia. The magnitude and rapidity of onset of the HVR on arrival at altitude varies considerably from individual to individual, and a failure to increase the HVR contributes to hypoxemia and the development of AMS...the initial response to high-altitude hypoxia is a respiratory alkalosis produced by hyperventilation. Within minutes, the kidneys respond to the alkalosis with an increased excretion of bicarbonate ions; this renal effect can continue for hours or days and functions to correct the alkalosis and return the pH of the serum toward a normal value. The kidneys also respond to hypoxia by the secretion of erythropoietin. Erythropoietin leads to an increase in red cell mass and the oxygen-carrying capacity of the blood (dissolved oxygen accounts for only about 2% of the oxygen-carrying capacity); however, it takes several days before an increased rate of erythrocyte production can be measured, and the process is not complete for weeks or months.”

“Ventilatory response at altitude...As distance from the sea level increases, barometric pressure of the air falls; however, the O2 concentration remains unchanged as does water vapor pressure. At sea level barometric pressure is 760mmHg, with 47mmHg vapor pressure, leaving PO2 as 0.21 * (760-47) ≈ 150mmHg. At 19,000ft (Mount Kilimanjaro) the barometric pressure is 380mmHg and thus PO2: 0.21 * (380-47) = 70mmHg. Thus, the PO2 of the inspired air decreases with increasing altitude (decreasing barometric pressure) and the body begins to adapt. These adaptations can be thought of as immediate and delayed (over days to weeks). The most important immediate adaptation is hyperventilation and thus increase in minute ventilation due to the decrease in PaO2, this via stimulation of the peripheral chemoreceptors (central chemoreceptors are not sensitive to falls in PaO2). This results in a respiratory alkalosis. This respiratory alkalosis inhibits breathing, however over the next 2-3 days the pH of the CSF compensates via bicarbonate loss and bicarbonate is further excreted by the kidneys to return blood to normal pH. This allows a continued increase in minute ventilation (via both increasing RR and TV). At altitude the inspired pO2 may fall sufficiently that oxyhemoglobin dissociation...
curve is no longer in its upper flat portion. The body compensates by increasing cardiac output to compensate in the short term. In the long term, compensation includes increases in hemoglobin concentration via hypoxia-mediated renal secretion of erythropoietin, thus maintaining DO2 at the expense of increasing viscosity of blood. The oxyhemoglobin dissociation curve shifts rightwards at moderate altitude to assist in unloading of O2, but shifts leftwards with continued increases in altitude to assist in pulmonary oxygen loading. This first rightward shift is caused by increases in 2,3-DPG resulting from the metabolic alkalosis. This adaptation occurs over hours to days. The long-term adaption with sustained presence at altitude causes arterial pH to return to normal and arterial pO2, pCO2 and HCO3- to remain reduced. The body’s sensitivity to rises in pCO2 increases. PVR becomes increased chronically due to hypoxic vasoconstriction. The CO returns to normal with a few days of acclimatization. With continued presence at altitude, vital capacity and FRC is unchanged from baseline, but MV remains elevated.” https://www.openanesthesia.org/aba_ventilatory_response_at_altitude/
Altitude Diseases: Bacterial Infections

- “Pneumococcal polysaccharide vaccine (PPSV)—known as Pneumovax 23 (PPV-23)—is the first pneumococcal vaccine derived from a capsular polysaccharide, and an important landmark in medical history. The polysaccharide antigens were used to induce type-specific antibodies that enhanced opsonization, phagocytosis, and killing of Streptococcus pneumoniae (pneumococcal) bacteria by phagocytic immune cells. The pneumococcal polysaccharide vaccine is widely used in high-risk adults.[2] As a result, there have been important reductions in the incidence, morbidity, and mortality from invasive pneumococcal disease.[citation needed] First used in 1945, the tetravalent vaccine was not widely distributed, since its deployment coincided with the discovery of penicillin.[3] In the 1970s, Robert Austrian championed the manufacture and distribution of a 14-valent PPSV.[4][5] This evolved in 1983, to a 23-valent formulation (PPSV23). A significant breakthrough affecting the burden of pneumococcal disease was the licensing of a protein conjugate heptavalent vaccine (PCV7) beginning in February 2000.” [https://en.wikipedia.org/wiki/Pneumococcal_polysaccharide_vaccine](https://en.wikipedia.org/wiki/Pneumococcal_polysaccharide_vaccine)

- “I was given the Pneumococcal Polysaccharide Vaccine (PPSV23) by my allergist in 2019 to help my asthma. I did not notice any significant negative reactions to it, but I did feel better afterwards. Notably, it seemed to reduce the amount of phlem that my lungs were producing. This did cause me to reflect on where I may have picked up bacterial infections from. The obvious exposure from my past was the W. M. Keck Observatory in Hawaii. Atop the very high altitude Mauna Kea mountain, we would routinely take medical oxygen to treat our medical conditions that Acute Mountain Sickness (AMS) was causing. We would all use the same oxygen mask, allowing infections to spread among the workers! Cross infection techniques were not practiced with this oxygen administration equipment. We all should have had our own personal oxygen administration masks and tubing.” Steven Magee CEng MIET

- “The Pneumococcal Polysaccharide Vaccine (PPSV23) is recommended for the following people: All adults 65 years of age and older. Anyone 2 through 64 years of age with certain long term health problems. Anyone 2 through 64 years of age with a weakened immune system. Adults 19 through 64 years of age who smoke or have asthma. I appeared to fit into the certain long term health problems, weakened immune system and asthma categories.” Steven Magee CEng MIET

- “Never share an oxygen administration mask.” Steven Magee CEng MIET - Q

- “PNEUMOVAX 23 is a vaccine that can help protect against infection by 23 types of pneumococcal bacteria, which are common and often cause serious illnesses.” [https://www.pneumovax23.com/](https://www.pneumovax23.com/)

- “Pneumococcal bacteria are more common than you think. Even some healthy people can have pneumococcal bacteria in their bodies...Pneumococcal vaccination helps your body develop antibodies that help protect you against certain strains of pneumococcal bacteria that can cause disease.” [https://www.aboutpneumonia.com/index.html?cmp=c829d29a-8620-48b0-bb41-805ab6ae807c#understand-your-risk](https://www.aboutpneumonia.com/index.html?cmp=c829d29a-8620-48b0-bb41-805ab6ae807c#understand-your-risk)
Altitude Diseases: Oxygen Administration Health Risks

- “Dangers of Wearing an Oxygen Mask...In review, the nasal cannula is today’s choice for delivering safe and effective oxygen to the patient with Chronic Obstructive Lung Disease. Unless you have specific circumstances and it is prescribed by your physician, the COPD patient should not wear a simple oxygen mask as it could raise your carbon dioxide levels and potentially compromise your health.” [https://oxygo.life/dangers-of-wearing-an-oxygen-mask/](https://oxygo.life/dangers-of-wearing-an-oxygen-mask/)
- “Sharing Oxygen Masks...Mask are possible fomites for the transmission of infectious agents. Proper disinfection is needed to reduce the potential for this transmission.” [http://safetyforum.alpa.org/LinkClick.aspx?fileticket=DzVceoV6OLA=&tabid=2886](http://safetyforum.alpa.org/LinkClick.aspx?fileticket=DzVceoV6OLA=&tabid=2886)
- “Disinfection of nitrous oxide inhalation equipment...Cross-infection by contaminated equipment is a potential hazard associated with conscious sedation with nitrous oxide and oxygen. Nosocomial infections have occasionally been linked with the use of unsterile inhalation devices; microbial contamination of sterile nasal hoods routinely occurs during administration of nitrous oxide; and in vitro experiments indicate that subsequent use of contaminated nasal masks may lead to aspiration of microorganisms. Although the incidence of respiratory disease after such contamination is unknown, it is clear that disinfection of the nitrous oxide apparatus between patients is desirable. A simple cleaning method involving alkaline glutaraldehyde is described that provides adequate disinfection of the rubber goods used in the administration of gas. Superiority of this technique over previously recommended cleaning methods is shown.” [https://www.ncbi.nlm.nih.gov/pubmed/106079](https://www.ncbi.nlm.nih.gov/pubmed/106079)
- “FiltaMask™ medium concentration oxygen mask...Can you provide the care they need, and the protection you need? Your patient is at risk and needs help, but can you be sure there is no risk to you from cross-infection? Patients with respiratory infections have specific needs and yet pose a specific risk. Conventional oxygen masks can generate a plume of particles from their exhalation ports, which can travel a distance of 0.4 metres[1] [2] resulting in a potential risk. The FiltaMask™ combines an oxygen delivery system with a filter media covering the exhalation ports. FiltaMask is intended for use on patients with respiratory infections who may be a source of aerosolised infectious pathogens and who also require supplementary oxygen. The FiltaMask is designed to reduce the risk to paramedics, hospital staff and visitors[3].” [https://au.intersurgical.com/products/oxygen-and-aerosol-therapy/filtamask-medium-concentration-oxygen-mask](https://au.intersurgical.com/products/oxygen-and-aerosol-therapy/filtamask-medium-concentration-oxygen-mask)
- “Respirator Cleaning and Maintenance. The manufacturer’s guidance for cleaning and sanitizing a respirator should always be followed and is included with the packaging of all products. If you do not have access to that copy, check the manufacturer’s website. If still not accessible, general cleaning and sanitizing guidance is provided by the Occupational Safety and Health Administration (OSHA). OSHA also has videos regarding maintenance and care of respirators.” [https://www.cdc.gov/niosh/npptl/cleaning.html](https://www.cdc.gov/niosh/npptl/cleaning.html)
- “Occupational Safety and Health Administration...Appendix B-2 to § 1910.134: Respirator Cleaning Procedures (Mandatory). These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B-2. Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth in Appendix B-2, i.e., must ensure that the respirator is properly cleaned and
disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.” [https://www.osha.gov/laws-regps/regulations/standardnumber/1910/1910.134AppB2

- “Occupational Safety and Health Administration...Maintenance and Care of Respirators (Mantenimiento Y Cuidado de los Respiradores)”
  [https://www.osha.gov/video/respiratory_protection/maintenance.html

- “I never observed Occupational Safety and Health Administration (OSHA) cross infection techniques being used with shared oxygen administration equipment at the Mauna Kea Observatories (MKO).” Steven Magee CEng MIET – Q

- “Oxygen Mask Use in Aviation...This paper addresses the current practice of sharing oxygen masks among multiple users both in aircraft cockpits and in training simulators. These procedures may place pilots at increased risk for contracting transmissible disease. The risks arise due to the mask’s inherent inability to be properly disassembled and cleaned between users. This concern exists not only in the aircraft but is of great concern in the simulator as well. After a formal request was made to the National Institute of Occupational Safety and Health (NIOSH), an expert opinion was issued by NIOSH that invites the airline industry to consider the serious consequences that can arise by maintaining the status quo. With the current threats associated with the swine flu (H1N1) pandemic and a forecast of additional pandemics on the horizon, we, as an industry, must move swiftly to ensure we are not unnecessarily risking pilot lives and contributing to the spread of disease. Current procedures deny pilots a very basic level of hygiene in the workplace. For example, directives are issued to wash hands frequently and to avoid sharing pillows or blankets during rest breaks. Yet somehow, it has become completely acceptable to share an intimate piece of medical equipment among thousands of users without ever properly disinfecting the device. Pilot users could harbor a virus or life-threatening bacterial infection without exhibiting any symptoms. Since various pathogens can live for weeks on a hard surface, by using the mask during the incubation period, the illness can be unknowingly transferred to the next user. We currently live in an age of pandemics.”

- “Hypoxia, such as encountered at high altitude, promotes deep vein thrombosis in mice...In the majority of cases, hypoxia is followed by restoration of oxygen supply, i.e., reoxygenation. Hypoxia-reoxygenation (H/R), which is known to be harmful to tissues [8, 9], is proposed to be an exacerbating factor for thrombus development in veins although this causal relationship has not been directly proven. A crucial role of the reoxygenation phase in DVT can be suggested because thrombotic events frequently occur after landing [7, 10]. We report that exposure to 6% oxygen for 24 hours followed by 1–3 hours of reoxygenation in normal room air led to significantly increased thrombus prevalence in a mouse model of DVT. Eleven of 15 mice (73%) developed a thrombus after one hour stenosis of the inferior vena cava (IVC) as compared to 1 of 8 (13%) in control animals maintained in normoxic conditions (Figure A,B) (P<0.01). Weight and length of the thrombi from animals that underwent H/R significantly exceeded those in the control group. Thus, mice that were subjected to IVC stenosis after H/R demonstrated a clear pro-thrombotic phenotype.”
  [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3773282/

- “Reactive species mechanisms of cellular hypoxia-reoxygenation injury...Exacerbation of hypoxic injury after restoration of oxygenation (reoxygenation) is an important mechanism of cellular injury in transplantation and in myocardial, hepatic, intestinal, cerebral, renal, and other ischemic syndromes. Cellular hypoxia and reoxygenation are two essential elements of ischemia-reperfusion injury. Activated neutrophils contribute to vascular reperfusion injury, yet
posthypoxic cellular injury occurs in the absence of inflammatory cells through mechanisms involving reactive oxygen (ROS) or nitrogen species (RNS). Xanthine oxidase (XO) produces ROS in some reoxygenated cells, but other intracellular sources of ROS are abundant, and XO is not required for reoxygenation injury. Hypoxic or reoxygenated mitochondria may produce excess superoxide (O) and release H(2)O(2), a diffusible long-lived oxidant that can activate signaling pathways or react vicinally with proteins and lipid membranes. This review focuses on the specific roles of ROS and RNS in the cellular response to hypoxia and subsequent cytolytic injury during reoxygenation.”

- “Hypoxia reoxygenation-induced injury of cultured pulmonary microvessel endothelial cells...Polymorphonuclear leukocyte (PMN) sequestration within the pulmonary microvasculature is known to occur in association with ischemia/reoxygenation (I/R). This sequestration is dependent on eicosanoids and reactive oxygen species. PMN sequestration within the lungs suggests that pulmonary microvascular endothelial cells (MECs) may in part regulate the I/R response. Simulating I/R, we examined the effect of hypoxia/reoxygenation (H/R) on pulmonary MECs in vitro, with and without PMNs. Significant cellular injury, assessed by 51Cr release, occurred upon reoxygenation of MECs (P < .01). Addition of PMNs to the H/R-injured monolayers did not increase MEC injury. Reoxygenation of MECs also resulted in increased thromboxane (Tx) B2 production compared to controls (P < .01). Inhibition of Tx secretion by aspirin reduced H/R-induced PMN adhesion to MECs (P < .01). Furthermore, H/R-induced increases in PMN-MEC adhesion were prevented by allopurinol and superoxide dismutase (P < .01). These data suggest that the pulmonary response to H/R is mediated by MEC generation of reactive oxygen radical species and Tx, which promotes increased PMN adhesion.”
Altitude Diseases: Vasodilators

- “Vasodilators (Drug Class Side Effects, List of Names)...What are pulmonary vasodilators? Pulmonary vasodilators are medicines that dilate small arteries in the lungs. Doctors prescribe pulmonary vasodilators to treat patients with pulmonary arterial hypertension, a health condition that involves constriction of pulmonary arteries. Examples of pulmonary vasodilators include: Oxygen”
  https://www.medicinenet.com/vasodilators_drug_class_side_effects_list_of_names/article.htm#vasodilator_side_effects_and_adverse_effects
- “Best Vasodilator Supplements & TOP 15 Supplement Reviews 2020...Do they have side effects? Since vasodilation widens the blood vessels, they lower blood pressure. Too much vasodilation may lead to a dizzy feeling. Generally, when taken according to package instructions, vasodilation supplements are safe and cause no side effects, however, if you take too much you may get stomach pain, diarrhea, dizziness or headache.”
  https://garagegympower.com/best-vasodilator-supplements/
- “What Are Vasodilators?...Side Effects of vasodilators may include: Chest pain. Heart palpitations (fluttering or pounding heartbeat). Rapid heartbeat. Fluid retention. Nausea or vomiting. Dizziness. Headache. Flushing. Excessive hair growth. Nasal congestion...Vasodilator Precautions. Tell your doctor about any other medical conditions you have before starting on a vasodilator. Vasodilators may help control your high blood pressure, but they won't cure the condition. Your doctor may suggest that you follow a special diet while taking vasodilators. Follow these instructions carefully. Vasodilators can cause dizziness. Don't drive or perform activities that require alertness until you know how these medicines affect you. Tell your healthcare provider that you're taking a vasodilator before having any type of medical procedure, including dental procedures. Your doctor will want to perform frequent tests to monitor your body's response to these medicines. Keep all appointments with your doctor's office and laboratory. Let your doctor know about all prescription, non-prescription, illegal, recreational, herbal, nutritional, or dietary drugs you're taking before starting on a vasodilator.”
  https://www.everydayhealth.com/vasodilators/guide/
Altitude Diseases: High-Altitude Edema

- “High-Altitude Edema...Many hikers experience moderate facial and lower extremity edema during exposure to high altitude with a diuresis and loss of edema on return to a lower elevation. Women are more likely to experience edema than men. A high salt intake will accentuate the edema. The use of acetazolamide (Diamox) or furosemide (Lasix) will prevent fluid retention. The condition is asymptomatic and occurs in normal subjects. The cause is unknown, but aldosterone or other steroids may play a role since an abrupt, moderate decrease in plasma volume occurs within the first 24 hours after exposure to high altitude and may increase the output of sodium-retaining steroids.”
  https://jamanetwork.com/journals/jama/article-abstract/657371
Altitude Diseases: Headache

- “High altitude headache. Headache is the most common symptom of high altitude sickness...The International Headache Society (IHS), an international group of headache specialists, has included a definition of high altitude headache in the second edition of their International Classification of Headache Disorders. Their definition is: A. Headache with at least two of the following characteristics and fulfilling criteria C and D, Bilateral, Frontal or frontotemporal (at the front of the head in the region of the temples), Dull or pressing quality, Mild or moderate intensity, Aggravated by exertion, movement, straining, coughing, or bending. B. Ascent to altitude above 2500 metres C. Headache develops within 24 hours after ascent. D. Headache resolves within eight hours of descent.” [https://www.migrainetrust.org/about-migraine/types-of-migraine/other-headache-disorders/high-altitude-headache/]

- “Six Tips to Avoid A High Altitude Headache and Migraine...Ascend Slowly: Slow your ascent at a rate of 300 metres or 1000 feet a day, if possible, allowing two days of acclimatization. Plan a stopover at a lower altitude. Wait a day before that mountaintop hike or snowmobile ride. Delay Exertion: Wait a day prior to engaging in strenuous exercise at high altitudes. Avoid Alcohol: Find another way to celebrate. Those apres-ski libations at the ski lodge boost your risk. Hydrate Heavily: Make sure you get at least 64 ounces or 2 litres of water a day. Avoid Other Triggers: Limit bright sun reflected by the snow with high-quality goggles or sunglasses. Pack Ibuprofen: If you feel a headache coming on, take ibuprofen quickly to manage inflammation.” [https://migraineagain.com/six-tips-to-avoid-a-high-altitude-headache-and-migraine/]

- “Altitude, Acute Mountain Sickness and Headache... AMS headache is usually intense, throbbing and is either generalized or in the forehead. It develops within six hours to four days of arrival at high altitude and can last for up to five days. The headache often worsens with exertion, coughing, straining or lying flat. Facial flushing, eye redness and sensitivity to light may accompany headache.” [https://americanmigrainefoundation.org/understanding-migraine/altitude-acute-mountain-sickness-and-headache/]

- “Higher Altitude Tied to Increased Migraine Prevalence, Symptoms...People who live at high altitudes may experience increased migraine prevalence, duration, and severity of symptoms, according to results from a population-based study conducted in Nepal and published in the European Journal of Neurology.” [https://www.neurologyadvisor.com/migraine-and-headache/migraine-associated-with-high-altitude/article/685724/]

- “Does altitude or pressure affect your allergies? - Asthma and allergies... I've been keeping a journal of all the air pressures. Every time the barometer drops below 30, I have been getting a migraine. If I take the butalbital/caffeine tabs early enough when the symptoms appear, I can keep the pain down. But, next to taking a barometer with me at all times, it's hard to monitor when a headache is going to come on...You might ask about having an ear/nose/throat (ENT) doctor do a CT scan of your sinuses. I have had seasonal allergies for years, but have gotten worse in recent years (I'm 58). Yes, changes in altitude/barometric pressure have an effect on my headaches. It turns out that in addition to allergies and the related swelling/mucus, I had a blocked sinus, which was just remedied with surgery. I am hoping this coming summer I won't be getting my annual sinus infection”
https://www.inspire.com/groups/living-with-asthma/discussion/does-altitude-or-pressure-affect-your-allergies/
Altitude Diseases: High Altitude Seizures (HAS)

- “I was diagnosed with absence seizures after a decade of high altitude work up to 13,797 feet.” Steven Magee CEng MIET - Q
- “Absence seizures are one of several kinds of generalized seizures. These seizures are sometimes referred to as petit mal seizures (from the French for "little illness", a term dating from the late 18th century).[1] Absence seizures are characterized by a brief loss and return of consciousness, generally not followed by a period of lethargy (i.e. without a notable postictal state).” [https://en.wikipedia.org/wiki/Absence_seizure](https://en.wikipedia.org/wiki/Absence_seizure)
- “Altitude induced seizures...Someone asked if being in or maybe it was moving to higher altitudes, or something about altitudes can cause seizures. The answer is now officially - YES. I've had epilepsy mildly all of my life. Then I went from 350 feet above sea level to over 5000 feet and started having seizures nearly immediately (2 days later). I maintained to my then "doctor" that I felt going up in altitude and coincidentally starting to sz was TOO coincidental. He insisted there was no literature to support that. Well guess what? Now there is.” [https://www.epilepsy.com/connect/forums/corner-booth/altitude-induced-seizures](https://www.epilepsy.com/connect/forums/corner-booth/altitude-induced-seizures)
- “Altitude and Epilepsy...Seizures have been reported at higher altitudes than the person is accustomed to. Mountain climbing should be avoided for your own safety.” [https://www.medhelp.org/posts/Neurology/Altitude-and-Epilepsy/show/697634](https://www.medhelp.org/posts/Neurology/Altitude-and-Epilepsy/show/697634)
- “How do you approach seizures in the high altitude traveler?...Counseling patients who suffer first-time or break- through seizures can be difficult, particularly when controllable external factors may be contributing to the lowering of their seizure threshold. High altitude as a potential trigger for seizures is a common question in our epilepsy clinics in Colorado, and this article reviews the existing anecdotal literature, presents our local experience with high altitude seizures (HAS), offers possible mechanisms to explain how high altitude may trigger seizures, and suggests an initial work-up and prophylactic strategies for future high altitude exposures.” [https://www.ncbi.nlm.nih.gov/pubmed/21452959](https://www.ncbi.nlm.nih.gov/pubmed/21452959)
- “New epilepsy seizure at high altitude without signs of acute mountain sickness or high altitude cerebral edema...Neurological disturbances may be present at high altitude independently of high altitude cerebral edema. We report here the case of a patient who experienced for the first time generalized seizures after spending a night at an altitude of 5200 m, with no preceding symptoms of acute mountain sickness. An initial CT scan performed 12 hours after his loss of consciousness and an MRI scan performed 2 months later were normal. An EEG, obtained 2 months after the event, showed epileptiform discharges triggered by hyperventilation. The description of the clinical event obtained from the witness and the presence of a positive family history strongly support a high altitude-triggered new epileptic seizure. This report suggests that at high altitudes seizure risks in a seizure-prone person may be higher than for normal individuals.” [https://www.ncbi.nlm.nih.gov/pubmed/16544970](https://www.ncbi.nlm.nih.gov/pubmed/16544970)
- “Seizure and hemiparesis at high-altitude outside the setting of acute mountain
sickness...Neurologic problems at high altitudes are well known. What is probably less emphasized are neurologic problems at altitude outside the setting of high-altitude cerebral edema. Because neurologic symptoms for these kinds of problems at high altitude are often transient, neuroradiologic scanning for these problems is usually not done or reported. Furthermore, diagnostic testing facilities may be unavailable in these remote high-altitude settings. A patient is described here with transient seizure and right-sided hemiparesis at high altitude with no preceding symptoms of acute mountain sickness. Computed tomography of the head was obtained in a hospital at lower altitude where the patient was taken promptly. The findings of the scan revealed probable focal cerebral edema in the left parietal lobe in keeping with his temporary right-sided weakness. Possible treatment modalities on the mountain for this problem are also discussed.”

- “Seizures at high altitude in a patient on antiseizure medications.”

- “Fatal grand mal seizure in a Dutch trekker...A 35-year-old healthy Dutch woman went on a trek (Lang Tang) in Nepal up to an approximate altitude of about 3800 meters. She had no prior history of any medical problems except attacks of generalized epilepsy when she was 19 years old, which had been controlled with antiepileptic medications. She had had no attacks after the age of 20. A CT scan done around that time had apparently been normal...When her friends returned to the hotel she was having another grand mal seizure. Medical help was sought, but she died before the doctor arrived to control her seizures. When the doctor did arrive and carried out CPR for half an hour it was to no avail as she continued to have no pulse or blood pressure.”

- “BRAIN MATURATION MEASURED BY ELECTROSHOCK SEIZURES IN RATS AT HIGH ALTITUDE (12,470 FT.; 3,800 M).”

- “ELECTROCONVULSIVE RESPONSES OF RATS TO CONVULSANT AND ANTICONVULSANT DRUGS DURING ACCLIMATIZATION AT HIGH ALTITUDE (12,470 FEET, 3,800 M).”
Altitude Diseases: High Altitude Stroke (HAS)

- “High Altitude Stroke...A high altitude stroke (HAS) is usually caused by a blood clot, as the result of the natural thickening of the blood during acclimatization. The decreased blood supply to the brain causes a rapid loss in brain functions, resulting in a stroke. Symptoms usually start suddenly and develop over just seconds or minutes, and further symptoms typically do not arise beyond those first few minutes. Symptoms depend on what part of the brain is affected and may include weakness or numbness in the face, arms or legs, especially on one side of the body, confusion, slurred speech, dizziness, loss of balance, trouble in seeing out of one or both eyes, and severe headache.” [https://www.mountainprofessor.com/high-altitude-stroke.html](https://www.mountainprofessor.com/high-altitude-stroke.html)

- “High altitude exposure and ischemic stroke...This review includes the relationship between acute and chronic high altitude exposure and the possible development of ischemic stroke in high altitude populations. Several risk factors are identified in high altitude dwellers such as polycythemia, increased platelet adhesiveness and greater risk to develop vascular thrombosis. Other conditions such as dehydration, extreme cold and immobilization might lead to increased risk of ischemic stroke in newcomers. Taking into account the limited number of studies, it is argued that high altitude and chronic hypoxia may be risk factors for the development of ischemic stroke. The altitude associated with higher prevalence of ischemic stroke is not clear, but it appears that there is increased risk above 3000m.” [https://www.researchgate.net/publication/270273416_High_altitude_exposure_and_ischemic_stroke](https://www.researchgate.net/publication/270273416_High_altitude_exposure_and_ischemic_stroke)

- “Stroke at High Altitude: Indian Experience... Long-term stay at high altitude is associated with higher risk of stroke. Although all types of stroke were seen, ischemic stroke was the commonest. Massive infarcts were common. Polycythemia was an important risk factor.” [https://www.liebertpub.com/doi/abs/10.1089%2F152702902753639513](https://www.liebertpub.com/doi/abs/10.1089%2F152702902753639513)
Altitude Diseases: High Altitude Retinopathy (HAR)

- “High-Altitude Retinal Hemorrhages...Retinal hemorrhages and disc edema at high altitudes have been previously reported. Tschudi in 18391 noted ocular symptoms and signs (blurred vision, ocular pain, and conjunctival hemorrhages) at 12,000 ft in Peru. Sédan2 found retinal hemorrhages in hypertensive subjects at 12,000 ft in 1938. Frayser et al,3 in 1968, found a 37.5% incidence of retinal hemorrhages in climbers on Mt Logan (17,500 ft). Subsequent studies have found even higher frequencies.” https://jamanetwork.com/journals/jama/article-abstract/373695

- “Delayed Appearance of High Altitude Retinal Hemorrhages...When closely examined, a very large amount of climbers exhibit retinal hemorrhages during exposure to high altitudes. The incidence of retinal hemorrhages may be greater than previously appreciated as a definite time lag was observed between highest altitude reached and development of retinal bleeding. Retinal hemorrhages should not be considered warning signs of impending severe altitude illness due to their delayed appearance...Many individuals who ascend to heights above 3000 m develop HAR, reported as engorgement and tortuosity of the retinal vessels, and optic disc hyperemia and swelling, retinal hemorrhages, nerve fiber layer infarction, and even vitreous hemorrhage.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3040733/

- “Ocular Problems In High Altitude Travelling” http://www.ijtmgh.com/article_46490_93a5194d8196fd0ca71bb5b401b29a23.pdf

- “High Altitude and the Eye...High altitude has both short-term and long-term effects on the eyes. The short-term effects include high-altitude retinopathy, change in corneal thickness, and photokeratitis. Long-term effects include pterygium, cataract, and dry eye syndrome. High-altitude retinopathy of mild degree does not affect vision but has a predictive value for the development of high-altitude cerebral edema. Change in corneal thickness at altitude induces refractive changes in eyes with radial keratotomy and in eyes with LASIK. High altitude does not adversely affect visual acuity and contrast sensitivity; scotopic vision may be affected if supplemental oxygen is not used.” https://www.ncbi.nlm.nih.gov/pubmed/26107334

Altitude Diseases: Dry Eyes

- “Dry Eyes and High Altitudes. People who live at high altitudes or who travel frequently by plane often have dry eyes. This is because the moisture content of air is reduced at high altitudes. The risk for dry eyes is especially significant during winter months, when low temperature and hot dry air from furnace or heaters make the situation even worse.”

  https://www.theralife.com/dry-eyes-and-high-altitudes/
Altitude Diseases: High Altitude Renal Syndrome (HARS)

- “High Altitude Renal Syndrome (HARS)...More than 140 million people live permanently at high altitude (>2400 m) under hypoxic conditions that challenge basic physiology. Here we present a short historical review of the populating of these regions and of evidence for genetic adaptations and environmental factors (such as exposure to cobalt) that may influence the phenotypic responses. We also review some of the common renal physiologic responses focusing on clinical manifestations. The frequent presentation of systemic hypertension and microalbuminuria with relatively preserved GFR coupled with the presence of polycythemia and hyperuricemia suggests a new clinical syndrome we term high altitude renal syndrome (HARS). ACE inhibitors appear effective at reducing proteinuria and lowering hemoglobin levels in these patients.” [http://jasn.asnjournals.org/content/22/11/1963.full](http://jasn.asnjournals.org/content/22/11/1963.full)

- “Polyuria (/ˌpɒliˈjʊəriə/) is excessive or an abnormally large production or passage of urine (greater than 2.5[5] or 3[6] L over 24 hours in adults). Frequent urination is usually an accompanying symptom. Increased production and passage of urine may also be termed diuresis.[7][8] Polyuria often appears in conjunction with polydipsia (increased thirst), though it is possible to have one without the other, and the latter may be a cause or an effect. Psychogenic polydipsia may lead to polyuria. [9] Polyuria is usually viewed as a symptom or sign of another disorder (not a disease by itself), but it can be classed as a disorder, at least when its underlying causes are not clear.[citation needed]...High-altitude diuresis occurs at altitudes above 10,000 feet (3,000 m) and is a desirable indicator of adaptation to high altitudes. Mountaineers who are adapting well to high altitudes experience this type of diuresis. Persons who produce less urine even in the presence of adequate fluid intake are probably not adapting well to altitude.” [https://en.m.wikipedia.org/wiki/Polyuria](https://en.m.wikipedia.org/wiki/Polyuria)

- “Short-term responses of the kidney to high altitude in mountain climbers...Systemic fluid balance and its renal regulation are at the core of adaptation to high altitude and high-altitude sickness. The initial decrease in plasma volume is a quick and powerful reaction to hypoxia that is based on several mechanisms. The magnitude and characteristics of this response may be helpful in predicting the symptoms of AMS.” [http://europepmc.org/articles/PMC3938295](http://europepmc.org/articles/PMC3938295)

- “Volume Regulation and Renal Function at High Altitude across Gender...We report details of changes in hormonal patterns across high altitude sojourn. To our knowledge we are not aware of any study that has examined these hormones in same subjects and across gender during high altitude sojourn.” [http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0118730](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0118730)

- “At altitude, a very common reaction is increased urinary output. The body's kidneys sense the lower level of oxygen immediately and kick into high gear. The kidneys release a hormone, erythropoietin, that commands the bone marrow to produce more red blood cells to increase the oxygen-carrying capacity of the blood. To make room for the increased red cells, the body dumps fluid from the blood - excess urine and collection of fluid in the body's tissues are two direct results of these biological actions.” [https://www2.keck.hawaii.edu/observing/visitor/hyalt.html](https://www2.keck.hawaii.edu/observing/visitor/hyalt.html)

- “Cardiovascular and renal effects of chronic exposure to high altitude...Over 140 million people live at high altitude, defined as living at an altitude of 2400 m or more above sea level. Subjects living under these conditions are continuously living under hypoxic conditions and, depending on the population, various adaptations have developed. Interestingly, subjects living chronically at high altitude appear to have a decreased frequency of obesity, diabetes and coronary artery
disease. However, these benefits on health are balanced by the frequent development of systemic and pulmonary hypertension. Recently, it has been recognized that subjects living at high altitude are at risk for developing high-altitude renal syndrome (HARS), which is a syndrome consisting of polycythemia, hyperuricemia, systemic hypertension and microalbuminuria, but with preserved glomerular filtration rate. More studies should be performed to characterize the mechanisms and etiology of HARS; as such studies may be of benefit not only to the high-altitude population, but also to better understanding of the renal consequences of acute and chronic hypoxia.”

Altitude Diseases: High Altitude Retinal Hemorrhage (HARH)

- “High Altitude Retinal Hemorrhage...To conclude the pathophysiology of HARH remain still obscure and even the retina and the optic nerve are closely related to the brain and cranial structures there is no clear relation between HARH and HACE or even HAPE. Prevention to avoid lesions is mandatory even though retinal lesions could resolve spontaneously. Most of the posterior pole lesions resolve spontaneously in a few days or weeks, but a few of them can leave sequelae such as scotomas of visual field [7]. More research need to be done to rule out the relation between retinal and cerebral lesions to avoid severe and irreversible problems.” https://www.omicsonline.org/open-access/high-altitude-retinal-hemorrhage-2155-9570-1000632.php?aid=86574

- “Delayed Appearance of High Altitude Retinal Hemorrhages...When closely examined, a very large amount of climbers exhibit retinal hemorrhages during exposure to high altitudes. The incidence of retinal hemorrhages may be greater than previously appreciated as a definite time lag was observed between highest altitude reached and development of retinal bleeding. Retinal hemorrhages should not be considered warning signs of impending severe altitude illness due to their delayed appearance.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3040733/

- “High altitude retinal hemorrhage...The accessibility of high-altitude areas presents the risk of high altitude retinal hemorrhages (HARH). Four cases reported illustrate localized macular, diffuse, and familial incidence of HARH. Fluorescein angiography indicated no leakage, and a superficial retinal location of the hemorrhages. Marked retinal artery and vein dilation occurs. Ophthalmodynamometry showed retinal vascular hypertension in the presence of HARH. The complete resolution of hemorrhages occurs in most cases. Despite the return of visual acuity to normal, visual function studies indicate the persistence of defects.” https://www.ncbi.nlm.nih.gov/pubmed/1131078

- “High Altitude Retinal Hemorrhages–An Update...Retinal hemorrhages represent a common phenomenon in eyes of high altitude climbers. In this review, we present an update about this entity, with focus on its pathophysiology and practical implications. Due to their delayed appearance in the course of an expedition, retinal hemorrhages are not predictive when assessing the risk for life-threatening complications related to hypobaric hypoxia. Consequences for ocular health depend greatly on the extent and localization of retinal bleedings, but are generally mild and reversible in healthy eyes.” https://www.liebertpub.com/doi/abs/10.1089/ham.2012.1077?src=recsys&journalCode=ham

- “Retinal changes in various altitude illnesses...HARHs occur more frequently in younger individuals who perform strenuous exercise at high altitude. Its severity is significantly associated with illnesses like HAPE and HACE. As a majority of these patients show resolution of retinal lesions and recovery of visual acuity, visual symptoms alone are not an indication for urgent descent. However, in the event of progression or worsening of the symptoms, descent is mandatory.” https://apamedcentral.org/Synapse/Data/PDFData/0022SMJ/smj-52-685.pdf

- “High Altitude Retinal Hemorrhage...First retinal hemorrhages related with high altitude were detected in 1968 in Mount Logan in Canada. Their relation with high altitude were first described in 1970 by Frayser et al. And first optic disc changes associated with high altitude were described by Singh et al.[1,2]. The mountain sickness syndrome includes acute mountain syndrome (AMS), high altitude retinal hemorrhage (HARH) and the severe forms high-altitude pulmonary oedema (HAPE) and cerebral oedema (HACE). These diseases are different facets
of failure to acclimatize at high altitude. These conditions are associated with the rapid ascent to above 3000 m.”

- "Retinal hemorrhages do appear to be commonplace at altitudes above 12,000 to 14,000 feet, and may or may not reflect similar hemorrhages in the brain...Peripheral high altitude retinal hemorrhages (HARH) and retinal hypoxia do not permanently affect visual function. But macular hemorrhage threatens permanent partial visual loss. By the very nature of its random occurrence, macular hemorrhage can recur with repeated hypoxic exposure." Going Higher. Oxygen, Man, And Mountains.
**Altitude Diseases: Amaurosis**

- “Amaurosis (Greek meaning darkening, dark, or obscure) is vision loss or weakness that occurs without an apparent lesion affecting the eye.[1] It may result from either a medical condition or excess acceleration, as in flight. The term is the same as the Latin gutta serena.”
  https://en.wikipedia.org/wiki/Amaurosis
- “Amaurosis fugax (Latin fugax meaning fleeting, Greek amaurosis meaning darkening, dark, or obscure) is a painless temporary loss of vision in one or both eyes...The experience of amaurosis fugax is classically described as a temporary loss of vision in one or both eyes that appears as a "black curtain coming down vertically into the field of vision in one eye;" however, this altitudinal visual loss is relatively uncommon. In one study, only 23.8 percent of patients with transient monocular vision loss experienced the classic "curtain" or "shade" descending over their vision.[2] Other descriptions of this experience include a monocular blindness, dimming, fogging, or blurring.[3] Total or sectorial vision loss typically lasts only a few seconds, but may last minutes or even hours. Duration depends on the cause of the vision loss. Obscured vision due to papilledema may last only seconds, while a severely atherosclerotic carotid artery may be associated with a duration of one to ten minutes.[4] Certainly, additional symptoms may be present with the amaurosis fugax, and those findings will depend on the cause of the transient monocular vision loss.”
  https://en.wikipedia.org/wiki/Amaurosis_fugax
- “Transient Monocular Amaurosis at High Altitude.”
  https://www.liebertpub.com/doi/10.1089/152702901750067963
- “TRANSIENT AMAUROSIS ASSOCIATED WITH INTRAOCULAR GAS DURING ASCENDING HIGH–SPEED TRAIN TRAVEL.”
  https://journals.lww.com/retinajournal/Citation/2001/10000/TRANSIENT_AMAUROSIS_ASSOCIATED_WITH_INTRAOCULAR.18.aspx
- “High Altitude and the Eye...The purpose of this study was to review the available data on the effect of high altitude on the eyes. We carried out electronic literature search on www.pubmed.com for articles published through year 2011. The search terms included high altitude and the eye, high-altitude retinopathy, eye problems in the Himalayas, and eye diseases in Tibet. Other terms like visual functions, intraocular pressure, corneal thickness, tear function, and ocular motility, at high altitude, were searched separately and in combination. Data were retrieved from both prospective and retrospective studies published in the English language. High altitude has both short-term and long-term effects on the eyes. The short-term effects include high-altitude retinopathy, change in corneal thickness, and photokeratitis. Long-term effects include pterygium, cataract, and dry eye syndrome. High-altitude retinopathy of mild degree does not affect vision but has a predictive value for the development of high-altitude cerebral edema. Change in corneal thickness at altitude induces refractive changes in eyes with radial keratotomy and in eyes with LASIK. High altitude does not adversely affect visual acuity and contrast sensitivity; scotopic vision may be affected if supplemental oxygen is not used.”
  https://www.researchgate.net/publication/272474295_High_Altitude_and_the_Eye
- “Ocular Problems in High-Altitude Traveling: A Review With Focus on Management...Individuals whose travels take them to high altitudes may experience some ocular problems, particularly disorders related to dry and cold environments. Physicians, especially ophthalmologists, should be knowledgeable in prevention techniques and treatments for these conditions. The main management for ocular disorders related to dry and cold
environments include the use of eye shields and artificial tear drops. Descending to low-altitude lands is the key to management of eye problems associated with low-pressure environments. Patients with past ocular problems or ocular surgery should consult their doctors before ascending to high altitudes.”

http://www.ijtmgh.com/article_46490_93a5194d8196fd0ca71bb5b401b29a23.pdf

- “Retinal changes following rapid ascent to a high-altitude environment...PurposeTo determine what impact rapid ascension to a high-altitude environment has on the retina with the aim of preventing and treating high-altitude oculopathy.Patients and methodsParticipants in the study were members of the Chinese military assigned to the high-altitude environment of the Tibetan plateau. Ninety-one participants were enrolled in the study. Optical coherence tomography was used to measure the thickness of retina-related indicators. Measurements were taken before and after exposure to the high-altitude environment and upon return to the baseline altitude.ResultsFollowing exposure to the high-altitude environment in Tibet, there was a significant increase in retinal nerve fiber layer (RNFL) thickness in the temporal and nasal quadrants of the optic disc, whilst a significant decrease in RNFL thickness in the inferior optic disc was also observed. A significant increase in RNFL thickness in the superior and inferior macula was also evident, along with a significant increase in the ganglion cell layer thickness in the superior macula. Upon return to the baseline altitude, all measurements returned to baseline levels except for the RNFL of the inferior macula, which was significantly thicker. Pathological changes were also documented in the eyes of nine participants upon returning to baseline altitude, including ischemic optic neuropathy, myopia, and cortical amaurosis.ConclusionsThe high-altitude environment can have a negative impact on the health of the retina and may contribute to the incidence of various eye diseases. This study deepens the understanding of what impact a high-altitude environment has on retina and provides reliable data for blindness prevention and treatment.” https://www.ncbi.nlm.nih.gov/pubmed/28912514

- “A blurred view from Everest...Direct ophthalmoscopy showed engorged retinal veins and wide large flame-shaped haemorrhages extending into both maculae (figure). The climber descended to base camp and eventually flew home to Australia. The scotomas resolved in 3 months, but the flame-shaped haemorrhages took 6 months to resolve. When last seen in May, 2002, he had no complaints and no discernible ophthalmological abnormalities.”

https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(03)15017-9/fulltext
Altitude Diseases: Barotrauma

- “Barotrauma is physical damage to body tissues caused by a difference in pressure between a gas space inside, or in contact with the body, and the surrounding gas or fluid.[1][2] The initial damage is usually due to over-stretching the tissues in tension or shear, either directly by expansion of the gas in the closed space, or by pressure difference hydrostatically transmitted through the tissue. Tissue rupture may be complicated by the introduction of gas into the local tissue or circulation through the initial trauma site, which can cause blockage of circulation at distant sites, or interfere with normal function of an organ by its presence. Barotrauma generally manifests as sinus or middle ear effects, decompression sickness (DCS), lung overpressure injuries, and injuries resulting from external squeezes. Barotrauma typically occurs when the organism is exposed to a significant change in ambient pressure, such as when a scuba diver, a free-diver or an airplane passenger ascends or descends, or during uncontrolled decompression of a pressure vessel such as a diving chamber or pressurised aircraft, but can also be caused by a shock wave. Ventilator induced lung injury (VILI) is a condition caused by over-expansion of the lungs by mechanical ventilation used when the body is unable to breathe for itself, and is associated with relatively large tidal volumes and relatively high peak pressures. Barotrauma due to overexpansion of an internal gas-filled space may also be termed volutrauma. Bats can be killed by lung barotrauma when flying in low-pressure regions close to operating wind-turbine blades....Examples of organs or tissues easily damaged by barotrauma are: Middle ear (barotitis or aerotitis)[1][2][4][5][6][7]. Paranasal sinuses[1][2][5] (causing Aerosinusitis). Lungs[1][2][8][9]. Eyes[1][2] (the under-pressure air space is inside the diving mask[10]). Skin[1][2] (when wearing a diving suit which creates an air space). Brain and cranium (temporal lobe injury secondary to temporal bone rupture)[11]. Teeth (causing Barodontalgia, i.e., barometric pressure related dental pain,[12][13][14][15][16] or dental fractures[17][18][19]). Genital (squeeze and associated complications of P-valve use)[20].”
  https://en.m.wikipedia.org/wiki/Barotrauma

- “Dysbarism refers to medical conditions resulting from changes in ambient pressure.[citation needed] Various activities are associated with pressure changes. Underwater diving is the most frequently cited example, but pressure changes also affect people who work in other pressurized environments (for example, caisson workers), and people who move between different altitudes.”
  https://en.m.wikipedia.org/wiki/Dysbarism

- “Weather pains, weather-related pain, or meteoropathy is a phenomenon that occurs when people with conditions such as arthritis or limb injuries claim to feel pain, particularly with changes in barometric pressure, humidity or other weather phenomena.[1][2] Scientific evidence, however, does not support a connection between weather and arthritic pain and concludes that it is largely or entirely due to perceptual errors such as confirmation bias.[3][4] The term is from Greek meteora, celestial phenomena, and pathos, feeling, pain, suffering.”
  https://en.m.wikipedia.org/wiki/Weather_pains

- “TRAPPED GAS - AIR EXPANSION AT ALTITUDE... There are several locations in the human body where gas can accumulate and possibly become trapped. These medical conditions, known collectively as ‘Trapped Gases’ often lead to discomfort, pain, and possibly destruction of surrounding tissues. Much like the condition of decompression illness, trapped gases commonly affect aircrew and scuba divers, due to the frequent exposure to significant pressure changes. The most common locations where this medical condition will develop are the middle...”

ear, the sinuses, the lungs, the gastrointestinal tract, and the teeth.”  http://goflightmedicine.com/trapped-gas/

- “The most painful experience that I had in high altitude astronomy was ear barotrauma on descent from the observatory. After experiencing this horrible condition a few times, I got wise and would always carry nasal decongestant medication with me to help prevent it. I saw many people experience the condition so severe that we had to stop descending in the car and sit at the side of the road until it subsided in the unfortunate high altitude worker.” Steven Magee CEng MIET - Q
- “I now suffer from hearing loss and wonder how much high altitude work contributed to this condition?” Steven Magee CEng MIET - Q
- “All high altitude workers should have their hearing tested annually.” Steven Magee CEng MIET - Q
- “Ear Barotrauma...Occasional ear barotrauma is common, especially in environments where the altitude changes. While the condition isn’t harmful in some people, frequent cases may cause further complications.” https://www.healthline.com/health/ear-barotrauma
- “What impact does high altitude have on hearing loss?...If you’ve ever had ear pain when flying, you’ve experienced the effects of barotrauma. A result of the pressure changes that occur when moving to higher or lower altitudes, barotrauma often goes after a few hours but can cause serious hearing damage in some cases.” https://www.audioclinic.com.au/latest-news/advice-and-tips/what-impact-does-high-altitude-have-on-hearing-loss/
- “Ears & Altitude...Many experienced air travelers use a decongestant pill or nasal spray an hour or so before descent. This will shrink the membranes and help the ears pop more easily. Travelers with allergy problems should take their medication at the beginning of the flight for the same reason. Decongestant tablets and sprays can be purchased without a prescription. However, they should be avoided by persons with heart disease, high blood pressure, irregular heart rhythms, thyroid disease or excessive nervousness.” http://www.entcarolina.com/education-ears-altitude.php
- “EARS AND ALTITUDE. Your ears and altitude changes could cause a host of problems as the ear drum and middle ear are very sensitive to changes in atmospheric pressure. In order for the ear drum to vibrate most efficiently, air pressure on both sides of it should be the same. As atmospheric pressure changes, air pressure behind the ear drum (pressure in the middle ear) equilibrates to atmospheric air pressure by opening of the Eustachian tube which connects the middle ear space to the nasopharynx. This usually occurs unknowingly when you swallow. During rapid changes in air pressure as in flying and scuba diving, the Eustachian tube may sometimes act as a one way valve allowing air to escape from the middle ear but not allowing air to get back in. When this happens, there can be sudden tension on the ear drum which can cause severe ear pain and rupture of the ear drum. A rapid change in middle ear pressure can also lead to a fluid buildup in the middle ear and even rupture of one of the delicate membranes that separate the middle ear from the inner ear.” https://www.advancedent.com/conditions-we-treat/ear-hearing-disorders/ears-altitude/
- “Ear Barotrauma & Meniere’s. This is interesting because since I have Meniere’s Disease, any time a storm is coming I tend to get bad headaches & off balance. Once the storm has past I start to feel better. Guess I don’t need the local Weatherman.” https://livingwithmenieresdisease.com/2015/09/02/ear-barotrauma-menieres/
- “Ménière's disease (MD) is a disorder of the inner ear that is characterized by episodes of feeling like the world is spinning (vertigo), ringing in the ears (tinnitus), hearing loss, and a
fullness in the ear. Typically only one ear is affected, at least initially; however, over time both ears may become involved. Episodes generally last from 20 minutes to a few hours. The time between episodes varies. The hearing loss and ringing in the ears may become constant over time. The cause of Ménière's disease is unclear but likely involves both genetic and environmental factors. A number of theories exist for why it occurs including constrictions in blood vessels, viral infections, and autoimmune reactions. About 10% of cases run in families. Symptoms are believed to occur as the result of increased fluid build up in the labyrinth of the inner ear. Diagnosis is based on the symptoms and frequently a hearing test. Other conditions that may produce similar symptoms include vestibular migraine and transient ischemic attack. There is no known cure. Attacks are often treated with medications to help with the nausea and anxiety. Measures to prevent attacks are overall poorly supported by the evidence. A low salt diet, diuretics, and corticosteroids may be tried. Physical therapy may help with balance and counselling may help with anxiety. Injections into the ear or surgery may also be tried if other measures are not effective but are associated with risks. The use of tympanostomy tubes, while popular, is not supported. Ménière's disease was first identified in the early 1800s by Prosper Ménière. It affects between 0.3 and 1.9 per 1,000 people. It most often starts in people 40 to 60 years old. Females are more commonly affected than males. After 5 to 15 years of symptoms, the episodes of the world spinning generally stop and the person is left with mild loss of balance, moderately poor hearing in the affected ear, and ringing in their ear.

- "aerodontalgia [ār″o-don-tal′jah] toothache experienced at lowered atmospheric pressures, as in aircraft flight or in a decompression chamber, caused by the expansion of air in the maxillary sinuses." [Medical Dictionary](https://medical-dictionary.thefreedictionary.com/aerodontalgia)
- "Barodontalgia, commonly known as tooth squeeze and previously known as aerodontalgia, is a pain in tooth caused by a change in ambient pressure. The pain usually ceases at ground level. Dental barotrauma is a condition in which such changes in barometric pressure changes cause damage to the dentition. The most common victims are underwater divers because in deep dives pressures can increase by several atmospheres and military pilots because of rapid changes. In pilots, barodontalgia may be severe enough to cause premature cessation of flights." [Wikipedia](https://en.m.wikipedia.org/wiki/Barodontalgia)
Altitude Diseases: Barometric Pressure Issues

- “Feel It? 4 Ways Barometric Pressure Affects Your Health...Can you feel a storm coming a mile away? Have you been told you’re a human barometer who can sense changes in barometric pressure? You’re not crazy and you’re not alone. It is possible to feel that storm coming “in your bones” – or in your head...Some of the ways changing weather barometric pressure changes can affect your health include: 1 – Headaches and Migraine attacks, 2 – Blood pressure, 3 – Blood sugar, 4 – Joint pain.” [https://migraineagain.com/feel-4-ways-barometric-pressure-affects-health/]
- “Inverse Association between Air Pressure and Rheumatoid Arthritis Synovitis...Rheumatoid arthritis (RA) is a bone destructive autoimmune disease. Many patients with RA recognize fluctuations of their joint synovitis according to changes of air pressure, but the correlations between them have never been addressed in large-scale association studies. To address this point we recruited large-scale assessments of RA activity in a Japanese population, and performed an association analysis. Here, a total of 23,064 assessments of RA activity from 2,131 patients were obtained from the KURAMA (Kyoto University Rheumatoid Arthritis Management Alliance) database. Detailed correlations between air pressure and joint swelling or tenderness were analyzed separately for each of the 326 patients with more than 20 assessments to regulate intra-patient correlations. Association studies were also performed for seven consecutive days to identify the strongest correlations. Standardized multiple linear regression analysis was performed to evaluate independent influences from other meteorological factors. As a result, components of composite measures for RA disease activity revealed suggestive negative associations with air pressure. The 326 patients displayed significant negative mean correlations between air pressure and swellings or the sum of swellings and tenderness (p=0.00068 and 0.00011, respectively). Among the seven consecutive days, the most significant mean negative correlations were observed for air pressure three days before evaluations of RA synovitis (p=1.7×10−7, 0.00027, and 8.3×10−8, for swellings, tenderness and the sum of them, respectively). Standardized multiple linear regression analysis revealed these associations were independent from humidity and temperature. Our findings suggest that air pressure is inversely associated with synovitis in patients with RA.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3893195/]
- “I don't have problems with arthritis (yet) but those that I do know both here in Colorado Springs and in Denver do have problems with barometric pressure. Whether or not that really has an medical affect (or effect) on arthritis is still up in the air as to it's validity. The thing is, those I know with joint problems (me, it's allergies), can sense a thunderstorm coming on long before it's apparent.” [http://www.city-data.com/forum/denver/310811-how-arthritis-denver.html]
- “Altitude Sickness & Joint Aches... Altitude decompression sickness causes achy joints and pain among other symptoms.” [https://www.livestrong.com/article/552091-altitude-sickness-joint-aches/]
- “How Weather Impacts Knee Pain. Why do joints hurt more when the weather changes?...Many clinicians agree that changes in barometric pressure, or air pressure, can potentially cause an increase in joint pain. One theory is that the tissues that surround your knee function like a balloon and when the pressure from the air increases, those tissues cannot expand. However, the reverse is true as well. When the air pressure decreases, the tissues have room to expand and put pressure on your joint, causing pain.” [https://www.brainlab.org/how-
Altitude Diseases: Pressure Sensitivity

- “Testing with CPAP and APAP sleep apnea machines in June 2020 revealed that I am intolerant to anything but the lowest pressure setting of 4 cmH2O.” Steven Magee CEng MIET – Q
- “The APAP sleep apnea machine would trigger Descent Fatigue after concluding the therapy in the morning.” Steven Magee CEng MIET – Q
- “The CPAP sleep apnea machine would trigger insomnia during nighttime treatment.” Steven Magee CEng MIET – Q
- “High CPAP pressures would cause Aerophagia, upsetting my gastrointestinal system.” Steven Magee CEng MIET – Q
- “Continuous positive airway pressure (CPAP) is a form of positive airway pressure ventilator, which applies mild air pressure on a continuous basis. It keeps the airways continuously open in people who are able to breathe spontaneously on their own, but need help keeping their airway unobstructed. It is an alternative to positive end-expiratory pressure (PEEP). Both modalities stent the lungs’ alveoli open and thus recruit more of the lung’s surface area for ventilation, but, while PEEP refers to devices that impose positive pressure only at the end of the exhalation, CPAP devices apply continuous positive airway pressure throughout the breathing cycle. Thus, the ventilator itself does not cycle during CPAP, no additional pressure above the level of CPAP is provided, and patients must initiate all of their breaths.”
  https://en.wikipedia.org/wiki/Continuous_positive_airway_pressure
- “Automatic positive airway pressure. An automatic positive airway pressure device (APAP, AutoPAP, AutoCPAP) automatically titrates, or tunes, the amount of pressure delivered to the patient to the minimum required to maintain an unobstructed airway on a breath-by-breath basis by measuring the resistance in the patient's breathing, thereby giving the patient the precise pressure required at a given moment and avoiding the compromise of fixed pressure.”
  https://en.wikipedia.org/wiki/Positive_airway_pressure#Automatic_positive_airway_pressure
Altitude Diseases: Humidity

- “Humidity could be at 100% or at near to zero, depending on the weather atop the very high altitude summit Mauna Kea.” Steven Magee CEng MIET – Q
- “There were no control room humidifiers when I worked atop the very high altitude summit of Mauna Kea and they showed up as I was leaving.” Steven Magee CEng MIET – Q
- “Nasty chapped lips were always a problem at the end of several night shifts atop the very high altitude summit of Mauna Kea.” Steven Magee CEng MIET – Q
- “How Humidity Causes Joint Pain…Dehydration. Studies have determined a direct link between humidity and dehydoration in the body. High humidity levels in the air thicken the blood, which increases pressure in the blood vessels and requires more effort by the heart to pump blood throughout the body. According to “Nutrition Info: Dangers of Chronic Dehydration,” written by Albert Grazia, M.S., N.D., dehydration causes joint pain because joint cartilage contains large amounts of water. Hot and humid environments cause excess sweating and loss of body fluid.” https://www.caryortho.com/how-humidity-causes-joint-pain/
- “Why Humidity & Rain Affects Arthritis & How to Stop Weather Pains...many arthritis sufferers report feeling more arthritis pain when the air is filled with humidity. This could be because the body’s tendons, ligaments, and muscles expand when humidity rises and barometric pressure drops. Some studies also show that high humidity levels can cause sweating and dehydration which can make the blood thicker, which increases blood pressure in the blood vessels and makes the body work more to pump blood through the body.5,6 Humid days can also cause the body to become dehydrated, which can decrease the concentration of fluid around the joints and create more joint pain.” https://www.jointflex.com/humidity-affects-arthritis-pain/
- “Does Weather Affect Joint Pain?...Does Humidity Make Your Joints Hurt? Here’s Why, and What to Do About It. People with arthritis often notice a connection between humidity or temperature and joint pain symptoms. Here’s what you need to know…. “Patients often say they can tell when it’s going to rain based on how their joints feel,” says Anne R. Bass, MD, rheumatologist at Hospital for Special Surgery in New York City. “Humidity seems to be the biggest culprit, but we actually don’t know why.” There’s the rub: People with arthritis often notice a connection between humidity or temperature and joint pain symptoms, and may even report it to their doctors. It’s a complaint Brett Smith, DO, a rheumatologist with East Tennessee Medical Group, hears often.” https://creakyjoints.org/living-with-arthritis/humidity-joint-pain-arthritis/
Altitude Diseases: Mood Changes

- “Does Humidity Make Your Joints Hurt? Here’s Why, and What to Do About It...Mood changes. It has also been suggested that weather affects mood, which may alter peoples’ pain perception. Bad weather may lead to a bad mood, and therefore may indirectly affect arthritis symptoms.” [https://creakyjoints.org/living-with-arthritis/humidity-joint-pain-arthritis/](https://creakyjoints.org/living-with-arthritis/humidity-joint-pain-arthritis/)

- “Can Weather Affect Your Mood?...Denissen et al. (2008) found that weather’s daily influence has more of an impact on a person’s negative mood, rather than helping one’s positive mood. Higher temperatures were associated with an increase in a person’s negative feelings, feelings such as being more irritable, distressed, or jittery. The researchers also found that greater amounts of sunlight and less amounts of wind decreased these negative feelings...Seasonal affective disorder (SAD) is a very real kind of depressive disorder (technically referred to as a depressive disorder with seasonal pattern) wherein a person’s major depressive episode is connected to a specific season. While we most commonly think of SAD affecting only people in the fall or winter months, a minority of people also experience SAD during the spring and summer months too.” [https://psychcentral.com/blog/can-weather-affect-your-mood/](https://psychcentral.com/blog/can-weather-affect-your-mood/)

- “How The Weather Can Affect Our Moods | Modius Health...Do you find that the weather can have a big impact on your mood? You're absolutely not alone and it's totally normal. There is a lot of scientific proof that shows weather affects mood. In fact, researchers from Stanford University recently conducted an investigation into exactly how weather influences mood. They took to social media and performed sentiment analysis on posts from a long period of time, assessing the weather conditions that they were written in. The research discovered that less ideal weather conditions led to a worsened sentiment. Unpleasant conditions, humidity, cloud cover, precipitation and more were found to have an impact on mood.” [https://us.modiushealth.com/blogs/news/weather-mood](https://us.modiushealth.com/blogs/news/weather-mood)
Altitude Diseases: Mood & Weather

- “The very high altitude summit of Mauna Kea was always cold and the telescope domes were chilled to the nighttime temperature which was often below freezing in wintertime.” Steven Magee CEng MIET – Q
- “How Humidity Causes Joint Pain….Temperature Variations. Temperature variations have long been believed to be a trigger for joint pain in many individuals with arthritis or other bone and joint injuries. The Rothman Institute of Thomas Jefferson University Hospital stated that changes in weather, such as warm and dry to damp and cold also triggered baroreceptors in joints that caused increased sensation of joint pain in individuals of all ages. Humid weather especially causes already sensitive or inflamed tissues to expand, increasing pain for arthritis sufferers.” [https://www.caryortho.com/how-humidity-causes-joint-pain/]
- “Weather Can Change Your Mood…Humidity, temperature, and hours of sunshine had the greatest effect on mood. High levels of humidity lowered scores on concentration while increasing reports of sleepiness. Rising temperatures lowered anxiety and skepticism mood scores. [...] The number of hours of sunshine was found to predict optimism scores significantly. As the number of hours of sunshine increased, optimism scores also increased. [...] Another study by Sanders and Brizzolara (1982) on 30 college students also found similar findings — that high humidity was a predictor for lack of vigor, elation, and affection...So no, you’re not crazy if you think your mood is affected by the weather. Nearly 40 years of research suggests there’s a strong link. And one that, in some people, can lead to significant seasonal problems.” [https://psychcentral.com/blog/weather-can-change-your-mood/]
- “Contradicting conventional wisdom, researchers found that daily temperature, wind, sunlight, precipitation, air pressure, and how long the days were had no significant effect on positive mood. Temperature, wind, and sunlight were found to have an effect on negative mood. Sunlight seemed to play a role on how tired people said they were. Wind had more of a negative effect on mood in spring and summer than in fall and winter. Sunlight had a mitigating effect on whether people reported they were tired on days when it rained. People were so varied in how they responded that researchers write that a mood-weather link may still exist for individuals. When days become shorter, some people's moods mirrored that, while others actually felt more positive feelings. The authors speculate that those who begin to get darker moods as the days get shorter may be people at higher risk for seasonal affective disorder, or SAD.” [https://www.medicinenet.com/script/main/art.asp?articlekey=93481]
Altitude Diseases: Skeletal Hazards

- “Bone atrophy at high altitude...Abstract. The bone metabolism in high mountaineering was investigated. The bone densities of 24 members of Himalayan expedition parties were measured before and after expedition by single photon absorptiometry and digital image processing method. As a result, decrease of bone density of 1/6 radial distal portion was 3.2±5.4% (p<0.01). The bone atrophy tended to recover in 5 months and 12 months follow-up measurement, but did not recover completely in a year. Among the indices of bone metabolism, moreover, serum Ca and 1,25-(OH)2D3 decreased of 4.5±4.1% and 22.4±21.9% respectively, during the Himalayan expedition. Concerning the nutritional state, 4.5±4.0% decrease of body weight was observed, but the serum cholesterol was increased of 12.6±14.8%, and this fact could not be explained by malnutrition alone. The special environment of high mountain, that is, low barometric pressure and low oxygen tension, is probably responsible for the bone atrophy.” [link.springer.com/article/10.1007/BF02383459]

- “The Effect of High-Altitude on Human Skeletal Muscle Energetics: 31P-MRS Results from the Caudwell Xtreme Everest Expedition...Abstract. Many disease states are associated with regional or systemic hypoxia. The study of healthy individuals exposed to high-altitude hypoxia offers a way to explore hypoxic adaptation without the confounding effects of disease and therapeutic interventions. Using 31P magnetic resonance spectroscopy and imaging, we investigated skeletal muscle energetics and morphology after exposure to hypobaric hypoxia in seven altitude-naïve subjects (trekkers) and seven experienced climbers. The trekkers ascended to 5300 m while the climbers ascended above 7950 m. Before the study, climbers had better mitochondrial function (evidenced by shorter phosphocreatine recovery halftime) than trekkers: 16±1 vs. 22±2 s (mean ± SE, p<0.01). Climbers had higher resting [Pi] than trekkers before the expedition and resting [Pi] was raised across both groups on their return (PRE: 2.6±0.2 vs. POST: 3.0±0.2 mM, p<0.05). There was significant muscle atrophy post-CXE (PRE: 4.7±0.2 vs. POST: 4.5±0.2 cm2, p<0.05), yet exercising metabolites were unchanged. These results suggest that, in response to high altitude hypoxia, skeletal muscle function is maintained in humans, despite significant atrophy.” [www.ncbi.nlm.nih.gov/pmc/articles/PMC2873292/]

- “Influence of high-altitude grazing on bone metabolism of growing sheep...Concentrations of 25-OH-Vitamin D, carboxy-terminal telopeptide of type I collagen and activities of bone-specific alkaline phosphatase were always higher in the HA group than in the C group, except on the last two sampling dates. Bone mineral content and density increased in both groups during the experiment, but more intensively in the HA group. In addition, the cortical thickness of the HA group increased. The present study demonstrates an increase in bone turnover and mineral content of the bones of the growing sheep grazing in high alpine pastures.” [www.ncbi.nlm.nih.gov/pubmed/21992062]

- “Effects of altitude acclimatization and deacclimatization on bone and marrow volume in dog...Marrow fat in the whole skeleton as well as in the individual parts of the skeleton was lowered on acclimatization and increased on deacclimatization. Of the fat lost, one-third was from the flat bones while one-half of the fat deposited on deacclimatization occurred in flat bones. The marrow water as well as the functional marrow (fat-free, by definition) in either the whole or the various parts of the skeleton was increased on acclimatization and decreased on deacclimatization.” [https://www.physiology.org/doi/abs/10.1152/ajplegacy.1965.209.2.347]
Altitude Diseases: Polycythemia - Thick Blood

- “Polycythemia vera (POL-e-si-THEE-me-ah VAY-rah or VE-rah), or PV, is a rare blood disease in which your body makes too many red blood cells. The extra red blood cells make your blood thicker than normal. As a result, blood clots can form more easily. These clots can block blood flow through your arteries and veins, which can cause a heart attack or stroke. Thicker blood also doesn't flow as quickly to your body as normal blood. Slowed blood flow prevents your organs from getting enough oxygen, which can cause serious problems, such as angina (an-JI-nuh or AN-juh-nuh) and heart failure. (Angina is chest pain or discomfort.)...Another type of polycythemia, called secondary polycythemia, isn't related to the JAK2 gene. Long-term exposure to low oxygen levels causes secondary polycythemia. A lack of oxygen over a long period can cause your body to make more of the hormone erythropoietin (EPO). High levels of EPO can prompt your body to make more red blood cells than normal. This leads to thicker blood, as seen in PV. People who have severe heart or lung disease may develop secondary polycythemia. People who smoke, spend long hours at high altitudes, or are exposed to high levels of carbon monoxide where they work or live also are at risk. For example, working in an underground parking garage or living in a home with a poorly vented fireplace or furnace can raise your risk for secondary polycythemia.”

- “Polycythemia (Elevated Red Blood Cell Count)...Polycythemia is a condition that results in an increased level of circulating red blood cells in the bloodstream. People with polycythemia have an increase in hematocrit, hemoglobin, or red blood cell count above the normal limits. Polycythemia is normally reported in terms of increased hematocrit (hematocrit is the ratio of the volume of red blood cells to the total volume of blood) or hemoglobin concentration (hemoglobin is a protein responsible for transporting oxygen in the blood).”

- “Excessive polycythemia of high altitude: role of ventilatory drive and lung disease...Persons residing at high altitude who develop excessive polycythemia are more hypoxemic than normal high-altitude residents. We investigated the causes of hypoxemia in 20 patients with excessive polycythemia residing at an altitude of 3,100 m. Lung disease evidenced by abnormal spirometric features and results of a respiratory questionnaire was present in 10 of 20 patients and resulted in increased alveolar-arterial difference for PO2 [(A-a)PO2]. The excessive hypoxemia in the patients with normal lungs was not due to increased (A-a)PO2. We measured ventilatory responses to hypoxia and to hypercapnia to determine whether blunting of these responses was a cause of this excessive hypoxemia. We found, however, that chemical drives to breathe, although blunted, were the same in patients with polycythemia as in high-altitude control subjects. However, an abnormal breathing pattern was observed; the polycythemic patients had a smaller tidal volume and a greater ratio of dead space to tidal volume than did the normal subjects. In addition, the polycythemic patients had increased minute ventilation on breathing 100 percent O2, whereas the normal subjects did not. Thus, hypoxic depression of ventilation may have been present. Our findings suggested that blunted chemical drives are not causative in this disease, and that some other cause of hypoxemia must be present.”

- “The Polycythemia of High Altitudes: Iron Metabolism and Related Aspects...Observations on
the iron metabolism as related to the influence of a low oxygen tension at high altitudes, and after the disappearance of this factor upon return to sea level, have been made in human subjects. They consisted mainly of studies of intestinal absorption and turnover rate of iron by means of the radioactive isotope of this metal (Fe-59). Additional observations were made on blood volume, reticulocytosis, bone marrow cytology, life span of the red cells and hemoglobin breakdown pigments.”

- “Associations of high altitude polycythemia with polymorphisms in EPHA2 and AGT in Chinese Han and Tibetan populations...High altitude polycythemia (HAPC) refers to the long-term living in the plateau of the hypoxia environment is not accustomed to cause red blood cell hyperplasia. The pathological changes are mainly the various organs and tissue congestion, blood stasis and hypoxia damage. Although chronic hypoxia is the main cause of HAPC, the related molecular mechanisms remain largely unclear. This study aims to explore the genetic basis of HAPC in the Chinese Han and Tibetan populations. We enrolled 100 patients (70 Han, 30 Tibetan) with HAPC and 100 healthy control subjects (30 Han, 70 Tibetan). To explore the hereditary basis of HAPC and investigate the association between EPHA2 with AGT and HAPC in Chinese Han and Tibetan populations. Using the Chi-squared test and analyses of genetic models, rs2291804, rs2291805, rs3768294, rs3754334, rs6603856, rs6669624, rs11260742, rs13375644 and rs10907223 in EPHA2, and rs699, rs4762 and rs5051 in AGT showed associations with reduced HAPC susceptibility in Han populations. Additionally, in Tibetan populations, rs2478523 in AGT showed an increased the risk of HAPC. Our study suggest that polymorphisms in the EPHA2 and AGT correlate with susceptibility to HAPC in Chinese Han and Tibetan populations.”

- “Thick Blood (Hypercoagulability)... What are the symptoms of thick blood? Many don’t have any symptoms of thick blood until they experience a blood clot. The blood clot usually occurs in a person’s vein, which can cause pain and affect circulation in and around the area where the clot occurs...Having too many blood cells can lead to a variety of symptoms. Examples of these include blurred vision, dizziness, easy bruising, excessive menstrual bleeding, gout, headache, high blood pressure, itching skin, lack of energy, shortness of breath.”

- “All you need to know about thick blood...Other possible and frequently serious complications of blood clots are: Stroke if a blood clot moves to the brain and blocks an artery that sends oxygenated blood to the brain. Heart attack resulting from a blood clot in a coronary artery. Acute kidney injury, resulting from a blockage or blood clot of one or both of the renal veins that move blood away from the kidneys.”

- “5 Things You Need to Know About Thick Blood Disease...Most importantly, immediate medical care is needed if a blood clot, stroke or heart attack is suspected. A blood clot in the leg can cause redness, pain, warmth and swelling in the lower leg. A heart attack or a blood clot in the lungs or heart can cause shortness of breath, chest pain, chest heaviness or pressure and discomfort in the neck, jaw, upper back or arms. Symptoms of a stroke include difficulty speaking or understanding speech, headaches or paralysis that is typically on one side of the body. These symptoms require emergency medical care to determine the cause and receive life-saving treatment as soon as possible.”

- “Polycythaemia ...However, people with PV can have a slightly lower life expectancy than
normal due to the increased risk of problems, such as heart attacks and strokes. PV can also sometimes cause scarring of the bone marrow (myelofibrosis), which can eventually lead to you having too few blood cells. In some rare cases, the condition can develop into a type of cancer called acute myeloid leukaemia (AML).” https://www.nhs.uk/conditions/polycythaemia/
Altitude Diseases: Blood Clotting

- “New link between hypoxia and blood clot risk...Researchers have found how hypoxia (a low concentration of oxygen) decreases Protein S, a natural anticoagulant, resulting in an increased risk for the development of potentially life-threatening blood clots (thrombosis). Although hypoxia has been associated with an increased risk for thrombosis, this research showed for the first time a molecular cause.”

- “CO2, Blood pH and Respiratory Alkalosis: Causes and Effects...CO2, hypocapnia, and viscosity of blood. CO2 also influences the viscosity of blood. Acute hyperventilation and arterial hypocapnia make blood more viscous. This effect is part of the fight-and-flight response (an immediate reaction to stress). While this is useful in the short run to prevent loss of blood (due to bleeding), increased blood viscosity produces a large strain on the heart and can cause other negative effects such as thrombosis (formation of blood clots).”
  https://www.normalbreathing.org/co2-blood-ph-respiratory-alkalosis/

- "Venous thrombosis at altitude presents with distinct biochemical profiles: a comparative study from the Himalayas to the plains...High-altitude (HA) hypoxia exposure is believed to induce venous thromboembolism (VTE) in otherwise healthy individuals, although this needs to be fully established. The present study aims to ascertain the role of HA exposure in aggravating any predisposition toward VTE and to explore whether the etiology of HA-induced VTE is different from that of VTE closer to sea level. We compared manifestation-matched male VTE patients from HA (HAPs) and VTE patients from the plains closer to sea level (SLPs) for 54 parameters, including coagulation-related, fibrinolytic, and thrombophilic variables, as well as markers for stress and inflammatory response and platelet and endothelial activation. Our results established an association between HA hypoxia and VTE in alterations of primarily hemostatic variables. Approximately 96% of HAPs presented with ≥10 altered parameters out of 54 studied compared with 7% of SLPs. Elevated platelet count, von Willebrand factor, and clotting factors and altered coagulation exhibited significant associations with VTE events and altitude exposure (all P < .05). Additionally, most VTEs at HA were associated with younger age groups, unlike those on the plains. A receiver operator characteristic curve analysis revealed differences between HAPs and SLPs for CD40 ligand (area under the curve [AUC], 0.90; 95% confidence interval [CI], 0.84-0.96), P-selectin (0.79; 0.70-0.88), platelet factor-4 (0.90; 0.84-0.96), intracellular adhesion molecule-1 (0.86; 0.79-0.93), vascular cell adhesion molecule-1 (0.97; 0.95-0.99), vascular endothelial growth factor (0.87; 0.8-0.94), FLT4 (0.94; 0.89-0.99), and Toll-like receptor-2 (0.98; 0.96-1.0) (all P < .05). In conclusion, this study suggests that HA exposure perturbs the molecules associated with vascular integrity and contributes to the early onset of VTE."  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6880906/
Altitude Diseases: Deep Vein Thrombosis (DVT)

- “Acute mountain sickness high altitude pulmonary oedema (HAPE) and high altitude cerebral oedema (HACE) are common at high altitude but just a few cases of coronary and cerebral thrombosis and phlebitis of limbs have been reported1…The successful medical treatment results from the fact that all disorders of coagulation return to normal on decent to lower heights i.e. less than 10000 ft (ideally sea levels) and early anticoagulant therapy with adequate mobilization. This is to highlight the role of high altitude as a factor leading to tendency towards hypercoagulability.” [http://jpma.org.pk/full_article_text.php?article_id=2418](http://jpma.org.pk/full_article_text.php?article_id=2418)
- “High altitude induced deep venous thrombosis: A study of 28 cases... It is well recognized that a hypercoagulable state exists when a person is exposed to high altitude environment...In view of the greatly increased risk of getting deep venous thrombosis in leg veins at high altitude, we wish to define this definite disease entity as High Altitude Induced Deep Venous Thrombosis (HADVT).” [http://www.bioline.org.br/abstract?is06022](http://www.bioline.org.br/abstract?is06022)
- “What causes blood clots on long-haul flights?…Studies comparing people on long-haul flights to those sitting still on the ground have indicated that there is a difference between the two groups, although it isn't clear exactly why. Researchers have suggested that the explanation could lie with passenger stress, poor air quality, low humidity, low air pressure, or exposure to cosmic radiation.” [https://www.nature.com/news/2006/060515/full/060515-7.html](https://www.nature.com/news/2006/060515/full/060515-7.html)
- “Deep Vein Thrombosis and Pulmonary Embolism in a Mountain Guide: Awareness, Diagnostic Challenges, and Management Considerations at Altitude...For mountaineers and those working at high altitude, additional risks exist. However, despite there being a high degree of vigilance for “classic” conditions encountered at altitude (eg, acute mountain sickness, high altitude pulmonary edema, and high altitude cerebral edema), mainstream awareness regarding thrombotic conditions and their complications in mountain athletes is relatively low. This is significant because thromboembolic events (including deep vein thrombosis, pulmonary embolism, and cerebral vascular thrombosis) are not uncommon at altitude.” [https://www.wemjournal.org/article/S1080-6032(15)00349-X/pdf](https://www.wemjournal.org/article/S1080-6032(15)00349-X/pdf)
- “Hypoxia, such as encountered at high altitude, promotes deep vein thrombosis in mice...Venous thromboembolism (VTE), including deep vein thrombosis (DVT) and its life-threatening complication, pulmonary embolism (PE), are among the most frequent causes of morbidity and mortality in developed countries. In the United States alone, the number of deaths due to VTE approaches 300,000 annually [1]. Blood flow restriction or stasis is considered a major factor driving DVT [2]. Regardless of its initial cause (bed-ridden position, long-haul flights, limb paralysis, etc.), delayed blood renewal in stasis is believed to produce limited oxygen supply to the vein walls (hypoxia), especially in the valvular sinus, which triggers thrombus development [2].” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3773282/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3773282/)
- “Post-Thrombotic Syndrome...Post-thrombotic syndrome (PTS) is a long-term condition that occurs as a result of a deep vein thrombosis (DVT). The veins in our arms and legs have small valves inside that ensure the blood flows correctly back toward the heart. A DVT is a blockage or clot that obstructs the vein and can lead to the valves becoming damaged. More than one third of people who have DVT then develop PTS, the symptoms of which include redness, swelling, ulcers, and chronic leg pain. PTS can affect your mobility and is expensive to treat, so it’s best to take preventative measures. It is most common for a DVT to occur in the legs.” [https://www.healthline.com/health/post-thrombotic-syndrome](https://www.healthline.com/health/post-thrombotic-syndrome)
Altitude Diseases: Pulmonary Embolism (PE)

- “Pulmonary Embolism Masquerading as High Altitude Pulmonary Edema at High Altitude...Pulmonary embolism (PE) at high altitude is a rare entity that can masquerade as or occur in conjunction with high altitude pulmonary edema (HAPE) and can complicate the diagnosis and management. When HAPE cases do not improve rapidly with descent, other diagnoses, including PE, ought to be considered.”
  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5175419/

- “Pulmonary embolism at high altitude and hyperhomocysteinemia...This case report describes pulmonary embolism in a patient as a complication of extended stay at high altitude. He also had increased plasma homocysteine levels. Hypercoagulability at high altitude along with hyperhomocysteinemia is a risk factor for arterial and venous thrombosis.”
  https://www.researchgate.net/publication/7331673_Pulmonary_embolism_at_high_altitude_and_hyperhomocysteinemia

- “Profile of pulmonary embolism in service personnel posted at high altitude area...We evaluated the clinical presentation and risk factors of pulmonary embolism (PE) in soldiers posted at high altitude areas (HAA)...PE is a common complication of HAA and hereditary thrombophilia contributes in a minority of the patients. Further studies are needed to ascertain the risk factors of PE at HAA.”

- “About 86% of patients were between 20-40 years of age. Dyspnea was the commonest symptom (40%) while tachypnea was the commonest clinical finding in these soldiers. D-dimer value was < 250 in only 10% of patients. Pleural effusion was the commonest radiological abnormality(40%) while non-specific T-wave inversions were noted as the most frequent ECG change(44%). Ventilation-perfusion (V/Q) scan was confirmatory in 80% of patients and spiral CT chest in 56%. When the frequency of risk factors of pulmonary embolism were analyzed, 50% of patients had high altitude as the only risk factor. Hereditary thrombophilic disorder was found in 14%, connective tissue disorder/infections in 20% and miscellaneous others in 16%...Pulmonary embolism occurs at an increased frequency in soldiers working at high altitude, without any other co-existent risk factor.”
Altitude Diseases: Cerebral Vascular Thrombosis (CVT)

• “Cerebral venous thrombosis at high altitude: A systematic review...Long-term stays at high altitude in association with a hypercoagulable state - in particular, congenital or acquired thrombophilia - appears to predispose to CVT. The association of CVT with a single exposure to high altitude seems low, but the risk cannot as yet be specifically estimated.”
Altitude Diseases: Cerebral Venous Sinus Thrombosis (CVST)

- “Cerebral venous sinus thrombosis at high altitude...Cerebral venous sinus thrombosis (CVST) is a rare but potentially life-threatening medical condition. We describe a case of a 47-year-old woman who presented with headache, speech defects, and visual disturbances, and was later diagnosed with cerebral venous sinus thrombosis. The article describes a possible risk of such thrombotic events with exposure to high altitude environment in patients with coagulation defects such as Factor V Leiden mutation. Besides, such neurological conditions can occur independent of altitude illness and need to be recognized as their management differs.”

- “Cerebral Venous Sinus Thrombosis Masquerading as High Altitude Cerebral Edema at Extreme Altitude... Extreme altitude travel has gained popularity globally for adventurous, scientific, and military endeavors. Cerebral venous sinus thrombosis (CVST) at extreme altitude is a rare, covert, and emergent condition requiring immediate intervention... CVST at extreme altitude can occur spontaneously due to prolonged hypobaric hypoxia which can precipitate thrombosis through capillary damage, haemoconcentration, and a hypercoagulable state.”
  http://www.ijtmgh.com/article_33033_eec801fcd4adbba7c550fa55a3f167ff.pdf
Altitude Diseases: Sleep Degradation

- “How to Sleep Better at High Altitude...La Paz, Bolivia. Lhasa, Tibet. Cusco, Peru. These cities are high on many travelers’ lists of dream destinations—and they’re also high in altitude. If you’re planning to journey to these spots or another high-elevation environment, be prepared to make a few adjustments in your daily routine, as even the most experienced travelers are susceptible to altitude sickness. Also known as mountain sickness, altitude sickness doesn’t just make you dizzy and nauseous—it may negatively affect your sleep...Less Oxygen, Lower Sleep Quality. The reduced oxygen experienced at higher elevations can cause breathing troubles at night, which may disrupt sleep. The result is that people visiting high altitudes can experience less sleep overall, trouble falling asleep, and frequent awakenings throughout the night, leading to next-day fatigue. People with sleep apnea should be especially cautious, since their breathing troubles may only worsen in high-altitude locations. It’s important for those with the condition to pack and use their CPAP machine when traveling. Even the fittest people are not immune to the challenges of sleeping at altitude: Research has found that professional athletes experience shorter, poorer quality sleep at higher elevations.” [https://www.sleep.org/articles/how-to-sleep-better-at-high-altitude/](https://www.sleep.org/articles/how-to-sleep-better-at-high-altitude/)

- “How Sleep Is Influenced by Altitude...Researchers found that sleep disturbances in those who recently moved to a high altitude were common when measured by questionnaires. In one study, close to half of the tourists surveyed at a ski resort located roughly 11,500 feet above sea level reported disturbed sleep and frequent awakenings during the first night at their hotel...The review identified a study that suggested the higher the altitude, the bigger the impact on sleep. In that study, mountaineers who reached an altitude of 15,000 feet experienced more subjective insomnia and a reduction in deep sleep compared to lower altitudes...Researchers suggested that subtle changes in electrical brain activity due to mild oxygen deprivation may affect brain function and this could explain any subsequent impact on sleep. In fact, two studies included in the review found that when participants suffering from cognitive impairment at higher altitude were given supplemental oxygen at night, daytime performance improved...At lower altitudes (below 11,000 feet) periodic breathing improved by the second night. At higher altitudes (15,000 feet and above), periodic breathing actually increased for each night spent at altitude.” [https://www.healthcentral.com/article/how-sleep-is-influenced-by-altitude](https://www.healthcentral.com/article/how-sleep-is-influenced-by-altitude)

- “Altitude. Altitude sickness can mimic the symptoms of sleep apnea, and aggravate the symptoms of sufferers of sleep apnea. Altitude above 7500 feet will affect 25% of people, including otherwise healthy and even athletic individuals. While most people naturally acclimate in a period of days or weeks, some individuals remain affected by altitude as long as they remain above 7500 feet...A large study in Colorado found that 25% of people from low altitude ascending rapidly and sleeping at 8200ft (2500m) will develop AMS. These people may feel lousy for short while, but most of them will get better in a few days and not get sicker. About 1%, however, will develop more severe illness- high altitude cerebral edema (HACE, or brain swelling) or high altitude pulmonary edema (HAPE, or high blood pressure and fluid in the lungs). Both of these are life-threatening emergencies, and require immediate medical attention and descent if at all possible. For most people who suffer AMS (but not HACE), significant relief from symptoms is possible with treatment using Diamox and ensuring good hydration, limiting exertion and avoiding alcohol.” [http://www.cpaptalk.com/wiki/index.php/Altitude](http://www.cpaptalk.com/wiki/index.php/Altitude)
Altitude Diseases: Altitude Insomnia

- “What is Altitude Insomnia?...Many people suffer from insomnia with sleeplessness a common factor in their lives and it can be very debilitating. But there is another form called Altitude Insomnia and it occurs in approximately 25% of people who go two miles above sea level. This rare type of insomnia is also called Alpine Sickness, Hypobaropathy, Acosta’s Disease or Acute Mountain Sickness. It often occurs with pilots, military personnel and mountain climbers as an effect of high altitude.” [https://www.vitalsleep.com/pages/what-is-altitude-insomnia](https://www.vitalsleep.com/pages/what-is-altitude-insomnia)

- “5 Tips For Battling Altitude Insomnia...Altitude insomnia usually affects travelers visiting places in elevations of more than 2,000 feet..."This sleep disorder is really a byproduct of altitude sickness," explains Dr. Valentino. "People report waking up feeling breathless or with a headache." These symptoms, which also includes fatigue, come with the changes in altitude and affect the sleeper's comfort.” [https://www.huffpost.com/entry/altitude-insomnia-tips_n_903700](https://www.huffpost.com/entry/altitude-insomnia-tips_n_903700)

- “Altitude Insomnia: Studies During an Expedition to the Himalayas...During an expedition to the Himalayas, we studied the sleep and respiration of six climbers. Three ingested acetazolamide (500 mg) daily throughout the climb and the other three ingested placebo. At high altitude (4,150-4,846 m), each subject ingested temazepam (10 mg) for one night and placebo for another. Acetazolamide improved sleep above 2,750 m, but it is uncertain whether this was due to sedation or to improvements in arterial oxygen saturation. Sleep was markedly disturbed in all subjects above 4,000 m. Temazepam improved sleep, and in subjects taking acetazolamide, it reduced sleep-onset latencies and increased sleep efficiency close to that of sea level values. These observations suggest that the prophylactic use of acetazolamide is likely to improve sleep in climbers and that a low dose of a benzodiazepine such as temazepam (10 mg) may be beneficial at high altitude. Studies are now needed to exclude any possibility of respiratory impairment at altitude before a firm recommendation can be made regarding the routine use of this hypnotic.” [https://pubmed.ncbi.nlm.nih.gov/2905069/](https://pubmed.ncbi.nlm.nih.gov/2905069/)

- “Trouble Sleeping at Altitude? A New Solution.  If you love the mountains but visiting or living at altitude makes you toss and turn in bed, you’re not alone...Insomnia is a common reaction to visiting high altitude areas, along with other symptoms that include headaches, fatigue, digestive issues and nausea. Yet altitude-induced insomnia is different than altitude sickness and may not improve even with long term acclimatization.  “One of the main reasons many people often don’t sleep well at altitude is because when you go to altitude your body goes through a variety of adaptations as it’s trying to make up for the lack of oxygen,” says Larry Kutt, CEO of Altitude Control Technologies. Lack of oxygen triggers an unstable breathing pattern during sleep as the body struggles to restore normal oxygen levels. These breathing patterns — deep breaths followed by 5- to 15-second pauses in breathing — occur even in healthy people at altitudes above 6,000 feet and disrupt sleep even for people who sleep well at sea level.”[https://www.aspensojo.com/sponsored/2019/12/trouble-sleeping-at-altitude-a-new-solution](https://www.aspensojo.com/sponsored/2019/12/trouble-sleeping-at-altitude-a-new-solution)

- “Not Sleeping at Altitude? A New Solution. Oxygenate your mountain home for better sleep, more energy, and no altitude sickness...Altitude-induced insomnia is different than altitude sickness and may not improve even with long term acclimatization. Unfortunately this can be a long term problem that makes mountain living miserable. The answer might be simple: oxygenation. A series of studies show that altitude related insomnia responds well to oxygen. Adding oxygen to your bedroom can create the same oxygen levels found at sea level and eliminate the cause of high altitude insomnia. Sophisticated room oxygenation systems are now
Environmental Radiation LLC - https://www.environmentalradiation.com

available for high altitude homeowners from a company in Colorado that has been in the altitude simulation business for 20 years.” https://www.vailmag.com/sponsored/2017/07/not-sleeping-at-altitude
Altitude Diseases: Sleep Apnea

- “Effects of High Altitude on Sleep and Respiratory System and Theirs Adaptations...High-altitude (HA) environments have adverse effects on the normal functioning body of people accustomed to living at low altitudes because of the change in barometric pressure which causes decrease in the amount of oxygen leading to hypobaric hypoxia. Sustained exposure to hypoxia has adverse effects on body weight, muscle structure and exercise capacity, mental functioning, and sleep quality. The most important step of acclimatization is the hyperventilation which is achieved by hypoxic ventilatory response of the peripheral chemoreceptors. Hyperventilation results in increase in arterial carbon dioxide concentration. Altitude also affects sleep and cardiac output, which is the other determinant of oxygen delivery. Upon initial exposure to HA, the resting pulse rate increases rapidly, but with acclimatization, heart rate and cardiac output tend to fall. Another important component that leads to decrease in cardiac output is the reduction in the stroke volume with acclimatization. During sleep at HA, the levels of CO2 in the blood can drop very low and this can switch off the drive to breathe. Only after the body senses a further drop in O2 levels breathing is started again. Periodic breathing is thought to result from instability in the control system through the hypoxic drive or the response to CO2.”
  
  [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3654241/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3654241/)

- "Is There a Connection Between Sleep Apnea and High Altitude?...When a person visits or lives at a high altitude (greater than 4,000 feet), the air is thinner. In order to compensate, you breathe faster in an attempt to get more oxygen into your lungs, and your heart works harder to get oxygen-rich blood into circulation. At high altitudes, a breathing pattern know as high-altitude periodic breathing can occur whereby individuals alternate between rapid breathing and not breathing adequately. Altitude also impacts sleep as the low level of oxygen disrupts the area of your brain that monitors sleep. As a result, people might experience a decrease in the total time and quality of sleep, along with frequent instances of awakenings."
  

- "Central Sleep Apnea at High Altitude...The discovery of central sleep apnea (CSA) at high altitude is usually attributed to Angelo Mosso who published in 1898. It can occur in susceptible individuals at altitude above 2000 m, but at very high altitude, say above 5000 m, it will occur in most subjects. Severity is correlated with ventilatory responsiveness, particularly to hypoxia...It occurs due to the interaction of hypocapnia with stages 1 and 2 NREM sleep, in the presence of increased loop-gain...The severity of the CSA can be reduced by descent, supplemental oxygen therapy, oral or intravenous acetazolamide."
  

- "Central sleep apnea due to high-altitude periodic breathing...Central sleep apnea due to high-altitude periodic breathing affects about a quarter of people who ascend to 2500 meters and almost 100% of those who ascend to 4000 meters or higher. It is characterized by central apneas, periodic breathing, insomnia, and sleep fragmentation."
  
  [http://www.medlink.com/article/central_sleep_apnea_due_to_high-altitude_periodic_breathing](http://www.medlink.com/article/central_sleep_apnea_due_to_high-altitude_periodic_breathing)

- "What you need to know about sleep apnea at high altitude...At high altitude areas like Denver, the oxygen levels are low which results in certain physiological changes in the body to adjust to the climatic conditions and this process of adjustment is known as acclimatization. The body adjusts in a number of ways to compensate for the low oxygen availability. The breathing and the heart rate increases to inhale and supply more oxygen to the tissues. Increased urination is
also common as a response to the change in the body’s acid-base balance. Amongst all the changes, altitude affects the respiration the most and studies have shown the occurrence of sleep apnea at high altitude despite acclimatization, even in healthy individuals visiting or living at high altitudes."

- "High Altitudes Impact Sleep Apnea...When vacation time comes around, many people head to the mountains for camping, skiing, or just to get away from the hustle and bustle of their daily lives. Although a visit to the mountains is great for the spirit, sufferers of sleep apnea should take care. Sudden altitude gains can exacerbate your symptoms."  

- "Effects of altitude on sleep apnea...Altitude has a HUGE impact on your breathing. It can be a serious problem for those who do not have sleep apnea. You can get altitude sickness very easily and if your breathing is already reduced it might pose a serious risk to your life. I live in Colorado at 5,280 feet, and when we have visitors go up to the mountain passes we see that they sometimes get altitude sickness."  

- "Travelling to High Altitudes Lead to Difficult Sleeping- Review... High-altitude (HA) environments have adverse effects on the normal physiological functioning of body in the people who are accustomed to living at low altitudes. New arrivals to altitude commonly experience decline in quality sleep. Most people don’t sleep well at altitude. Sojourns commonly report vivid dreams, feelings of being suffocated and wake up in the morning feeling un-refreshed. These complaints are commonly associated with increased fragmentation of sleep by frequent brief arousals, which are in turn linked to periodic breathing...Changes in sleep architecture include a shift toward lighter sleep stages, with noticeable decrements in slow wave sleep and with variable decreases in REM sleep. Increased hypoxic ventilatory responsiveness and loss of regularization of breathing during sleep contribute to the occurrence of periodicity."  

- "Effects of Positive Airway Pressure on Patients with Obstructive Sleep Apnea during Acute Ascent to Altitude... In acute ascent to altitude, untreated obstructive sleep apnea (OSA) is often replaced with central sleep apnea (CSA). In patients with obstructive sleep apnea who travel to altitude, it is unknown whether their home positive airway pressure (PAP) settings are sufficient to treat their obstructive sleep apnea, or altitude-associated central sleep apnea....Acute altitude exposure in individuals with PAP-treated OSA had worsened hypoxemia during sleep, and increased hypopnea, suggesting that baseline PAP settings are insufficient at altitude. Application of PAP appears to reduce hypoxemia, hypopnea, and central apnea at altitude."  

- "FAA Announces New Policy for Sleep Apnea in Pilots...In 2008, the impact of sleep apnea (specifically, obstructive sleep apnea, or OSA) on pilots attracted heightened public attention when a commercial flight missed its destination. The commuter jet, carrying 40 passengers between islands in Hawaii, flew 26 miles past its destination. Air-traffic controllers lost contact with the jet for 18 minutes. Fortunately, the plane landed safely. The pilot was reported to suffer from previously undiagnosed OSA."  

- "FAA Revises Sleep Apnea Guidelines..., the Federal Aviation Administration (FAA) introduced rules that would have forced all pilots with a body mass index (BMI) of 40 or more to undergo mandatory sleep apnea testing. However, protests from pilots’ groups and timely action by the
House and Senate led FAA to back off and rewrite the rules, coming up with a new system for sleep apnea screening for pilots...the FDA’s own statistics note that of the 4917 pilots diagnosed with sleep apnea, only 347 (7%) have a BMI of 40 or greater...In the words of FAA, “Untreated OSA has always been and will continue to be a disqualifying medical condition.”" 

"Obstructive Sleep Apnea: From Simple Upper Airway Obstruction to Systemic Inflammation...Probably, the most important advance in the history of sleep medicine was the discovery of sleep apnea in 1965.1 For years, specialists looked into obstructive sleep apnea (OSA) as a simple, intermittent closure of the upper airway; hence, early treatments focused mainly on eliminating airway obstruction. Prior to the 1980s, the only effective treatment for OSA was tracheostomy, which bypasses the upper airway obstruction. The introduction of continuous positive airway pressure (CPAP) therapy through a nasal mask in 1981 marked another important discovery that fueled interest in sleep medicine practice and research.2 Since that time, our understanding of the features and consequences of OSA has progressed significantly, and it is now recognized as a major health issue...The body responds to severe and sustained hypoxia through a number of adaptive mechanisms that aim to improve tissue perfusion and oxygenation, such as increasing the levels of EPO. Shorter and milder intermittent nocturnal hypoxia may not stimulate the release of EPO or initiate other adaptive mechanisms. Winnicki et al showed an increase in EPO levels in patients with severe OSA; however, EPO levels remained stable in patients with mild OSA.14 Therefore, it seems that EPO levels in OSA patients are related to the degree and duration of nocturnal hypoxia, which may explain the discrepancy between different studies. Additionally, VEGF serum levels correlate with the severity of nocturnal hypoxemia. Indeed, Schulz et al demonstrated that patients with severe OSA had markedly increased levels of VEGF compared to patients with moderate OSA."
Altitude Diseases: Sleep Apnea & Eyes

- “The Eye and Sleep Apnea...Several eye disorders have been found in association with obstructive sleep apnea (OSA). This paper reviews the current state of knowledge of eye disorders associated with OSA. OSA is associated with a number of eye disorders including floppy eyelid syndrome (FES), optic neuropathy, glaucoma, non-arteritic anterior ischemic optic neuropathy and papilledema secondary to raised intracranial pressure. FES patients have a very high incidence of OSA and a causal relationship may exist, but amongst patients with OSA, FES is uncommon but commoner than in the general population. Treatment of OSA may help floppy eyelid syndrome, halt progression of associated glaucoma or optic neuropathy, and reduce intracranial pressure in patients with associated papilledema. Sleep apnea patients should be asked about ocular symptoms and appropriately examined or referred for assessment as some of the associated eye disorders may permanently impair vision. Ophthalmologists should be aware of the association of sleep apnea with these eye disorders and consider referral to a sleep physician for investigation and possible treatment.” [https://pubmed.ncbi.nlm.nih.gov/17628316/](https://pubmed.ncbi.nlm.nih.gov/17628316/)

- “5 Eye Conditions and Their Connection to Sleep Apnea...Floppy Eyelid Syndrome...Glaucoma...Nonarteritic Anterior Ischemic Optic Neuropathy...Papilledema...Retinal Vein Occlusion.” [https://valleysleepcenter.com/5-eye-conditions-and-their-connection-to-sleep-apnea/](https://valleysleepcenter.com/5-eye-conditions-and-their-connection-to-sleep-apnea/)

- “Do you know if you have sleep apnea? An eye exam may tell you...An association of OSA and eye and vision problems is very common and often missed during any type of eye exam or physician visit. At your next eye exam, consider if you have any of these symptoms and share them with your provider. You may help them catch something they otherwise might miss! There are three common eye-related OSA side effects to watch for: Floppy eyelid syndrome – this is the most common and the easiest to miss during your eye exam. The person often wakes with scratchy or irritated eye(s) and some mucus discharge (some people refer to it as crusty eyes) that comes and goes over a long period of time. Close to 100 percent of people with floppy eyelid syndrome have some form of OSA. Keratoconus – the person experiences irregular astigmatism and chronic blurred vision that glasses only partially correct. Glaucoma – everyone should be tested for glaucoma. Its association to OSA is often missed. If a provider suspects someone has glaucoma, and also has any risk factors for OSA, they should consider further screening.” [https://whatsnew.dentaquest.com/do-you-know-if-you-have-sleep-apnea-an-eye-exam-may-tell-you/](https://whatsnew.dentaquest.com/do-you-know-if-you-have-sleep-apnea-an-eye-exam-may-tell-you/)

- “Ophthalmic Diseases in Patients With Obstructive Sleep Apnea...Symptomatic obstructive sleep apnea (OSA) affects 2% of women and 4% of men, but the prevalence of asymptomatic OSA is significantly higher. Several ophthalmic conditions are associated with OSA, including floppy eyelid syndrome, glaucoma, nonarteritic anterior ischemic optic neuropathy, papilledema, keratoconus, and central serous chorioretinopathy. The purpose of this review is to provide primary care physicians with a general knowledge of the signs, symptoms, and management of the ophthalmic diseases associated with OSA.” [https://jaoa.org/article.aspx?articleid=2538812](https://jaoa.org/article.aspx?articleid=2538812)

- “Sleep Apnea’s Effect on the Eyes...If a good night's sleep helps the brain and body perform better, it's a good guess that sleep problems can cause more than just fatigue. Numerous studies have shown a connection between sleep disorders and medical conditions such as cardiovascular disease, cerebrovascular disease, and metabolic disorders, including the risk of
obesity and diabetes. Now researchers outline several interesting associations between sleep disorders and eye disease.” [https://www.alaskasleep.com/blog/sleep-apneas-effect-on-the-eyes](https://www.alaskasleep.com/blog/sleep-apneas-effect-on-the-eyes)
Altitude Diseases: Central Sleep Apnea

- “Central Sleep Apnea at High Altitude...The discovery of central sleep apnea (CSA) at high altitude is usually attributed to Angelo Mosso who published in 1898. It can occur in susceptible individuals at altitude above 2000 m, but at very high altitude, say above 5000 m, it will occur in most subjects. Severity is correlated with ventilatory responsiveness, particularly to hypoxia. Theoretically, it should spontaneously improve with time and acclimatization. Although the time course of resolution is not well described, it appears to persist for more than a month at 5000 m. It occurs due to the interaction of hypocapnia with stages 1 and 2 NREM sleep, in the presence of increased loop-gain. The hypocapnia is secondary to hypoxic ventilatory drive. With acclimatization, one might expect that the increase in PaO2 and cerebral blood flow (CBF) would mitigate the CSA. However, over time, both the hypoxic and hypercapnic ventilatory responses increase, causing an increase in loop gain which is a counteracting force. The severity of the CSA can be reduced by descent, supplemental oxygen therapy, oral or intravenous acetazolamide. Recent studies suggest that acute further increases in cerebral blood flow will substantially, but temporarily, reduce central sleep apnea, without altering acid based balance. Very recently, bi-level noninvasive ventilation has also been shown to help (mechanism unknown). Sleep quality can be improved independent of the presence of CSA by the use of benzodiazepine sedation.”

- “Central sleep apnea causes...High altitudes. Irregular breathing such as that attributed to Cheyne-Stokes can also be caused by high altitudes and less oxygen. The low oxygen levels found at high altitude is well known to cause alternating rapid breathing (hyperventilation) and “under breathing” (hypoventilation), and is thought to also be a cause for central sleep apnea. Complex sleep apnea. When someone has symptoms of both central sleep apnea and obstructive sleep apnea, this is referred to as complex sleep apnea (or, sometimes, mixed sleep apnea). It’s believed that complex sleep apnea can be caused by the use of continuous positive airway pressure (CPAP) to treat OSA, blurring the lines between the two types of sleep apnea even further.”

- “What you need to know about sleep apnea at high altitude...Altitude induced apnea or central sleep apnea is a disorder in which the breathing invariably stops and starts during sleep. The low oxygen level at altitudes directly affects the sleep center of the brain resulting in disturbed sleep, decrease in total sleep time, reduced sleep efficiency and sleepiness throughout the day. CSA is the condition of irregular, periodic breathing during sleep and it occurs because the brain fails to send across right signals to the muscles involved in breathing during sleep. As the oxygen levels are low, the oxygen sensors in the body signals the brain to increase breathing (hyperventilation) which in turn, leads to increase in oxygen and decrease of carbon dioxide in the body. The low carbon dioxide levels then send across signals to the brain to stop breathing to cover up the low CO2 levels and thus, breathing stops for about 12 seconds and resumes again taking in more oxygen. This results in an irregular pattern of breathing causing trouble sleeping. CSA differs from another common form of sleep apnea known as obstructive sleep apnea (OSA) in which breathing is affected due to some obstruction in the upper airway passages. Manifestations of CSA. If you are experiencing the following symptoms in addition to trouble sleeping you should seek medical help: Nocturnal choking leading to abrupt awakenings from sleep. Irregular breathing during sleep. Excessive sleepiness during the day. Morning headache. Mood changes. Shortness of breath that wakes you from sleep and is better
by sitting up. Chronic fatigue.” [https://www.denversleeps.com/sleep-apnea-at-high-altitude/]

- “The 3 Types of Sleep Apnea Explained: Obstructive, Central, & Mixed...People sleeping at higher altitudes than they're accustomed to. Symptoms usually go away after returning to regular altitude.” [https://www.alaskasleep.com/blog/types-of-sleep-apnea-explained-obstructive-central-mixed]

- “Central sleep apnea due to high-altitude periodic breathing...This article includes discussion of central sleep apnea due to high-altitude periodic breathing, altitude insomnia, and high-altitude periodic breathing. The foregoing terms may include synonyms, similar disorders, variations in usage, and abbreviations...In this article, the authors explain the basics of central sleep apnea due to high-altitude periodic breathing. Included are updates related to sleep timing, oxygen saturation and pulse oxymetry measurements at high-altitude. Central sleep apnea due to high-altitude periodic breathing affects about a quarter of people who ascend to 2500 meters and almost 100% of those who ascend to 4000 meters or higher. It is characterized by central apneas, periodic breathing, insomnia, and sleep fragmentation. There are a variety of medications that may be beneficial, including sedative hypnotics, acetazolamide, steroids, and nonsteroidal anti-inflammatory drugs (NSAIDs). Women are more resistant to the effects of high altitude than men. Pregnant women at high altitudes tend to have increased neonatal complications and high risk of low birthweight in newborns.” [http://www.medlink.com/article/central_sleep_apnea_due_to_high-altitude_periodic_breathing]

- “The Effects of Altitude Associated Central Apnea on the Diagnosis and Treatment of Obstructive Sleep Apnea: Comparative Data from Three Different Altitude Locations in the Mountain West...This study demonstrates that central apnea becomes significantly more common at increasing altitude in both diagnostic and treatment portions of split-night polysomnography in patients with significant OSA. An apparent exponential increase in the percentage of OSA patients with a CAI > 5.0 occurs with increasing altitude. Altitude associated central apnea has a significant negative effect on the quality of OSA treatment obtained during PAP titration for patients living at the altitudes addressed in this study.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3227706/]

- "Central sleep apnea (CSA) or central sleep apnea syndrome (CSAS) is a sleep-related disorder in which the effort to breathe is diminished or absent, typically for 10 to 30 seconds either intermittently or in cycles, and is usually associated with a reduction in blood oxygen saturation.[1][2] CSA is usually due to an instability in the body's feedback mechanisms that control respiration.[3] Central sleep apnea can also be an indicator of Arnold–Chiari malformation...CSA is divided in 6 categories, Primary CSA, Cheyne–Stokes respiration, High-altitude periodic breathing, CSA due to a medical condition without CSB, Central sleep apnea due to a medication or substance and Treatment Emergent Central Apnea (also called Complex Sleep Apnea)...High-Altitude Periodic Breathing requires that the patient has recently been at least 2500 meters.” [https://en.m.wikipedia.org/wiki/Central_sleep_apnea]

- "Central Sleep Apnea...There are several types of central sleep apnea, each with a different cause...High-altitude periodic breathing. Many people have trouble breathing when they go up to a high elevation, usually 2,500 meters (8,000 feet) or more.” [https://www.webmd.com/sleep-disorders/sleep-apnea/central-sleep-apnea#1]

- "Central sleep apnea is a disorder in which your breathing repeatedly stops and starts during sleep. Central sleep apnea occurs because your brain doesn't send proper signals to the muscles that control your breathing. This condition is different from obstructive sleep apnea, in which you can't breathe normally because of upper airway obstruction. Central sleep apnea is less
common than obstructive sleep apnea. Central sleep apnea may occur as a result of other conditions, such as heart failure and stroke. Sleeping at a high altitude also may cause central sleep apnea. Treatments for central sleep apnea may involve treating existing conditions, using a device to assist breathing or using supplemental oxygen."

https://www.mayoclinic.org/diseases-conditions/central-sleep-apnea/symptoms-causes/syc-20352109

- "Central sleep apnea (CSA) or central sleep apnea syndrome (CSAS) is a sleep-related disorder in which the effort to breathe is diminished or absent, typically for 10 to 30 seconds either intermittently or in cycles, and is usually associated with a reduction in blood oxygen saturation.[1][2] CSA is usually due to an instability in the body's feedback mechanisms that control respiration.[3] Central sleep apnea can also be an indicator of Arnold–Chiari malformation." https://en.wikipedia.org/wiki/Central_sleep_apnea

- "The astronomy managers never told us about the central sleep apnea risks, even though we would work and sleep at high altitude." Steven Magee CEng MIET – Q

- "There was no monitoring of astronomy staff for central sleep apnea, even when we would sleep at high altitude." Steven Magee CEng MIET – Q

- "When I worked the day shift at the W. M. Keck Observatory, a registered nurse came to visit and commented that my breathing during sleep was irregular. I had no idea what central sleep apnea was at that time and ignored the comment. Many years later I was diagnosed with sleep apnea." Steven Magee CEng MIET – Q

- "A registered nurse (RN) is a nurse who has graduated from a nursing program and met the requirements outlined by a country, state, province or similar government-authorized licensing body to obtain a nursing license.[1] An RN's scope of practice is determined by legislation, and is regulated by a professional body or council. Registered nurses are employed in a wide variety of professional settings, and often specialize in a field of practice. They may be responsible for supervising care delivered by other healthcare workers, including student nurses, licensed practical nurses (except in Canada), unlicensed assistive personnel, and less-experienced Rns. Registered nurses must usually meet a minimum practice hours requirement and undertake continuing education to maintain their license.[2] Furthermore, there is often a requirement that an RN remain free from serious criminal convictions." https://en.wikipedia.org/wiki/Registered_nurse

- "Keeping a human in a state of high altitude induced central sleep apnea for many years should be expected to bring on a wide range of adverse health conditions." Steven Magee CEng MIET – Q

- "Central Sleep Apnea...The most common symptom of central sleep apnea is short periods during sleep when breathing stops. Some people exhibit very shallow breathing instead of actually stopping breathing. You may wake up feeling short of breath. The lack of oxygen can cause you to wake up frequently throughout the night, and can lead to insomnia. Other symptoms associated with central sleep apnea occur during the day as a result of an interrupted night’s sleep. You may feel very sleepy during the day, have trouble concentrating or focusing on tasks, or have a headache when you wake up. Central sleep apnea caused by Parkinson’s disease or other neurological conditions can be characterized by additional symptoms, including: difficulty swallowing, changes in speech patterns, changes in voice, generalized weakness" https://www.healthline.com/health/sleep/central-sleep-apnea#symptoms


- "Stroke, cancer and death: the long-term risks of sleep apnea...Moderate to severe obstructive sleep apnea makes you four times more likely to die when the sleep disorder is left untreated in the long term. A recent study in the Journal of Clinical Sleep Medicine found that sleep apnea is independently associated with an increased risk of stroke, cancer and death." [http://sleepeducation.org/news/2014/04/16/stroke-cancer-and-death-the-long-term-risks-of-sleep-apnea](http://sleepeducation.org/news/2014/04/16/stroke-cancer-and-death-the-long-term-risks-of-sleep-apnea)

- "Health Consequences...Obstructive sleep apnea increases the risk of developing hypertension, heart disease including heart attacks and heart failure, stroke, and diabetes." [http://healthysleep.med.harvard.edu/sleep-apnea/living-with-osa/health-consequences](http://healthysleep.med.harvard.edu/sleep-apnea/living-with-osa/health-consequences)

- "Mechanisms and Clinical Consequences of Untreated Central Sleep Apnea in Heart Failure...Central sleep apnea (CSA) is a highly prevalent, though often unrecognized, comorbidity in patients with heart failure (HF). Data from HF population studies suggest that it may present in 30% to 50% of HF patients. CSA is recognized as an important contributor to the progression of HF and to HF-related morbidity and mortality. Over the past 2 decades, an expanding body of research has begun to shed light on the pathophysiologic mechanisms of CSA. Armed with this growing knowledge base, the sleep, respiratory, and cardiovascular research communities have been working to identify ways to treat CSA in HF with the ultimate goal of improving patient quality of life and clinical outcomes. In this paper, we examine the current state of knowledge about the mechanisms of CSA in HF and review emerging therapies for this disorder." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4391015/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4391015/)

- "Exacerbation of sleep apnoea by frequent central events in patients with the obstructive sleep apnoea syndrome at altitude: a randomised trial...Many patients with the obstructive sleep apnoea syndrome (OSA) travel to the mountains for recreational and professional activities while temporarily discontinuing continuous positive airway pressure (CPAP) treatment. A study was undertaken to evaluate the hypothesis that altitude would aggravate their hypoxaemia, sleep-related breathing disturbances and impair daytime performance...Altitude exposure in untreated patients with OSA aggravates hypoxaemia, increases sleep-related breathing disturbances due to frequent central apnoeas/hypopnoeas, impairs driving simulator performance and induces cardiovascular stress. These findings have implications for counselling and treating patients with OSA planning to travel to high altitude." [https://thorax.bmj.com/content/65/5/429](https://thorax.bmj.com/content/65/5/429)

- "The Effects of Altitude Associated Central Apnea on the Diagnosis and Treatment of Obstructive Sleep Apnea: Comparative Data from Three Different Altitude Locations in the Mountain West...This study demonstrates that central apnea becomes significantly more common at increasing altitude in both diagnostic and treatment portions of split-night polysomnography in patients with significant OSA. An apparent exponential increase in the percentage of OSA patients with a CAI > 5.0 occurs with increasing altitude. Altitude associated central apnea has a significant negative effect on the quality of OSA treatment obtained during PAP titration for patients living at the altitudes addressed in this study." [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3227706/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3227706/)

- "Influence of Cerebral Blood Flow on Central Sleep Apnea at High Altitude...To further our understanding of central sleep apnea (CSA) at high altitude during acclimatization, we tested the hypothesis that pharmacologically altering cerebral blood flow (CBF) would alter the severity of CSA at high altitude...Measurements and Results: Arterial blood gases, hypoxic and
hypercapnic ventilatory responses, and CBFv and its reactivity to carbon dioxide were measured awake. Overnight polysomnography was performed. The central apnea-hypopnea index was elevated following administration of indomethacin (89.2 ± 43.7 to 112.5 ± 32.9 events/h; mean ± standard deviation; P < 0.05) and was reduced following IV acetazolamide (89.2 ± 43.7 to 47.1 ± 48.1 events/h; P < 0.001). Intravenous acetazolamide elevated CBFv at high altitude by 28% (95% confidence interval [CI]: 22-34%) but did not affect ventilatory responses. The elevation in CBFv was partly mediated via a selective rise in partial pressure of arterial carbon dioxide (PaCO2) (28 ± 4 to 31 ± 3 mm Hg) and an associated fall in pH (P < 0.01). Oral indomethacin reduced CBFv by 23% (95% CI: 16-30%), blunted CBFv reactivity, and increased the hypercapnic ventilatory response by 66% (95% CI: 30-102%) but had no effect on PaCO2 or pH. Conclusion: Our findings indicate an important role for cerebral blood flow regulation in the pathophysiology of central sleep apnea at high altitude."
Altitude Diseases: Complex Sleep Apnea

- “Complex Sleep Apnea (CPAP Emergent Central Apneas), and Apnea Related to Narcotics and to Altitude...Complex sleep is the persistence of or emergence of central apneas on CPAP, when a patient with obstructive sleep apnea is treated with CPAP. Its recognition by the primary care provider is important since it may affect the patient’s ability to comply with and improve from therapy. It may be more common in obstructive sleep apnea patients with cardiac disease, on narcotics or living at altitude, but it is also common in patients with none of these risk factors. Treatment strategies range from watchful waiting on CPAP alone, using CPAP with adaptive servo ventilation, adding in-line O2 with CPAP, adding dead space or in-line CO2 to CPAP, or combinations of these strategies. Narcotic medication may cause central sleep apnea, worsen obstructive sleep apnea, and predispose patients to complex sleep apnea. The tendency for the hypoxia of altitude to cause central apneas with periodic breathing may affect healthy mountaineers at high altitudes, and also affect obstructive sleep apnea patients traveling to or living at even moderate altitudes.” [https://link.springer.com/chapter/10.1007/978-1-4939-1185-1_13]

- “For some sleep apnea patients that use CPAP machines, they develop the more severe Complex Sleep Apnea during long term treatment.” Steven Magee CEng MIET – Q

- “Mayo Clinic Discovers New Type Of Sleep Apnea...2006...Researchers at Mayo Clinic have identified a new type of sleep apnea they call "complex sleep apnea." The newly discovered type, complex sleep apnea, is a combination of both obstructive and central sleep apneas... Patients with complex sleep apnea at first appear to have obstructive sleep apnea and stop breathing 20 to 30 times per hour each night. But unlike typical obstructive sleep apnea patients, their breathing problem is not completely alleviated by a CPAP (continuous airway pressure) machine, which functions like a pneumatic splint to open a patient's airway. Instead, once the CPAP is applied to complex sleep apnea patients, the obstruction seems to dissipate, but still they do not breathe properly. Symptoms of central sleep apnea then appear and fragmented sleep results, due to frequent pauses in breathing.” [https://www.sciencedaily.com/releases/2006/09/060901161349.htm]

- “For some patients who undergo CPAP treatment for OSAS, CPAP therapy leads to the development of recurrent central apneas or even clear periodic breathing. This phenomenon of obstructive events or mixed central and obstructive events with short cycles of obstruction and the incomplete response to positive airway pressure (PAP) due to CPAP treatment related central events has been labeled “complex sleep apnea syndrome”...Complex sleep apnea syndrome is the diagnostic term for the form of central sleep apnea that persists or develops upon treatment of primarily obstructive sleep apnea with CPAP. The pathogenesis likely is related to a combination of the impact of CPAP therapy on ventilation, disturbed ventilatory control related to sleep and host response, and other medical comorbidities. It is more common in men, coronary artery disease, and those with congestive heart failure. The vast majority will be successfully treated with CPAP but caution is recommended to ensure that the CPAP pressure setting is limited to treating only the obstructive breaths (limited over titration). For those who are poor candidates for CPAP therapy and those who are CPAP therapy failures, more advanced respiratory assist devices including bilevel PAP-ST or adaptive servoventilation therapy can be effective. Other therapeutic medications such as acetazolamide or theophylline may offer an alternative when positive pressure devices of any type are ineffective or poorly
tolerated. New devices aimed at increasing the amount of inhaled carbon dioxide gas to stabilize the breathing pattern appear promising and are under development.”
Altitude Diseases: Periodic Breathing

- “There was no monitoring of sleep in very high altitude workers that were sleeping at 9,200 feet. No warnings were given about high altitude induced sleep disorders.” Steven Magee CEng MIET - Q
- “Central sleep apnea due to high-altitude periodic breathing...In this article, the authors explain the basics of central sleep apnea due to high-altitude periodic breathing. Included are updates related to sleep timing, oxygen saturation and pulse oxymetry measurements at high-altitude. Key points. Central sleep apnea due to high-altitude periodic breathing affects about a quarter of people who ascend to 2500 meters and almost 100% of those who ascend to 4000 meters or higher. It is characterized by central apneas, periodic breathing, insomnia, and sleep fragmentation. There are a variety of medications that may be beneficial, including sedative hypnotics, acetazolamide, steroids, and nonsteroidal anti-inflammatory drugs (NSAIDs). Women are more resistant to the effects of high altitude than men. Pregnant women at high altitudes tend to have increased neonatal complications and high risk of low birthweight in newborns. Historical note and terminology. High-altitude insomnia and high-altitude periodic breathing are no longer diagnostic categories in the 2014 International Classification of Sleep Disorders, 3rd edition (American Academy of Sleep Medicine 2014). The current nomenclature is central sleep apnea due to high-altitude periodic breathing, which is characterized by cyclic periods of central apnea and hypopnea, usually accompanied by frequent awakenings, poor quality sleep, sense of suffocation, and fatigue at high altitudes.”
  https://www.medlink.com/article/central_sleep_apnea_due_to_high-altitude_periodic_breathing
- “ALTITUDE SICKNESS...Every year, people die of altitude sickness. All of these deaths are preventable. If you are travelling above 2500m (8000ft), read this information and tell your companions about it - it could save your life…Two things are certain to make altitude sickness very likely - ascending faster than 500m per day, and exercising vigourously. Physically fit individuals are not protected - even Olympic athletes get altitude sickness. Altitude sickness happens because there is less oxygen in the air that you breathe at high altitudes....Periodic breathing (Cheyne Stokes breathing, or PB) is common at high altitude and becomes more frequent with increasing altitude. Periodic breathing involves alternating periods of deep breathing and shallow breathing. Typically, three to five deep breaths will be followed by a couple of very shallow breaths or even a complete pause in breathing. A pause in breathing like this usually lasts around 5 to 15 seconds and is called an apnoea. Apnoeas may end with a gasp that sometimes wakes the individual or their sleeping companions! People may breathe this way for most of the night. During apnoeic phases, oxygen levels drop and heart rate slows. Oxygen levels and heart rate rise again when breathing resumes resulting in cyclical variations in heart rate and the amount of oxygen in the blood. Low oxygen levels overnight are likely to disturb sleep but PB may also contribute to arousals: periods when you almost or completely wake up. Arousals are more frequent at altitude, but they can occur even in the absence of periodic breathing. Perhaps surprisingly, although PB may disturb sleep, it doesn’t seem to make the other symptoms of acute mountain sickness worse. Why does periodic breathing happen? At sea level the build up of the waste gas, carbon dioxide, in the blood controls breathing. If you hold your breath, carbon dioxide levels rise and create the urge to breathe. At high altitude, the body senses low oxygen levels and this becomes the main drive to breathe. Breathing faster and deeper at high altitude leads to a profound reduction in the carbon dioxide levels in the blood.
You can read more about the effects of breathing harder at altitude here. During sleep at high altitude, the levels of carbon dioxide in the blood can drop very low and this can switch off the drive to breathe. Only after the body senses a further drop in oxygen levels do you start breathing again. During the apnoea carbon dioxide levels rise but levels fall again when ventilation resumes, continuing the cycle."

“Travelling to High Altitudes Lead to Difficult Sleeping- Review...Background: High-altitude (HA) environments have adverse effects on the normal physiological functioning of body in the people who are accustomed to living at low altitudes. New arrivals to altitude commonly experience decline in quality sleep. Most people don’t sleep well at altitude. Sojourns commonly report vivid dreams, feelings of being suffocated and wake up in the morning feeling un-refreshed. These complaints are commonly associated with increased fragmentation of sleep by frequent brief arousals, which are in turn linked to periodic breathing. Findings: Changes in sleep architecture include a shift toward lighter sleep stages, with noticeable decrements in slow wave sleep and with variable decreases in REM sleep. Increased hypoxic ventilatory responsiveness and loss of regularization of breathing during sleep contribute to the occurrence of periodicity. Conclusions: One of the immediate effects of altitude exposure is to cause a general reduction in sleep quality. The purpose of this review was to consolidate the findings of the significant studies that examined the effects of HA on the sleep disturbances so far, so that further study in this regard can take new dimensions.”
Altitude Diseases: Positional Sleep Apnea

- “After five years of visits to four different sleep doctors, I was eventually diagnosed with positional sleep apnea in June 2020.” Steven Magee CEng MIET – Q
- “Does keeping a high altitude worker in a state of central sleep apnea for many years eventually develop into positional sleep apnea and obstructive sleep apnea?” Steven Magee CEng MIET – Q
- “Are we missing a simple treatment for most adult sleep apnea patients? The avoidance of the supine sleep position...Obstructive sleep apnea (OSA) is a sleep disorder which has been gradually accepted as an important cause of increased morbidity and mortality. The treatment of moderate–severe OSA has improved dramatically since the introduction of continuous positive airway pressure (CPAP) devices; however, the adherence of patients to CPAP treatment is relatively low. Adherence appears to be even worse in patients with mild or asymptomatic OSA. The failure to identify and treat mildly symptomatic or asymptomatic OSA patients may be costly, as such patients comprise about 20% of the general adult population. OSA patients could be divided into positional and non-positional patients. Positional patients show most of their breathing abnormalities while sleeping in the supine position. Simply, by sleeping in the lateral postures, they eliminate or reduce significantly the number of apneas and hypopneas. On the contrary, non-positional patients suffer from breathing abnormalities in the supine and lateral postures, and as a consequence those are the most severe OSA patients for whom CPAP is the treatment of choice. In this paper we intend to argue that positional therapy, i.e. avoidance of the supine posture during sleep, could represent a valuable therapy mainly for mild–moderate OSA. Considering the fact that the vast majority of mild–moderate OSA patients are positional patients (between 65 and 87%), positional therapy may be a simple, cheap and effective solution for them. High-quality research regarding this issue is needed to evaluate the real effectiveness of this mode of therapy.”

- “Can Positional Therapy Help Treat Some Patients with Central Sleep Apnea?...Keeping obstructive sleep apnea patients from sleeping on their backs has a long and evolving history. But emerging research supports a role for sleep position management in CSA patients as well...About half of patients with obstructive sleep apnea (OSA) have positional OSA, which means that their apnea-hypopnea index (AHI) increases by at least 50% when they sleep on their backs compared with their sides. Although the reasons behind this are not totally understood, it makes sense intuitively: on one’s back, gravity pulls the tongue and pharynx down, potentially blocking the airway.”

- “Positional Therapy for Sleep Apnea. Side Sleeping to Treat Positional Sleep Apnea…Because snoring has similar causes with obstructive sleep apnoea (OSA), scientists decided to test the effectiveness of positional sleep therapy in OSA sufferers. In this clinical study published in 2012 scientists wanted to test the long term efficacy of this therapy in patients with positional OSA. 16 patients who couldn't tolerate CPAP were tested with the positional therapy device. They had to perform a test night study before wearing the device every night for 3 months. The patients were being monitored with an actigraphic recorder. After 3 months, they were tested again with a follow-up night study. Scientists compared the results with the first night study, and their conclusion is: positional OSA can be effectively treated by a positional therapy.”
https://www.environmentalradiation.com

https://www.sleep-apnea-guide.com/positional-therapy.html
Altitude Diseases: Sleep Apnea & Drugs

- “How Sleeping Pills Make Your Sleep Apnea Worse—and What To Do About It...Sleeping pills, otherwise known as sedative hypnotics, can help the insomniac fall asleep. These medications are prescribed frequently to help people fall asleep, and stay asleep. Sleep apnea and insomnia are two separate conditions which can exist together. Patients who have both conditions, but are not aware of their sleep apnea diagnosis, may be making their sleep condition worse by taking sleeping pills...Over the counter sleep aids such as Benadryl, Tylenol-PM, and Advil-PM can exacerbate untreated sleep apnea, also due to the heightened muscle relaxation effect they induce. Some antihistamine medications are used to treat allergies and can also be sedating. These medications can also make the sleep apnea worse, and this is of concern in the individual who has not had the sleep apnea treated adequately. Some antidepressants can be used off-label for insomnia including: Amitriptyline, Remeron (Mirtazapine), and Oleptro (Trazodone). These medications can be sedating and may worsen untreated sleep apnea.”
  http://www.mysleepapneamd.com/blog/sleeping-pills-make-sleep-apnea-worse

- “Medications To Avoid If You Have OSA...Medications with muscle relaxants...Antihistamines...Antidepressants...Opioids and pain relievers...Sleeping medications and Barbiturates...There are a number of other, more specific medications that can affect or cause OSA through weight gain, influence on breathing and sleep cycles, and other factors. So the only way to know for sure that a drug is safe is to talk to a doctor.”

- “How Do Drugs and Alcohol Affect Sleep Apnea?...With headlines of Carrie Fisher’s death being linked to Sleep Apnea and drug use, it’s important to understand how drugs and alcohol affect Sleep Apnea....Anti-anxiety medicine, like benzodiazepines, are often used as a sedative during surgery or are given to individuals to use occasionally to help manage anxiety. Just like how alcohol slows down the response rates throughout the central nervous system, these types of drugs can do the same, effectively triggering central or obstructive Sleep Apnea...Accidental suffocation is another real concern for Sleep Apnea patients who are prescribed opioids for pain...Other prescription drugs that can cause sleep issues are: Antidepressants. Diet pills. Inhaled respiratory drugs. High blood pressure drugs, like beta blockers. Steroids, including prednisone. ADHD stimulant medications. Oral contraceptives, or hormones...Non-prescription drugs can also cause sleep issues, and make Sleep Apnea symptoms worse. Some of the leading offenders are: Cough and cold medicines. Painkillers with caffeine. Sudafed, or anything with pseudoephedrine. Nicotine, whether taken via a patch or through tobacco use.”
  https://www.cpap.com/blog/drugs-alcohol-affect-sleep-apnea/
Altitude Diseases: Nocturnal Angina

- “Angina (Angina Pectoris)...Angina is temporary chest pain or a sensation of pressure that occurs while the heart muscle is not receiving enough oxygen...Nocturnal angina is angina that occurs at night, during sleep...Most commonly, a person feels angina as pressure or an ache beneath the breastbone (sternum). People often interpret the sensation as discomfort or heaviness rather than pain. Discomfort also may occur in either shoulder or down the inside of either arm, through the back, and in the throat, jaw, or teeth.” [https://www.merckmanuals.com/home/heart-and-blood-vessel-disorders/coronary-artery-disease/angina#v721521](https://www.merckmanuals.com/home/heart-and-blood-vessel-disorders/coronary-artery-disease/angina#v721521)
- “After routinely being awakened during the night with chest pains, I was diagnosed with Nocturnal Angina in 2020 and prescribed nitroglycerin.” Steven Magee CEng MIET - Q
- “Sleep problems, heart disease often in bed together. Disturbed sleep can trouble the heart and a troubled heart can disturb sleep. Sleep seems to be such a serene way to replenish energy and restore the mind. For your heart, blood vessels, and immune system, though, it's anything but peaceful. There are periods of calm, to be sure, but they are rudely interrupted by abrupt spikes in blood pressure and heart rate. Blood flow through the heart and brain varies widely during sleep, as do electrical activity in the heart, the elasticity of blood vessels, and the tendency of blood to clot. And all of this activity is just part of a normal night's sleep. Researchers are just beginning to reveal the two-way street between sleep and heart disease: Poor sleep can interfere with the heart, and heart disease can disturb sleep.” [https://www.health.harvard.edu/heart-health/sleep-problems-heart-disease-often-in-bed-together](https://www.health.harvard.edu/heart-health/sleep-problems-heart-disease-often-in-bed-together)
Altitude Diseases: Sleep Apnea At High Altitude

- “What you need to know about sleep apnea at high altitude...At high altitude areas like Denver, the oxygen levels are low which results in certain physiological changes in the body to adjust to the climatic conditions and this process of adjustment is known as acclimatization. The body adjusts in a number of ways to compensate for the low oxygen availability. The breathing and the heart rate increases to inhale and supply more oxygen to the tissues. Increased urination is also common as a response to the change in the body’s acid-base balance. Amongst all the changes, altitude affects the respiration the most and studies have shown the occurrence of sleep apnea at high altitude despite acclimatization, even in healthy individuals visiting or living at high altitudes.” [https://www.denversleeps.com/sleep-apnea-at-high-altitude/]

- “Elevation Effects on Sleep Apnea...I have used CPAP or APAP for almost 20 years. In recent years I have used a ResMed S9 AutoSet running in AutoSet mode. Most of that was at 5200 feet above mean sea level. My sleep had become increasingly poor in recent years at that altitude, fragmented at best, and often very poor. Of course, I felt awful most days because of that. Eight months ago I moved to sea level on the Oregon Coast. That move was not made with the hope of improving my sleep. I didn't expect moving to sea level would have much effect on my sleep, because, after all, I was using a machine that provided Continuous Positive Airway Pressure automatically adjusted to meet my varying needs. At least that is what I had thought it was doing. The first night at sea level I slept seven hours straight through without waking up. That had almost never happened in recent years at 5200 feet. The same thing happened the second night, the third, the fourth, and most nights since, except during trips back to high elevation to visit family and friends...My experience with this suggests two things. 1) People with significant sleeping problems at a high elevation should experimentally try sleeping a few nights at or near sea level. 2) Anyone using CPAP who now lives at a significantly different elevation than the elevation where their sleep study was performed probably should have a new study to be sure their machine settings are optimum...When you moved to the lower altitude - well now - that makes each breath contain considerably more O2 - like what you would get if you supplemented at the higher altitude where the air is so much thinner. So breathing is quieted and less likely to become unstable.” [http://www.cpaptalk.com/viewtopic/t79476/Elevation-Effects-on-Sleep-Apnea.html]

- “Effects of altitude on sleep apnea...I have been invited to travel to Nepal to trek to Mt. Everest base camp. I have been using a CPAP machine for the last 3+ years. I would be traveling up to 19000 feet in the mountains...Altitude has a HUGE impact on your breathing. It can be a serious problem for those who do not have sleep apnea.. This is a discussion that you should have with your sleep doctor, plus a doctor that is used to working with mountaineers. You can get altitude sickness very easily and if your breathing is already reduced it might pose a serious risk to your life. I live in Colorado at 5,280 feet, and when we have visitors go up to the mountain passes we see that they sometimes get altitude sickness...Healthy people have been known to have trouble at this altitude. I would suggest a sleep study to go along with your oral device just to make sure it is working. I just recently had a pt that had switched to a dental device due to tolerance issues with CPAP. It lowered his apnea index, but his hypopnea index went through the roof. The dental devices are designed to stop the obstruction by preventing the tongue from falling backwards into the esophagus by holding it in place, and pulling the jaw forward. This is only going to be effective if your tongue is the only thing causing your obstruction. In my pts case it
was not, so his problems will continue...OSA begins to turn to CSA at high altitudes.”

https://www.sleepguide.com/forum/topics/effects-of-altitude-on-sleep

- “Traveling to High Altitude When You Have Sleep Apnea...What is the best way to manage sleep apnea when traveling to high altitude? A study published in the December 12, 2012, issue of JAMA reports treatments to minimize the risk of altitude-related illness for patients with sleep apnea. At altitude, the reduced oxygen content of the blood induces breathing instability, with periods of deep and rapid breathing alternating with central apnea. This breathing pattern is called high-altitude periodic breathing. It occurs even in healthy persons at altitudes above 6000 ft. It may lead to sleep disturbances with frequent awakenings and a feeling of lack of air. High-altitude periodic breathing in healthy mountain travelers and in patients with preexisting obstructive sleep apnea can be prevented or treated with acetazolamide, a drug that is also used for acute mountain sickness.”
  https://jamanetwork.com/journals/jama/fullarticle/1484517

- “DRUG MAY AID SLEEP APNEA AT ALTITUDE (The following article may be of interest to those who have occasion to be at altitudes above 5000′) People with sleep apnea can safely travel to high altitudes with the help of a diuretic and a commonly used breathing device, a new study from Switzerland suggests. Researchers found acetazolamide (sold as Diamox), which is already used to treat mountain sickness, improved overnight oxygen levels among people with the sleep disorder who spent time above 5,000 feet. Because there is less oxygen in the air at high altitude, nighttime breathing symptoms may get worse far above sea level. However, there aren’t any standard recommendations for mountain travelers with sleep apnea, according to Dr. Konrad Bloch, who worked on the new study.”
  https://ccsleepcenter.com/altitude-sleep-apnea/
Altitude Diseases: Sleep Apnea Mental Health Issues

- “Treating sleep apnea reverses brain damage...Obstructive sleep apnea can be destructive to your brain. But new research shows that CPAP therapy repairs the damage. What is obstructive sleep apnea? OSA is a chronic disease that involves repetitive pauses in breathing during sleep. These breathing pauses can prevent your body from supplying enough oxygen to the brain. In severe cases this lack of oxygen can lead to brain damage. Signs of this damage include memory problems, difficulty concentrating, and moodiness... they had a significant reduction in white matter – “the subway of the brain.” The men with severe sleep apnea also showed signs of impaired thinking, mood and alertness.” [http://sleepeducation.org/news/2014/09/08/treating-sleep-apnea-reverses-brain-damage](http://sleepeducation.org/news/2014/09/08/treating-sleep-apnea-reverses-brain-damage)

- “The Dangers of Uncontrolled Sleep Apnea...Sleep apnea occurs in about 3 percent of normal weight individuals but affects over 20 percent of obese people, Jun says. In general, sleep apnea affects men more than women. However, sleep apnea rates increase sharply in women after menopause. Sleep apnea is often linked to heart disease and metabolic issues like diabetes...People with sleep apnea might also suffer from unexplained fatigue and mood swings, because their breathing interruptions continually wake them and prevent them from settling into a deep, nourishing sleep. The consequences can be significant, Jun says. “We're talking about car accidents in the daytime, lost productivity at work, mood swings, waking up feeling groggy and falling asleep in class.” Other sufferers might wake up with a dry mouth, since sleep apnea tends to make you breathe with an open mouth, drying out your saliva. Some awaken with a headache, which may be caused by low oxygen or high carbon dioxide levels during sleep.” [https://www.hopkinsmedicine.org/health/wellness-and-prevention/the-dangers-of-uncontrolled-sleep-apnea](https://www.hopkinsmedicine.org/health/wellness-and-prevention/the-dangers-of-uncontrolled-sleep-apnea)
Altitude Diseases: Hormones & Sleep Apnea

- “Snoring? Blame Your Hormones...There may be a biological cause for those snorts, chokes and gasps that come from the man's side of the bed in the middle of the night. And biology may explain why more men than women have the disorder called sleep apnea. The cause? Hormones...A new study finds that estrogen seems to protect women against the type of oxygen deprivation common in obstructive sleep apnea, at least in rats…The researchers say learning which hormones react to oxygen deprivation could help scientists come up with new treatments for obstructive sleep apnea..."We think that estrogen has a protective role against [oxygen deprivation]," says Zabka. To test this theory, the researchers removed the ovaries of the rats to decrease estrogen levels and simulate menopause. These rats responded more like older male rats and had a reduced response to oxygen deprivation..."A recent large study found that post-menopausal women given hormone replacement therapy had similar rates of sleep apnea to pre-menopausal women,”” https://consumer.healthday.com/sleep-disorder-information-33/apnea-sleep-problems-news-624/snoring-blame-your-hormones-505090.html
- “Bio-identical Hormone Replacement Therapy for Sleep Problems...Bio-identical hormone replacement therapy (BHRT) has emerged as a safer and more effective alternative to traditional hormone therapy for a variety of problems related to hormone imbalances. Irregular sleep, sleep apnea, and insomnia may be associated with hormone deficiency in men following andropause, or even in women...BHRT should be combined with correct nutrition and fitness regimen to mitigate the hormonal and lifestyle causes of OSA. Furthermore, experienced pharmacists supported by physicians can measure and balance the insulin, cortisol and other hormone levels that are disrupted by the sleep apnea condition. With a professional bio-identical hormone therapy plan, the patient can regain sleep and have an improved quality of life.” https://www.americanintegrative.com/bio-identical-hormone-replacement-therapy-for-sleep-problems/
- “Low Testosterone Therapy and Sleep Apnea...Recent research on sleep apnea, particularly obstructive sleep apnea (OSA) has revealed some shocking findings regarding sleep and a man's libido. It turns out, there's a relationship between low testosterone and sleep apnea. Men who don't get enough sleep, have fragmented sleep, or have obstructive sleep apnea, tend to have low-T levels, according to a study in the Journal of the American Medical Association (JAMA)...Research has confirmed that there is a relationship between sleep apnea and low T. During sleep, changes in testosterone levels in both men and women occur naturally. These levels increase while you sleep and decrease when you're awake. The highest levels of the hormone happen in your REM sleep. When you have a sleep disorder like sleep apnea, your amounts of REM sleep are reduced which often leads to low-T levels.” https://www.soundsleephealth.com/blog/low-testosterone-therapy-and-sleep-apnea.html
- “Hormone Therapy Insomnia & Sleep Apnea Treatment for Men...The cause of insomnia in men often varies significantly from the causes of insomnia in women. The low testosterone associated with andropause (the male version of menopause) can contribute to sleep apnea in men, which can then lead to insomnia or other sleep problems...However, combining testosterone replacement therapy with an individualized nutrition plan, a targeted supplement regimen, and other strategic lifestyle changes may be able to relieve sleep problems and other debilitating symptoms of inadequate levels of testosterone. Optimal levels of testosterone combined with proper nutrition and exercise can reduce the hormonal and lifestyle causes of..."
obstructive sleep apnea. Furthermore, your BodyLogicMD-affiliated practitioner can measure and balance cortisol, insulin, and other hormone levels thrown off by the sleep apnea.”

https://www.bodylogicmd.com/for-men/sleep-apnea

- “Sleep apnea and hormone replacement therapy: a pilot study and a literature review...Background. Sleep apnea syndrome (SAS) is a common condition and a risk factor of cardiovascular and cerebrovascular diseases. The purpose of this pilot study was to investigate the effect of a gestagen (trimegeston) and estradiol hormone combination on perimenopausal and postmenopausal women with SAS. Methods. Four postmenopausal and one perimenopausal women were studied by polysomnography before and after treatment with hormone replacement therapy (HRT). Results. The subjects had a mean reduction of the severity of their sleep apnea by 75% measured by apnea/hypopnea index. Conclusions. HRT might be an alternative in the treatment of SAS.”


- “Sleep-disordered breathing and hormones...Sleep-disordered breathing (SDB) is not only a problem of the upper airway but is a systemic condition with endocrine and metabolic interactions. The accumulating body of evidence shows that SDB induces changes in the serum levels or secretory patterns of several hormones. Conversely, various endocrine disorders and hormone therapies may induce, exacerbate or alleviate SDB. Much of the understanding of the interactions between hormones and sleep-disordered breathing derive from intervention studies with nasal continuous positive airway pressure therapy. Better understanding of hormones and breathing may open new perspectives in developing strategies to prevent, alleviate or cure sleep-disordered breathing and its systemic consequences.”

https://erj.ersjournals.com/content/22/1/161

- “Hormone Replacement Therapy May Alleviate Sleep Apnea in Menopausal Women: A Pilot Study...Objective: The incidence of sleep apnea syndrome (SAS) in women increases after menopause. Progestins alone do not alleviate SAS in menopausal women. However, progestins may require concomitant estrogen administration and estrogen alone may stimulate breathing during sleep. To test these hypotheses, we studied the effects of estrogen alone and estrogen combined with progestin on SAS in menopausal women, using a prospective, cross-over, inception cohort study. Design: In this pilot study, live women who developed SAS after menopause underwent 2 nights of polysomnography to obtain a baseline, then returned for polysomnography after 3-4 weeks of taking micronilzed 17β-estradiol (E2) and after 10-12 days of taking E2 combined with medroxyprogesterone acetate (E2 + P), Sleep stages were scored according to Rechtshaffen and Kales, frequency and length of apneas were recorded for each subject each night, and the data were analyzed by Student's t test. Results: E2 and E2 + P both reduced the Respiratory Distress Index. E2 also raised the lowest oxygen desaturation associated with apneic episodes. Total minutes of rapid eye movement sleep increased, and the number of waking episodes decreased when the women were taking E2 and E2 + P, as previously reported. Conclusions: Within 1 month after initiating E2 or E2+P, SAS was reduced in all patients. The Respiratory Distress Index decreased by 25% and the addition of progestin brought the SAS reduction to 50% in this pilot study. A randomized study in a large group of patients is justified by the findings of this study. Because SAS increases the risk of cardiovascular disease and fatal accidents, the amelioration of SAS by sex steroid hormones could have significant implications for the health of menopausal women.”

https://journals.lww.com/menopausejournal/Abstract/1999/06030/Hormone_Replacement_Therapy_May_Alleviate_Sleep.4.aspx
“Obstructive sleep apnea and hormones – a novel insight...Obstructive sleep apnea (OSA), a disorder characterized by repetitive collapse of the upper respiratory tract during sleep, occurs in about 4% of middle-aged men and 2% of women. The incidence of the disorder is rising due to an increase in obesity and ageing of the population. Patients with obstructive sleep apnea are at elevated risk of some endocrinal and metabolic disorders, which may lead to serious consequences including shortening of life expectancy. The recognition and understanding of interactions between local upper airway dysfunction and its endocrinal consequences is therefore vital. In this review we will focus on the influence of OSA on bone metabolism and endocrine homeostasis.”

“The Hormone Replacement Dilemma for the Pulmonologist...Based on the current literature (4–6) and the pathophysiologic principles described above, I suspect that patients with an apnea–hypopnea index greater than 25 or 30 will not respond to HRT and will ultimately require continuous positive airway pressure. In women with less severe disease, HRT may be a viable therapeutic approach and should be considered. However, randomized clinical trials of HRT in postmenopausal apnea patients are needed before a rationale approach can be defined.”

“Hormone Replacement Therapy and Sleep-disordered Breathing...Disordered breathing during sleep is more common among postmenopausal women than among their premenopausal counterparts, possibly because of declining levels of estrogen and progesterone. We examined the relationship between the use of replacement hormones and sleep-disordered breathing in a sample of 2,852 noninstitutionalized women, 50 years of age or older, who participated in the Sleep Heart Health Study. The frequency of apneas and hypopneas per hour of sleep (apnea–hypopnea index) was determined by unattended, single-night polysomnography at the participant's home. The prevalence of sleep-disordered breathing (apnea–hypopnea index of 15 or more) among hormone users (61 of 907) was approximately half the prevalence among nonusers (286 of 1,945). Multivariable adjustment for known determinants of the disorder, including age, body mass index, and neck circumference, has attenuated the association, but only moderately (adjusted odds ratio, 0.55; 95% confidence interval, 0.41 to 0.75). The inverse association between hormone use and sleep-disordered breathing was evident in various subgroups and was particularly strong among women 50 to 59 years old (adjusted odds ratio, 0.36; 95% confidence interval, 0.21 to 0.60). If the observed associations are causal, hormone replacement therapy could have a role in preventing or alleviating sleep-disordered breathing.”
Altitude Diseases: Dying From Sleep Apnea Complications

- "Death Rate Triples for Sleep Apnea Sufferers...A continuing study of sleep problems in the general population shows some alarming findings: over an 18-year period, people with severe, untreated sleep apnea died a rate more than three times that of those without apnea.” [https://www.uwhealth.org/referring-physician-news/death-rate-triples-for-sleep-apnea-sufferers/13986](https://www.uwhealth.org/referring-physician-news/death-rate-triples-for-sleep-apnea-sufferers/13986)

- "Severe Sleep Apnea Doubles Risk of Death in Men — Implications for Those with Atrial Fibrillation...men between the ages of 40 and 70 who have severe sleep apnea have twice the risk of death, specifically from coronary artery disease, as men without sleep apnea. Even for men with moderate sleep apnea, the risk of death is 45% higher.” [https://www.stopafib.org/newsitem.cfm/NEWSID/186/Severe%20sleep%20apnea%20doubles%20risk%20in%20men/sleep%20apnea%20and%20atrial%20fibrillation](https://www.stopafib.org/newsitem.cfm/NEWSID/186/Severe%20sleep%20apnea%20doubles%20risk%20in%20men/sleep%20apnea%20and%20atrial%20fibrillation)

- "Study shows that people with sleep apnea have a high risk of death...people with severe sleep apnea have a much higher mortality risk than people without sleep apnea, and this risk of death increases when sleep apnea is untreated. Results show that people who have severe sleep apnea, which involves frequent breathing pauses during sleep, have three times the risk of dying due to any cause compared with people who do not have sleep apnea. This sleep apnea risk is represented by an adjusted hazard ratio of 3.2 after controlling for age, sex and body mass index. When 126 participants who reported regular use of continuous positive airway pressure (CPAP) therapy were removed from the statistical analysis, the hazard ratio for all-cause mortality related to severe sleep apnea rose to 4.3.” [https://aasm.org/study-shows-that-people-with-sleep-apnea-have-a-high-risk-of-death/](https://aasm.org/study-shows-that-people-with-sleep-apnea-have-a-high-risk-of-death/)

- "Yes, you can die from sleep apnea. Carrie Fisher did...Carrie Fisher died four days after suffering a heart attack during a flight from London to Los Angeles six months ago. Her assistant shared in a recent interview that Fisher slept most of the flight and had suffered some respiratory events (apneas) during this time, which was considered normal for her. (It’s still unclear whether Fisher knew she had sleep apnea, according to this report from Forbes, which suggests if she did, she was potentially unaware of it and, therefore, not actively treating it.) At the end of the flight, Fisher could not be awakened easily. When she did arouse, she began to vomit before slumping over and becoming unresponsive. These are symptoms consistent with heart attack in women.” [https://www.sleepapnea.org/carrie-fisher-yes-you-can-die-from-sleep-apnea/](https://www.sleepapnea.org/carrie-fisher-yes-you-can-die-from-sleep-apnea/)

- “Carrie Fisher: Coroner Finds Sleep Apnea Contributed to Actress’ Death. Atherosclerotic heart disease, “multiple drug intake” also factors in actress’ massive heart attack...The Los Angeles County coroner’s office added Friday that atherosclerotic heart disease – fatty tissue in the walls of Fisher’s arteries – also contributed to her death, but the exact cause of her heart attack aboard a Los Angeles-bound airplane remains unclear.” [https://www.rollingstone.com/movies/movie-news/carrie-fisher-coroner-finds-sleep-apnea-contributed-to-actress-death-200341/](https://www.rollingstone.com/movies/movie-news/carrie-fisher-coroner-finds-sleep-apnea-contributed-to-actress-death-200341/)

- “Sleep Apnea Mortality Statistics and the Importance of Treatment...people with sleep apnea have a higher risk of death from related cardiac complications. The study found that sleep apnea can increase the risk of sudden cardiac death. This is most likely if you: are older than 60 years of age, have 20 or more apnea episodes per hour of sleep, have a blood oxygen level of less than 78 percent during sleep.” [https://www.healthline.com/health/can-you-die-from-sleep-apnea#types](https://www.healthline.com/health/can-you-die-from-sleep-apnea#types)
“Who Died from Sleep Apnea?...For people with apnea syndrome, is always reassuring to find people who have accomplished great things even though they died from sleep apnea. Some of these famous people are: John Candy - known to be substantially overweight, Harris Glenn Milstead (also known as Divine) - also obese, Jerry Garcia - known to have weight problems with diabetes, Israel Kamakawiwo'ole - with 750 pounds (such a beautiful voice...), Joseph Merrick, Audrey Santo, William Howard Taft - with over 300 pounds (yes, the president!), Reggie White.” [https://www.sleep-apnea-guide.com/sleep-apnea-death.html](https://www.sleep-apnea-guide.com/sleep-apnea-death.html)
Altitude Diseases: Magee’s Sleep Movement Disorder

- “I purchased an infrared camcorder in September 2020 to video record my sleeping. Much to my horror, I discovered I move about every 20 minutes during the night. I call this ‘Magee’s Sleep Movement Disorder’.” Steven Magee CEng MIET
- “Is a Sleep Movement Disorder Messing with Your Slumber?...You may be familiar with the tossing and turning that occurs when you’re unable to fall asleep at night. But for millions of Americans who suffer from sleep movement disorders, it’s the uncontrollable twitching once they climb into bed that prevents them from sleeping in the first place. These common sleep movement disorders can wreak havoc on your nightly slumber. Learn what you can do about it.” https://www.sleepfoundation.org/articles/sleep-movement-disorder-messing-your-slumber
- “Sleep Rhythmic Movement – Overview & Facts...Sleep related rhythmic movement disorder (RMD) involves repeated body movements. They occur while drowsy or asleep. It is typically seen in children. Rhythmic humming or other sounds are sometimes made along with the body motions. These sounds can be quite loud.” http://sleepeducation.org/sleep-disorders-by-category/sleep-movement-disorders/sleep-rhythmic-movement/overview-facts/
- “REM sleep behavior disorder...Rapid eye movement (REM) sleep behavior disorder is a sleep disorder in which you physically act out vivid, often unpleasant dreams with vocal sounds and sudden, often violent arm and leg movements during REM sleep — sometimes called dream-enacting behavior.” https://www.mayoclinic.org/diseases-conditions/rem-sleep-behavior-disorder/symptoms-causes/syc-20352920
- “Top 4 Causes of Nighttime Restlessness—and How to Manage Them...Getting a good night’s rest is important for so many reasons. Allowing our bodies and minds to “reset” is critical for cognitive and memory function, mood stabilization, and cellular repair. Unfortunately, not everyone gets the rest they need. Whether it’s a new baby or puppy, racing thoughts late at night, or simply too many “to do’s” on our lists, plenty of things temporarily interfere with getting the recommended 7-9 hours every night. Still, more Americans are finding that a regular restful night’s sleep is nothing more than a dream. Getting a good night’s rest is important for so many reasons. Allowing our bodies and minds to “reset” is critical for cognitive and memory function, mood stabilization, and cellular repair. Unfortunately, not everyone gets the rest they need. Whether it’s a new baby or puppy, racing thoughts late at night, or simply too many “to do’s” on our lists, plenty of things temporarily interfere with getting the recommended 7-9 hours every night. Still, more Americans are finding that a regular restful night’s sleep is nothing more than a dream.
- “Top 4 Causes Of Nighttime Restlessness And How To Manage Them...Although it’s normal to experience an occasional night of tossing and turning, chronic restlessness can have a major impact on your quality of life, causing daytime sleepiness, irritability, weight gain, and even lower your immunity making you more vulnerable to viruses. There are several factors that contribute to nighttime restlessness, which we address in this blog. If you experience one or several of these, talk to your primary care provider. You also may be referred to our sleep center for further evaluation. Restless Legs Syndrome. Diet. Obstructive sleep apnea. Poor sleep hygiene. Hormones. Stress. Late night exercise/work schedule.” https://www.pinnaclehealth.org/wellness-library/blog-and-healthwise/blog-home/post/top-4-causes-of-nighttime-restlessness-and-how-to-manage-them
- “Primary Sleep Disorders: Dyssomnias...Parasomnia sleep disorders cause abnormal activities
during sleep, such as sleep terrors or sleep walking. Dyssomnia sleep disorders cause trouble falling asleep or staying asleep. Perhaps the most well known dyssomnia is obstructive sleep apnea...Problems with the central nervous system can trigger a sleep disorder. Central sleep apnea occurs when breathing temporarily stops for 10 seconds or more many times during a night's sleep. This is caused by an abnormality in the brain, which prevents it from regulating oxygen levels and automatically triggering breathing. This diminished oxygen is a condition called hypoxia. It can worsen conditions such as epilepsy, or lead to problems such as chest pain or heart attack in people who have coronary artery disease. Central sleep apnea may also be caused by problems in carbon dioxide regulation.”

“Approach to abnormal movements and behaviors during sleep...Abnormal movements and behaviors during sleep are part of a larger group of nocturnal events that may occur during sleep, wake, or the transitions into or out of sleep. These events are most common early in life, affecting approximately 15 to 20 percent of children and 4 percent of adults [1-4]. Nocturnal events are typically divided into simple behaviors (eg, single movements, repetitive or periodic movements, rhythmical movements) and complex behaviors (eg, sleep talking, sleepwalking, sleep terrors, dream enactment) (table 1). A detailed history, including a clear description from the patient and ideally a bed partner or family witness, is the cornerstone of establishing clues about the underlying etiology. The challenge for the clinician is to recognize when certain nocturnal events signal an underlying, treatable disorder, an emerging neurological abnormality, or a benign age-appropriate episode. An approach to the evaluation and diagnosis of abnormal movements and behaviors during sleep is presented here. Additional topics on the diagnosis and treatment of specific parasomnias, sleep-related movement disorders, and other paroxysmal neurological events in both children and adults can be found elsewhere. (See "Parasomnias of childhood, including sleepwalking" and "Disorders of arousal from non-rapid eye movement sleep in adults" and "Rapid eye movement sleep behavior disorder" and "Clinical features and diagnosis of restless legs syndrome and periodic limb movement disorder in adults" and "Restless legs syndrome and periodic limb movement disorder in children" and "Sleep-related epilepsy syndromes").”

"What medications treat periodic limb movement disorder?...Benzodiazepines suppress muscle contractions and help you sleep through the movements. Clonazepam (Klonopin) is probably the most widely used drug to treat PLMD. Dopaminergic agents raise levels of the neurotransmitter dopamine, which is important in regulating muscle movements. Anticonvulsant agents reduce muscle contractions in some people. GABA agonists prevent the release of certain neurotransmitters that stimulate muscle contractions."
"Restless Leg Syndrome...Conventional medicine initially recommends basic testing including blood tests for glucose, iron, magnesium and thyroid hormones, largely because imbalances in these factors can lead to neurologic or muscular dysregulation. Magnesium, for example, is essential for proper functioning of both the nerves and muscles. Discovering that your levels are low might lead to a very neat, simple solution to the problem: Take the correct form of magnesium. Further, iron deficits have been documented in the vast majority of patients with RLS. Again, such a finding would lead to an easy resolution. B6, Sam-e, folic acid and specific forms of B12 can be extremely helpful at treating RLS provided appropriate testing supports their use. RLS may also develop due to an imbalance in the neurotransmitter dopamine. Dopamine is a neurotransmitter that affect many functions in the body. Symptoms of dopamine deficiency are varied but include constipation, digestive difficulties, low libido, excessive need for sleep, movement disorders, tremors, difficulty with muscle control, decreased physical strength, increased need for carbohydrates, forgetfulness, aggression, depression, mood swings, inability to concentrate and many other affectations. Those with RLS likely do not have most of these symptoms. However, it has been conclusively established that those with RLS suffer from a dopamine deficiency." 

"Major Depression Serotonin Precursors: SAMe....SAMe (pronounced "Sammy") stands for S-adenosyl-L-methionine. SAMe is a compound produced by the liver and used throughout the body in a chemical process called methylation. Methylation, essential to many chemical reactions in the body, is one of the last steps in the production of serotonin, dopamine and norepinephrine...Dosing for SAMe is typically between 800mg/day and 1600mg/day. SAMe is very safe at recommended dosages. Because it is essentially a protein, it has no real side effects other than gastrointestinal upset and the possibility of triggering mania in people with bipolar disorder." 

"The SAM-e Story. Thoroughly natural SAM-eis no mundane molecule....It's available in the U.S. as a dietary supplement, but that is merely a technicality, its pharmacologic green card. SAM-e is a bona-fide prescription drug in Europe, where it has been shown effective against depression, osteoarthritis, and liver disease." 

"SAME...SAMe is LIKELY SAFE when taken by mouth, given intravenously (by IV), or when injected as a shot, appropriately. It can sometimes cause gas, vomiting, diarrhea, constipation, dry mouth, headache, mild insomnia, anorexia, sweating, dizziness, and nervousness, especially at higher doses. It can also make some people with depression feel anxious."
Altitude Diseases: Night Shift Diseases

- “I would run down like a battery during several extreme night shifts atop the very high altitude summit of Mauna Kea in Hawaii.” Steven Magee CEng MIET - Q

- “Does Night Shift Work Increase Your Cancer Risk?...The strongest correlation was seen with breast cancer – for every five years a woman worked the night shift, her breast cancer risk increased by 3.3%. This population was also discovered to have an increased risk of digestive system cancer and skin cancer. Interestingly, nurses who worked night shifts also had a higher incidence of lung cancer. “It is usually considered that night shift work impairs health, but we were still surprised by the increased risks attributed to long-term night shift work when we integrated the statistics together,”” [https://www.oncnursingnews.com/web-exclusives/does-night-shift-work-increase-your-cancer-risk](https://www.oncnursingnews.com/web-exclusives/does-night-shift-work-increase-your-cancer-risk)

- “How night shifts can increase cancer risk...Working night shifts disrupts the body's circadian rhythm, which a number of studies have found may raise the risk of cancer development. Now, researchers have shed light on the mechanisms behind this association. Scientists from the Massachusetts Institute of Technology (MIT) reveal that disruption to the circadian rhythm also leads to the impairment of two tumor suppressor genes, which can spur tumor growth.” [https://www.medicalnewstoday.com/articles/312064.php](https://www.medicalnewstoday.com/articles/312064.php)

- “Why working the night shift can pose a cancer risk. New study reveals a link between circadian clock disruption and tumor growth...In humans and most other organisms, a circadian clock governed by light regulates the timing of key aspects of human physiology, by controlling cellular activities such as metabolism and division. In a study of mice, the MIT team found that two of the genes that control cells’ circadian rhythms also function as tumor suppressors. Loss of these tumor suppressors, either through gene deletion or disruption of the normal light/dark cycle, allows tumors to become more aggressive. “It doesn’t matter how you disrupt the clock — both ways, loss of it seems to drive tumorigenesis.”” [http://news.mit.edu/2016/night-shift-cancer-risk-0728](http://news.mit.edu/2016/night-shift-cancer-risk-0728)

- “Night Shifts Increase Breast Cancer Risk, Especially for Nurses...A meta-analysis of international data confirms a positive association between long-term night shift work and an increased overall risk for cancer in women, particularly breast cancer. In North America and Europe, working the night shift was associated with a 32% increased risk for breast cancer overall (odds ratio [OR], 1.316), the authors report” [https://www.medscape.com/viewarticle/891048](https://www.medscape.com/viewarticle/891048)

- “LIGHT AT NIGHT OR SHIFT WORK AND BREAST CANCER RISK...Women who routinely work overnight shifts (such as nurses and flight attendants) for many years may have a slightly increased risk of breast cancer. One possible reason is the exposure to light related to these types of jobs. Being exposed to light throughout the night affects some hormone functions in the body that may be related to breast cancer.” [https://ww5.komen.org/BreastCancer/Table13Lightatnightshiftworkandbreastcancerrisk.html](https://ww5.komen.org/BreastCancer/Table13Lightatnightshiftworkandbreastcancerrisk.html)

- “Are Women Who Work Night Shifts at a Higher Risk for Developing Breast Cancer?...When a woman is working night shifts, she might use external signals, like artificial light or caffeine, to help tell her body to stay awake. The problem is that her body still sends internal signals that it is time for sleep. These different signals disrupt her natural sleep-wake cycle. Hormones and other bodily activities do not change to match the woman’s work schedule either. Some of these hormones affect tumors, so this can allow tumors to grow.[9] One example is the melatonin[9]”
that our bodies make at night to help us sleep.[8] Melatonin helps to prevent tumor growth.[9] A woman who works in artificial light at night makes less melatonin. Another example is glucocorticoids, which our bodies make when we are stressed. People who work night shifts have higher levels of glucocorticoids that help tumors survive.”

http://www.center4research.org/women-work-night-shifts-higher-risk-developing-breast-cancer/

- “Effect of night shift work on the risk of multiple primary cancers in men...a dose-response meta-analysis was conducted, which showed that cancer risk gradually increased with the accumulation of night-shift years. For every 5 years of night shift work, cancer risk increased by 24.9% (OR = 1.249; 1.146, 1.361; P< 0.05)...night shift work was associated with increased cancer risk of men in a dose-response way.”

https://ascopubs.org/doi/abs/10.1200/JCO.2018.36.15_suppl.e13556

- “Female Night Shift Workers May Have Increased Risk of Common Cancers...long-term night shift work among women increased the risk of cancer by 19 percent. When analyzing specific cancers, the researchers found that this population had an increased risk of skin (41 percent), breast (32 percent), and gastrointestinal cancer (18 percent) compared with women who did not perform long-term night shift work. After stratifying the participants by location, Ma found that an increased risk of breast cancer was only found among female night shift workers in North America and Europe.”

https://www.aacr.org/Newsroom/Pages/News-Release-Detail.aspx?ItemID=1139

- “Does night-shift work increase the risk of prostate cancer? a systematic review and meta-analysis...Based on a meta-analysis, night-shift work is associated with an increased risk of prostate cancer. Because of the limited number of included studies and the large level of heterogeneity, further well-designed studies are still warranted to confirm the findings of our analysis.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4599640/

- “Shift Workers at Higher Risk for Prostate Cancer...A new meta-analysis confirms that shift workers have increased risks for developing prostate cancer (PCa) and provides some additional insight...shift workers had a significant 23% higher risk of PCa than those who had never performed shift work. The investigators found a nonlinear relationship between longer shift duration and greater PCa risk...Possible biologic mechanisms linking shift work in general to PCa include disruption of circadian rhythms, decreased melatonin (a hormone that has antioxidant, anti-mitosis, anti-angiogenesis, and immune effects that might protect from cancer), and impaired vitamin D synthesis due to reduced sunlight exposure.”


- “Night Shift Work Triples the Risk of Prostate Cancer in Men...Working night shifts raises the risk of men developing prostate cancer by almost three times compared to working only day shifts, according to a new study. Men who work night shifts are also at a significantly greater risk of a variety of other types of cancer like bowel, bladder and lung tumors.”


- “Sleep, immunity and shift workers: A review...Sleep is a vital behavioral state of living beings and probably a modulator of the immune function. Both acute and chronic deprivation are associated with immune changes. It is likely that shift workers show an increased risk for viral infections because of a possible compromise of the innate immune response and perhaps also of the immune acquired response. There is a need for more quality studies also evaluate the future risk for the onset of inflammatory or autoimmune diseases among these workers. Future research including the different subtypes of shift workers is necessary to answer many gaps in
this interesting theme.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5241621/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5241621/)

- “A Simple Way to Improve Night Shift Worker's Hammered Immune Systems...Natural Killer Cells are a type of white blood cell that play a large role in our immune system. They help destroy illness-causing cells by rejecting virally-infected cells and tumors. Because of the hormones circulating throughout the body, these immune cells peak during the day (in your wakeful hours) in order to repair damaged tissue (when the damage is most likely to occur). When you’re sleep deprived, an insufficient amount of immune cells are produced during the day, which means there’s not enough to fight off the infections and illnesses that may be entering your system.” [https://nightrevive.com/blogs/overcoming-sleep-deprivation/a-simple-way-to-improve-night-shift-workers-hammered-immune-systems](https://nightrevive.com/blogs/overcoming-sleep-deprivation/a-simple-way-to-improve-night-shift-workers-hammered-immune-systems)

- “Why Late Nights Are Bad for Your Immune System...Jet lag, shift work, and even late nights staring at your tablet or smartphone may be making you sick. That's because the body's internal clock is set for two 12-hour periods of light and darkness, and when this rhythm is thrown off, so is the immune system. One reason may be that the genes that set the body clock are intimately connected to certain immune cells, according to a new study.” [https://www.sciencemag.org/news/2013/11/why-late-nights-are-bad-your-immune-system](https://www.sciencemag.org/news/2013/11/why-late-nights-are-bad-your-immune-system)

- "Randy Gardner (born c. 1948), a high school student in San Diego, California set the record for the longest a human has gone without sleep in 1964, at the age of 17. Gardner stayed awake for 11 days and 25 minutes (264.4 hours.), breaking the previous record for sleeplessness of 260 hours held by DJ Tom Rounds in Honolulu...Lt. Cmdr. John J. Ross, who monitored his health, reported serious cognitive and behavioral changes. These included moodiness, problems with concentration and short term memory, paranoia, and hallucinations. On the eleventh day, when he was asked to subtract seven repeatedly, starting with 100, he stopped at 65. When asked why he had stopped, he replied that he had forgotten what he was doing.” [https://en.wikipedia.org/wiki/Randy_Gardner_(record_holder](https://en.wikipedia.org/wiki/Randy_Gardner_(record_holder)
Altitude Diseases: High Altitude Flatus Expulsion (HAFE)

- "Flatulence is defined in the medical literature as "flatus expelled through the anus" or the "quality or state of being flatulent",[1] which is defined in turn as "marked by or affected with gases generated in the intestine or stomach; likely to cause digestive flatulence".[2] The root of these words is from the Latin flatus – "a blowing, a breaking wind".[3] Flatus is also the medical word for gas generated in the stomach or bowels.[4] Despite these standard definitions, a proportion of intestinal gas may be swallowed environmental air, and hence flatus is not totally generated in the stomach or bowels. The scientific study of this area of medicine is termed flatology...Interest in the causes of flatulence was spurred by high-altitude flight and manned spaceflight; the low atmospheric pressure, confined conditions, and stresses peculiar to those endeavours were cause for concern.[16] In the field of mountaineering, the phenomenon of high altitude flatus expulsion was first recorded over two hundred years ago.” [10]

- "Is High Altitude Gas a Thing? Not to be vulgar, but I get gassy whenever I go somewhere above 7,000 feet...We would like to report our observations upon a new gastrointestinal syndrome, which we shall refer to by the acronym HAFE (high altitude flatus expulsion). This phenomenon was most recently witnessed by us during an expedition to in the San Juan Mountains of southwestern Colorado, with similar experiences during excursions past. The syndrome is strictly associated with ascent, and is characterized by an increase in both the volume and the frequency of the passage of flatus, which spontaneously occurs while climbing to altitudes of 11,000 feet or greater.” [11]

- "High altitude syndromes at intermediate altitudes: a pilot study in the Australian Alps...Our hypothesis is that symptoms of high altitude syndromes are detectable even at intermediate altitudes, as commonly encountered under Australian conditions (<2500 m above sea level)...We found that the frequency of flatus production more than doubled following ascent...The frequency and severity of headaches also increased following ascent. These results support the hypothesis that high altitude symptoms can be significant issues even at the relatively lower altitudes encountered in Australian alpine regions. Increased awareness amongst clinicians of this possibility could contribute to a reduction in the disease burden from high altitude syndromes at intermediate altitudes.” [12]

- "Here's Why You're So Gassy...You're on an airplane. Yes, in addition to Montezuma's revenge, there is the very real phenomenon of airplane farts. When you're on a plane cruising at a high altitude the gas in your body expands, leading to a bloated feeling and, yes, more flatulence, according to researchers writing in the New Zealand Medical Journal. In that paper, the researchers argued that airlines should consider using activated charcoal (an odor absorber) in seat cushions to help make flights more comfortable.” [13]

- "Aerophagia (var. aerophagy) is a condition of excessive air swallowing, which goes to the stomach. Aerophagia may also refer to an unusual condition where the primary symptom is excessive flatus, belching is not present, and the actual mechanism by which air enters the gut is obscure.[1] Aerophagia in psychiatry is sometimes attributed to nervousness or anxiety." [14]
"Aerophagia Causes and Resolutions...CPAP users who experience excessive belching, stomach bloating, stomach distension and agonizing gas pains may be suffering from aerophagia. It’s the medical term for the phenomenon when air enters the esophagus, goes into the belly and causes bloating. Aerophagia can be caused by eating, drinking or even talking too fast. It can occur with hyperventilation from anxiety, from chewing gum, smoking cigarettes and even during strenuous exercising." [https://www.sleepapnea.org/treat/cpap-therapy/troubleshooting-guide-for-cpap-problems/aerophagia-causes-and-resolutions/](https://www.sleepapnea.org/treat/cpap-therapy/troubleshooting-guide-for-cpap-problems/aerophagia-causes-and-resolutions/)

"Suffering from aerophagia and mixed sleep apnea...I am a 44 year old female. I am 118 lbs and I live at 7100 feet. I lived 37 years at sea level. The last three years I have been treated for Fibromyalgia, asthma and ADHD...Suffering from aerophagia is such a common issue in CPAP users that it should be included in every CPAP manual or discussed by every sleep doctor...clinical studies demonstrated that people sleeping at high altitude have an increased risk of having central sleep apnea.... I'm not surprised you have central apnea episodes when you live over 7000 feet." [https://www.sleep-apnea-guide.com/suffering-from-aerophagia-and-mixed-sleep-apnea.html](https://www.sleep-apnea-guide.com/suffering-from-aerophagia-and-mixed-sleep-apnea.html)
Altitude Diseases: Inflammation Hazards

- “Increased systemic low-grade inflammation in high altitude native rats mediated by adrenergic receptors…RESULTS: The HA (High Altitude) native rats showed significant increases in the serum levels of inflammatory cytokines, lipid profiles, as well as a significant increase in the urinary norepinephrine with a concomitant decrease in the serum levels of Mg+2 and increased lipid peroxidation. Blockage of the beta and alpha adrenergic receptors of the HA rats caused partial or complete decreases in both inflammatory and oxidative stress mediators. CONCLUSION: Living under HA conditions results in an increased systemic inflammatory reaction; an effect that is mediated through the sympathetic nervous system mainly via alpha-adrenergic receptors and could be attributed to low Mg+2 levels.”

- “Can High Altitude Influence Cytokines and Sleep?...4. Altitude and Inflammation. The exposure to hypoxia promotes several transcription factors, including nuclear factor-κB (NF-κB), which plays a central role in stimulating the proinflammatory cytokines TNF-α and IL-6 [27]. Similarly, several studies with rodents and humans have shown that effects-induced hypoxia can cause inflammation, including increase in transvascular leakage and oxidative stress with increased NF-κB expression in lungs followed by significant increase in proinflammatory cytokines IL-1, IL–6, and TNF-α”
  https://www.hindawi.com/journals/mi/2013/279365/

- “Effects of high altitude and cold air exposure on airway inflammation in patients with asthma...Conclusions. Exposure to environmental conditions at high altitude (hypoxia, exercise, cold) was associated with a moderate loss of asthma control, increased airway obstruction and neutrophilic airway inflammation. The cold temperature is probably the most important contributing factor as 24-hour cold exposure by itself induced similar effects.”
  https://thorax.bmj.com/content/68/10/906

- “New findings link estrogen and T cell immune response to autoimmune inflammation...Women are more prone to the development of autoimmune diseases. The female hormone estrogen is likely to affect the immune system. A team of scientists reported new findings related to the involvement of estrogen hormone receptor in autoimmune diseases.”
  https://www.sciencedaily.com/releases/2018/05/180531131116.htm

- “The Immune System Is a Natural Target for Estrogen Action: Opposing Effects of Estrogen in Two Prototypical Autoimmune Diseases...Analogous to other physiological systems, the immune system also demonstrates remarkable sex differences. Although the reasons for sex differences in immune responses are not precisely understood, it potentially involves differences in sex hormones (estrogens, androgens, and differential sex hormone receptor-mediated events), X-chromosomes, microbiome, epigenetics among others. Overall, females tend to have more responsive and robust immune system compared to their male counterparts. It is therefore not surprising that females respond more aggressively to self-antigens and are more susceptible to autoimmune diseases. Female hormone (estrogen or 17β-estradiol) can potentially act on all cellular subsets of the immune system through estrogen receptor-dependent and -independent mechanisms. This minireview highlights differential expression of estrogen receptors on immune cells, major estrogen-mediated signaling pathways, and their effect on immune cells. Since estrogen has varied effects in female-predominant autoimmune diseases such as multiple sclerosis and systemic lupus erythematosus, we will mechanistically
postulate the potential differential role of estrogen in these chronic debilitating diseases.”
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4701921/

- “Sex Hormones Determine Immune Response...Females and males differ in the energy consumption and nutritional requirements which are based on the interactions between environmental factors and sex hormones (1). The studies in early 1940s ascertained that females have enhanced capability of producing antibodies (2, 3). This enhanced immune reactivity in females helps mount an effective resistance to infection and therefore females are less susceptible to viral infections, but can develop immune-pathogenic effects and predisposition to autoimmunity due to hyper immune responses (4, 5). Sex hormones can also control the immune response via circadian rhythm. Many hormones like cortisol, known to regulate T cell mediated inflammation, have a circadian rhythm with a maximum peak at 8:00 a.m. and progressively lower levels as the day progresses (6). Interaction between sex hormones and environmental factors like cigarette smoke and infections lead to variable responses in both genders (5, 7, 8). There is emerging evidence that sex hormones impact microbial composition and the resulting immune response via secondary metabolites binding with receptors like estrogen receptors (ERs), peroxisome proliferator-activated receptors (PPARs) etc. (9). These differences in immune response can lead to variability in disease phenotypes with autoimmunity occurring more often in females and cancers occurring more in males.”
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6119719/

- “The Autoimmune Hormone Connection... insufficient hormones can lead to mood swings, increased irritability, feeling like anything will make you cry, experiencing depression or anxiety, and make you feel susceptible to stress...One current hypothesis is that the estrogen may actually enhance the inflammatory process of the immune system, meaning it could increase the number of antibodies attacking our tissues...While the decline in estrogen accompanies a decline in immune function, there is also a level of immune dysfunction that can arise. This may be one of the reasons we see a rise in heart disease (which has a strong autoimmune component) in postmenopausal women.”
https://drbrighten.com/the-autoimmune-hormone-connection/

- “Sex Hormones and Immunoregulation...The most obvious effects of sex hormones on the immune response are the effects of these hormones on the numbers of circulating immune cells. In the peripheral blood, about 65% of the leukocytes are granulocytes (90% neutrophils), 5-10% is monocytes, and 30% are lymphocytes (85-90% T lymphocytes and 10-15% B lymphocytes). Sex hormones have been shown to affect these cell numbers by affecting proliferation or apoptosis of the cells or by recruitment of new cells from the bone marrow [39,40]. Although total white blood cell counts did not differ between males and females, an increase in white blood cells counts was observed in the luteal phase (and during pregnancy) as compared with the follicular phase of the ovarian cycle [40-43]. This may be largely due to an increase in granulocyte numbers in these reproductive conditions [42,44-47]. This suggests a role for progesterone and/or estrogen in increasing the numbers of granulocytes. In addition, various studies point to a decrease of monocyte numbers in the presence of estrogen, as shown by increased numbers of monocytes in males and menopausal women as compared with women in the follicular phase of the ovarian cycle [14,48]. However, the presence of estrogen together with progesterone may increase monocyte numbers as monocyte numbers are increased in the luteal phase and during pregnancy as compared with the follicular phase. Whether sex hormones also affect B and T lymphocyte numbers remains to be established. Conflicting results have been published [41,42,46,49-56]. Treg cell numbers may be modulated by sex
hormones, since it has been shown that both estrogen [57,58] and testosterone [59] increase Treg cells numbers.” [http://www.brainimmune.com/sex-hormones-and-immunoregulation/]

- “Hormones and the immune response...Recent advances suggest that the immune system does not function in isolation but is influenced by other physiological systems such as the endocrine and neuroendocrine systems. This review discusses aspects of immune function altered by neuroendocrine peptides, sex hormones, and vitamin D metabolites.” [https://ard.bmj.com/content/annrheumdis/48/1/1.full.pdf]

- “Hormonal Link to Autoimmune Allergies...IgE recognition of autoantigens might augment allergic inflammation in the absence of exogenous allergen exposure. Among allergy and autoimmunity, there is disproportionate representation of males before puberty and females after puberty, suggesting a role for sex hormones. Hormone allergy is an allergic reaction where the offending allergens are one's own hormones. It is an immune reaction to the hormones, which can interfere with the normal function of the hormones. It can occur perimenstrually in women along with the variation in menstrual cycle. The perimenstrual allergies are about the cyclic abundance of the hormone causing a cyclic expression of allergic symptoms. The inflammatory mechanisms of allergic reactions to hormone allergens, which are intrinsic to the body, are the same as the mechanisms of allergic reactions to external allergens.” [https://www.hindawi.com/journals/isrn/2012/910437/]

- “Interplay between Hormones, the Immune System, and Metabolic Disorders...Hormones are metabolic components produced by different cell types, capable of regulating body homeostasis and the cross talk among the endocrine, cardiovascular, and immune systems. In patients with compromised immune response, inflammation may last longer or may be ineffective, leading to recurrent infections or other types of systemic dysfunctions associated with chronic inflammation. In the past few years, it became evident that hormones, neurotransmitters, and dietary factors are specific modulators of cells from the immune system by fine-tuning their activation and key functions. Of note, cells from the immune system present high expression of receptors for different hormones present in the blood circulation, such as aldosterone and glucocorticoids. This in turn might also affect the vascular function leading to cardiovascular diseases. Therefore, the main scope of this edition is to contribute to knowledge in this growing and innovative area, through reviews and original articles that will help to understand the diverse mechanisms by which hormones and/or diet can influence inflammatory response and immune activation.” [https://www.hindawi.com/journals/mi/2018/8654212/]

- “An Overview of Endocrine Issues and Autoimmune Diseases...Endocrine disorders are diseases and conditions that affect your endocrine system. The endocrine system includes your glands, which secrete hormones that have effects on other organs in the body...Your key endocrine glands include: Thyroid gland, Pituitary gland, Pineal gland, Pancreas, Ovaries, Testes, Parathyroid, Hypothalamus, Adrenals. Some of the most common endocrine disorders include a number of thyroid-related conditions, including: Hypothyroidism, Hyperthyroidism, Hashimoto's Thyroiditis, Graves' disease, Thyroid cancer, Goiter, Thyroiditis, Thyroid nodules. Some other common endocrine disorders include: Adrenal disorders, Diabetes, Osteoporosis, Pituitary disorders, Polycystic ovary syndrome” [https://www.verywellhealth.com/thyroid-disease-related-conditions-4013033]
Altitude Diseases: Gastrointestinal

- “My coworker at very high altitude died from colon cancer and another coworker died from throat cancer.” Steven Magee CEng MIET - Q
- “High Altitude May Give Rise to IBD Flares...Traveling at high altitudes — be it a mountain vacation or an hour-long flight — may put inflammatory bowel disease (IBD) patients at risk for flares, researchers reported here. Travel at heights of at least 2,000 meters (about 6,562 feet) above sea level triggered IBD flares in patients within 4 weeks of being at the altitude, according to data presented by Stephan Vavricka, PD, of Trieml Hospital in Zurich, and colleagues here at Digestive Disease Week. There has been early evidence that hypoxia can induce inflammation in the gastrointestinal tract” https://www.everydayhealth.com/digestive-health/0524/high-altitude-may-give-rise-to-ibd-flares.aspx
Altitude Diseases: Altitude Induced Acid Reflux (AIAR) & Antacid Use

- “Being at very high altitude generally required using the company supplied antacids to calm down Altitude Induced Acid Reflux (AIAR).” Steven Magee CEng MIET - Q

- “How Your Antacid Drug Is Making You Sick (Part A)...There are four primary consequences of acid stopping drugs: Increased bacterial overgrowth. Impaired nutrient absorption. Decreased resistance to infection. Increased risk of cancer and other diseases...low stomach acid causes bacterial overgrowth in the stomach and other parts of the intestine. Bacterial overgrowth causes maldigestion of carbohydrates, which in turn produces gas. This gas increases the pressure in the stomach, causing the lower esophageal sphincter (LES) to malfunction. The malfunction of the LES allows acid from the stomach to enter the esophagus, thus producing the symptoms of heartburn and GERD...Stomach acid is a prerequisite to healthy digestion. The breakdown and absorption of nutrients occurs at an optimum rate only within a narrow range of acidity in the stomach. If there isn’t enough acid, the normal chemical reactions required to absorb nutrients is impaired. Over time this can lead to diseases such as anemia, osteoporosis, cardiovascular disease, depression, and more.”

- “Antacids Can Cause Ulcers and More...Antacids Can Cause Ulcers, Inflammatory Bowel Disease, Chronic Inflammation, Leaky Gut, Food Allergies, Anemia, and More...Your stomach is a very acidic environment, with its optimum pH at 2 or less (7 is neutral). This naturally acidic condition in the stomach serves many purposes. It helps to destroy bacteria, yeasts, and parasites. It allows the stomach to secrete intrinsic factors needed to absorb vitamin B12. It is necessary for the absorption of minerals that trigger the release of hormones by the pancreas, without which diabetes can result. It is needed to secrete enzymes, especially pepsin, which converts proteins into amino acids. When undigested proteins make it into the intestines, inflammation begins, causing leaky gut syndrome, chronic allergies, chronic constipation and/or diarrhea, and inflammatory bowel disease. Finally, without adequate stomach acids you can develop colonization of Helicobacter pylori bacteria (H. pylori). The medical community associates these bacteria with ulcers, inflammatory bowel disease, blood diseases, and cancer. Once acquired, H. pylori can inhabit your stomach for years, decades, or even life. Since a low pH and normally acid stomach is the natural barrier against H. pylori, one of the root causes of this bacterial overgrowth is a deficiency of stomach acid, which can be induced or aggravated by antacids and acid blockers.”

- “Antacid Increases Survival of Vibrio vulnificus and Vibrio vulnificus Phage in a Gastrointestinal Model...Viable counts of three strains of Vibrio vulnificus and its phage were determined during exposure to a mechanical gastrointestinal model with or without antacid for 9 h at 37°C. V. vulnificus was eliminated (>4-log reduction) within 30 min in the gastric compartment (pH decline from 5.0 to 3.5). Viable V. vulnificus cells delivered from the gastric compartment during the first 30 min of exposure reached 106 to 108 CFU/ml in the intestinal compartment after 9 h (pH 7.0). Phages were eliminated within 45 min in the gastric compartment (pH decline from 5.1 to 2.5). Less than a 2-log reduction of phage was observed in the intestinal compartment after 9 h (pH 7.0). When the gastric compartment contained
antacid V. vulnificus counts decreased slightly (<2 log) during 2 h of exposure (pH decline from 7.7 to 6.0), while counts in the intestinal compartment (pH 7.5) reached 107 to 109 CFU/ml. Phage numbers decreased 1 log after 2 h in the gastric compartment (pH decline from 7.7 to 5.7) containing antacid and decreased 1 log in the intestinal compartment (pH 7.6) after 9 h. Presence of antacid in the gastric compartment of the model greatly increased the ability of both V. vulnificus and its phage to survive simulated gastrointestinal transit and may be a factor involved with oyster-associated illness.”
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC92958/
Altitude Diseases: Bruxism

- “Occlusion time analysis in military pilots affected by bruxism...Military pilots are characterized by peculiar job conditions related to intense accelerative stresses. For this, they frequently report work-related neck and back pain and are affected by bruxism...military pilots have an importantly increase incidence of bruxism, as confirmed by a previous study that found bruxism of clinical importance in the 71% of Israel military jet pilots and only in the 27% of the non-pilots aircrew members.” [https://www.nature.com/articles/s41598-018-38166-2](https://www.nature.com/articles/s41598-018-38166-2)
- “Bruxism in military pilots and non-pilots: Tooth wear and psychological stress...Bruxism of clinical importance (i.e., with dentin exposure) was found in 69% of the aircrew members but only 27% of the non-pilot group. No difference was found between groups regarding stress levels. Military aircrews may be relatively vulnerable to deleterious bruxism as well as other signs of chronic stress. Among bruxers, pilots tended to show coping strategies that were significantly more emotional and less task-oriented than non-pilots, whereas non-bruxers showed no significant differences in coping behavior. This study suggest that integrating dental and psychological preventive intervention may be helpful.” [https://www.researchgate.net/publication/6494607_Bruxism_in_military_pilots_and_non-pilots_Tooth_wear_and_psychological_stress](https://www.researchgate.net/publication/6494607_Bruxism_in_military_pilots_and_non-pilots_Tooth_wear_and_psychological_stress)
- “7 reasons why you're tired all the time...You grind your teeth. Stressed out? You may be taking out your frustrations out in your sleep. Called bruxism, teeth grinding uses all the muscles surrounding your jaw and skull, says Tim Chase, D.M.D., a practicing partner at SmilesNY, a cosmetic dentistry practice in New York City. “Imagine how tired your arm would feel if you were doing biceps curls all night while you slept,” says Chase. No wonder you wake up tired. Bruxism can also wear down the enamel of the teeth over time. See your dentist if you suspect bruxism to discuss treatment options. Might be time for a retainer.” [https://www.today.com/health/tired-all-time-reasons-behind-fatigue-I547823](https://www.today.com/health/tired-all-time-reasons-behind-fatigue-I547823)
- “How to Stop Grinding Your Teeth at Night...teeth grinding can also cause tooth sensitivity, sore jaw muscles and headaches, especially around the temples. Damage to the teeth can also develop. Over time, the tooth enamel can become worn. Tooth fractures and chips can also occur. The exact reason why some people grind their teeth while they sleep is not understood. But it appears, in some cases, teeth grinding is associated with sleep arousals. Sleep arousals are common in people who have snoring and sleep apnea.” [https://www.sleepassociation.org/sleep-disorders/more-sleep-disorders/bruxism/stop-grinding-teeth-night/](https://www.sleepassociation.org/sleep-disorders/more-sleep-disorders/bruxism/stop-grinding-teeth-night/)
- “The Link Between Sleep Apnea and Teeth Grinding...Waking up with tired, tight jaw muscles or sensitive teeth could be a sign that you grind or clench your teeth during the night, a condition known as bruxism. If left untreated, bruxism can lead to tooth decay, headaches, and trouble sleeping.” [https://www.sleepfoundation.org/articles/link-between-sleep-apnea-and-teeth-grinding](https://www.sleepfoundation.org/articles/link-between-sleep-apnea-and-teeth-grinding)
Altitude Diseases: Dental Issues

- “During my time working at the very high altitude Mauna Kea Observatories, my teeth started turning yellow. They were so discolored that I had to have two veneers attached to my front teeth.” Steven Magee CEng MIET - Q
- “Why do I have Yellow Teeth?...Illness or Medication. Certain illnesses or medications can alter the color of your teeth...Age or Hormones. Hormones play a vital role in the appearance of our teeth as does aging.” [https://www.drliufamilydental.com/p/BLOG-22252-2015.7.10-Why-do-I-have-Yellow-Teeth-p.asp](https://www.drliufamilydental.com/p/BLOG-22252-2015.7.10-Why-do-I-have-Yellow-Teeth-p.asp)
Altitude Diseases: Malnutrition Hazards

- “By the end of 2018 it had become clear from experiments with supplements and dietary changes that I had been suffering from the long term effects of malnutrition.” Steven Magee CEng MIET - Q
- “What is malnutrition?...Malnutrition refers to deficiencies, excesses or imbalances in a person’s intake of energy and/or nutrients. The term malnutrition covers 2 broad groups of conditions. One is ‘undernutrition’—which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other is overweight, obesity and diet-related noncommunicable diseases (such as heart disease, stroke, diabetes and cancer).”

https://www.who.int/features/qa/malnutrition/en/
- “Malnutrition is a condition that results from eating a diet in which one or more nutrients are either not enough or are too much such that the diet causes health problems.[1][3] It may involve calories, protein, carbohydrates, vitamins or minerals.[1] Not enough nutrients is called undernutrition or undernourishment while too much is called overnutrition.[2] Malnutrition is often used to specifically refer to undernutrition where an individual is not getting enough calories, protein, or micronutrients.[2][12] If undernutrition occurs during pregnancy, or before two years of age, it may result in permanent problems with physical and mental development. [1] Extreme undernourishment, known as starvation, may have symptoms that include: a short height, thin body, very poor energy levels, and swollen legs and abdomen.[1][2] People also often get infections and are frequently cold.[2] The symptoms of micronutrient deficiencies depend on the micronutrient that is lacking.”

https://en.wikipedia.org/wiki/Malnutrition
- “List of types of malnutrition or list of nutritional disorders include diseases that results from excessive or inadequate intake of food and nutrients. They come in two broad categories: undernutrition and overnutrition.”

- “Malnutrition: What you need to know...Signs and symptoms of undernutrition include: lack of appetite or interest in food or drink. tiredness and irritability. inability to concentrate. always feeling cold. loss of fat, muscle mass, and body tissue. higher risk of getting sick and taking longer to heal. longer healing time for wounds. higher risk of complications after surgery. Depression. reduced sex drive and problems with fertility.”

https://www.medicalnewstoday.com/articles/179316.php
- “Malnutrition...Signs of malnutrition. The most common symptom of undernutrition is unintentional weight loss (losing 5-10% or more of your body weight over three to six months). Other signs can include: weak muscles. feeling tired all the time. low mood. an increase in illnesses or infections. The main sign of overnutrition is being overweight or obese. However, people with undernutrition can also be overweight if they eat a diet high in energy (calories), but low in other nutrients. Signs of malnutrition in children can include failure to grow at the expected rate and changes in behaviour, such as appearing unusually irritable, sluggish or anxious.”

https://www.nhsinform.scot/illnesses-and-conditions/nutritional/malnutrition
- “Malnutrition: Definition, Symptoms and Treatment...Preventing and treating malnutrition involves addressing the underlying causes. Government agencies, independent organizations and schools can play a role in preventing malnutrition. Research suggests that some of the most effective ways to prevent malnutrition include providing iron, zinc and iodine pills, food supplements and nutrition education to populations at risk of undernutrition (45). In addition,
interventions that encourage healthy food choices and physical activity for children and adults at risk of overnutrition may help prevent overweight and obesity (46, 47).”

- “Sea level adapted very high altitude workers eventually end up in a state of malnutrition from exposure to abnormal environmental conditions. Long term exposure to malnutrition is known to bring on mental and physical health problems.” Steven Magee CEng MIET - Q

- “THE IMPORTANCE OF NUTRITION IN MOUNTAINEERING. “The importance of adequate caloric and fluid intake must be rated as least as highly as that of oxygen” Dr Griffith Pugh...The paper tackles the following fundamental subjects: The reasons for weight loss at altitude. How to decide what food rations should be taken on expedition. The importance of experimenting by preparing/eating foods on expedition at home first. During the Expedition – How to keep properly hydrated at altitude and avoid problems concerning dehydration and diarrhea. Water retention in Acute Mountain Sickness (AMS). Micronutrient deficiencies-(vitamins and minerals). Understanding and calculating energy needs. What is Basal Metabolic Rate (BMR). How to calculate energy needs and physical activity. Diet-induced energy expenditure. Macronutrients – carbohydrates, fats, and protein – distribution at altitude.” https://www.theuiaa.org/mountaineering/the-importance-of-nutrition-in-mountaineering/


- “A Review of the Physiology and Nutrition in Cold and in High-Altitude Environments by the Committee on Military Nutrition Research...high doses (400 mg/d) of vitamin E decreased the exhalation of pentane and the production of thiobarbituric acid-reacting substances (TBARS) by erythrocytes of subjects at high altitudes, suggest that tocopherol may have a role in inhibiting increased lipid peroxidation under such conditions. Furthermore, a high dose of vitamin E appeared to improve the rheological characteristics of blood of subjects at high altitudes...As with cold exposure, concern was expressed regarding the adequacy of current dietary recommendations for the water-soluble vitamins essential for energy production (thiamin, niacin, riboflavin, and pantothenic acid) for individuals at high altitudes...adequate iron nutriture is important for individuals working at higher elevations, because of the well-known phenomenon of altitude-induced polycythemia...urinary zinc losses were significantly elevated during exposure to the very high altitude of 27,726 ft (8,450 m) altitudes.” https://www.ncbi.nlm.nih.gov/books/NBK232855/

- “Risk of malnutrition is associated with mental health symptoms in community living elderly men and women: The Tromsø Study...Conclusions. Impaired mental health was strongly associated with the risk of malnutrition in community living elderly men and women and this association was also significant for subthreshold mental health symptoms.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3173300/

- “The link between psychosis and malnutrition...First-time psychosis sufferers are far more likely to be deficient in micronutrients and protein than the general population – and more intervention studies are needed to explore strategies against this, say UK researchers.” https://www.nutraingredients.com/Article/2015/08/24/Psychosis-and-malnutrition?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright

- “Assessment of malnutrition in mental health clients: nurses’ judgement vs. a nutrition risk
tool...Results. The comparison revealed that nurses did not identify malnutrition in the same patients as the risk score, overlooking 27 (29%) at risk patients. Nurses associated malnutrition with psychotic illness, suggesting that depressed patients are more likely to be overlooked.”


- “Malnutrition is a condition that results from eating a diet in which one or more nutrients are either not enough or are too much such that the diet causes health problems.”

https://en.wikipedia.org/wiki/Malnutrition

- “How Malnutrition Affects the Brain...Inadequate intake of essential vitamins and nutrients has repercussions on the entire body. One of the most concerning is the effects malnutrition can have on the brain. This organ -- in charge of thinking, emotions and instigating bodily functions -- needs proper nutrition from the time you're in the womb through old age. Failure to provide the brain with nourishment can have lasting consequences.”

Altitude Diseases: Biochemical Adaptations

- “Biochemical adaptations to moderately high altitude living...Human adaptation to moderately high altitude living produces physiological changes. We examined blood chemistry values in 46 male and 30 female natives residing at 3000 m and compared them to an adult population not matched for age (44 men and 40 women) residing at sea level. The following values were significantly lower (p <0.05) in the high altitude subjects: serum glucose, magnesium, bicarbonate, creatinine and high density lipoprotein. Serum potassium, triglycerides, amylase, aspartate aminotransferase and alkaline phosphatase levels were found to be significantly (p <0.05) higher. The authors did not detect hyperuricemia in any subject. Serum calcium and phosphorus concentrations were significantly higher (p <0.05) in the high altitude women, corresponding to higher serum protein. In a subgroup of high altitude subjects (22 men and 18 women), total T4 and free T3 and T4 were significantly higher (p <0.05), and thyroid binding globulin (TBC) lower (p <0.05) compared to sea level subjects. The gamma globulins, notably IgA, were increased in the high altitude subjects. Iron binding capacity was elevated in women at high altitude. Detailed metabolic studies to elucidate the reason(s) for differences between high altitude and sea level individuals might enhance our understanding of the chronic effects of mild hypoxemia.”  
  https://www.wemjournal.org/article/S0953-9859(91)71297-7/pdf

- “Sherpas, Hypoxia, and Saving the ICU Patient...Hypoxia is a relative drop in tissue oxygen levels. It is a common feature of many human diseases, including heart failure, lung diseases, anemia, and many cancers, and can compromise normal cellular function...the Sherpas' mitochondria were more efficient at using oxygen to produce ATP, the energy that powers our bodies...As predicted from genetic differences, they also found lower levels of fat oxidation in the Sherpas... In lowlanders, after two months at high altitude, phosphocreatine levels crash, whereas in Sherpas levels actually increase...levels of free radicals increase rapidly at high altitude, at least initially, levels in Sherpas are very low. Free radicals are molecules created by a lack of oxygen that can be potentially damaging to cells and tissue.”  
Altitude Diseases: Altered Hormones

- “Hormones at high altitude...Humans cannot live at high altitudes because we cannot elicit long term physiological adaptation of the cardiorespiratory, metabolic and reproductive systems in such a hostile climate. As hormones play a key role in regulating these processes, von Wolff et al. investigated whether the endocrine system becomes significantly dysregulated at a certain altitude...Hormone concentrations correlated with altitude but not with oxygen parameters, indicating that hypoxia was not a major driver of hormonal dysregulation in this context. Adrenal, thyroid and gonadal axes were affected by altitude, characterised by activation of the adrenal and thyroid axes and inhibition of the male reproductive endocrine axis. Acclimatisation at 4844m led to normalisation of adrenal and gonadal but not thyroid hormone axes. At higher altitudes (>5000m), endocrine dysregulation was pronounced, which may contribute to the incapability of humans to live permanently at very high altitude.”
  https://www.endocrinology.org/endocrinologist/130-winter18/hot-topics/hormones-at-high-altitude/

- “Endocrine responses to acute and chronic high-altitude exposure (4,300 meters): modulating effects of caloric restriction...Altitude exposure is known to stimulate neuroendocrine systems as part of the acute hypoxic and chronic adaptive acclimatization process (2). In contrast, prolonged caloric restriction (CR) tends to blunt some of the same neuroendocrine pathways that are stimulated at altitude as the body attempts to reduce basal energy expenditure (44). In this report, we describe the hormone and metabolic responses to HA as measured in three groups of subjects over the course of a 21-day dietary intervention.”
  https://www.physiology.org/doi/full/10.1152/ajpendo.00449.2005

- “Physiological effects of high-altitude trekking on gonadal, thyroid hormones and macrophage migration inhibitory factor (MIF) responses in young lowlander women...Altitude hypoxia is often associated with impairment of human reproduction. In this study, hormones and macrophage migration inhibitory factor (MIF, a proinflammatory cytokine with key roles in human reproduction) were determined in seven regularly menstruating, lowlander native women living at sea level participating in 14 days of trekking at moderate and high altitude. Blood and saliva samples were collected from each subject at high altitude (5050 m a.s.l. [above sea level]), and at sea level before and after the expedition. Testosterone level was lowered by high altitude and was restored after the end of the expedition, while progesterone decreased significantly in all participants at the end of the expedition, although most of the participants were in the luteal phase. The salivary concentration of MIF decreased greatly at altitude, but its levels were completely restored after the return to sea level. Our findings showed high sensitivity and rapid changes in the determined parameters in response to the high-altitude hypoxic environment, particularly MIF.”

- “Effects of high-altitude hypoxia on the hormonal response to hypothalamic factors...Acute and chronic exposure to high altitude induces various physiological changes, including activation or inhibition of various hormonal systems. In response to activation processes, a desensitization of several pathways has been described, especially in the adrenergic system. In the present study, we aimed to assess whether the hypophyseal hormones are also subjected to a hypoxia-induced decrease in their response to hypothalamic factors. Basal levels of hormones and the responses of TSH, thyroid hormones, prolactin, sex hormones, and growth hormone to the injection of
TRH, gonadotropin-releasing hormone, and growth hormone-releasing hormone (GHRH) were studied in eight men in normoxia and on prolonged exposure (3-4 days) to an altitude of 4,350 m. Thyroid hormones were elevated at altitude (+16 to +21%), while TSH levels were unchanged, and follicle-stimulating hormone and prolactin decreased, while leutinizing hormone was unchanged. Norepinephrine and cortisol levels were elevated, while no change was observed in levels of epinephrine, dopamine, growth hormone (GH), IGF-1, and IGFBP-3. The mean response to hypothalamic factors was similar in both altitudes for all studied hormones, although total T4 was lower in hypoxia during 45 to 60 min after injection. The effect of hypoxia on the hypophyseal response to hypothalamic factors was similar among subjects, except for the GH response to GHRH administration. We conclude that prolonged exposure to high-altitude hypoxia induces contrasted changes in hormonal levels, but the hypophyseal response to hypothalamic factors does not appear to be blunted.”


- “The Effect of High Altitude on Blood Hormones in Male Westar Rats in South Western Saudi Arabia...Living in high altitude areas results in chronic hypoxia, which induces complex metabolic and endocrine adaptations. The current study investigated the endocrine responses of male Westar rats chronically exposed to high altitude-induced hypoxia in Abha City, in Southwestern Saudi Arabia. Approach: The rats were separated in to 2 groups of 10 rats. The first group was kept at an altitude of 600 m above sea level in the King Saud University animal house in Riyadh City and designated the low altitude group; the second group of rats was transferred to the King Khalid University animal house in Abha City, which is 2800 m height above sea level and was designated the high altitude group. All rats were housed under the same laboratory conditions and fed the same diet. Blood samples were collected from both groups of animals 45 days after transferring the high altitude group to Abha City. Results: The data revealed that the rats transferred to the high altitude area had significant decreases in serum Thyroid Stimulating Hormone (TSH) and testosterone levels and significant increases in the levels of serum cortisol, free Triiodothyronine (T3) and free Thyroxin (T4) compared to rats kept at low altitude. Conclusion: The current study demonstrates that rats chronically exposed to high altitude hypoxia experienced alternations in various hormones. These findings will contribute to a better understanding of human endocrine and metabolic physiology in hypoxic conditions.”

https://www.researchgate.net/publication/49619640_The_Effect_of_High_Altitude_on_Blood_Hormones_in_Male_Westar_Rats_in_South_Western_Saudi_Arabia

- "What Are Skin Tags (And How Do You Get Rid of Them)?...Recent studies have also linked a higher incidence of skin tags to conditions like obesity, diabetes, metabolic syndrome, and insulin resistance. Hormonal changes seem to play a role, too, since many women develop skin tags during pregnancy." https://www.msn.com/en-us/health/health-news/what-are-skin-tags-and-how-do-you-get-rid-of-them/ar-BBVj2al?ocid=spartanntp

- "A strange skin tag grew on right side of my belly in my early forties.  My doctors did not pay any attention to it and it was only years later that I discovered through experimentation with supplements that I had a DHEA hormone deficiency."Steven Magee CEng MIET - Q

“Addison's disease...Addison's disease is caused by damage to the adrenal glands, which make hormones to control multiple metabolic processes in the body, and balance body salt and water. Treatment is with hormone replacement tablets and some lifestyle adaptations to ensure patients remain well...The signs and symptoms of Addison’s disease usually appear very gradually, as it takes months or years for the adrenal cortex to be destroyed significantly enough to cause symptoms. General signs such as tiredness, weight loss, feeling faint, depression and aches in the joints, muscles and abdomen are all common signs of Addison’s disease, but could also be caused by a wide range of other diseases. Nausea, vomiting, diarrhoea and a craving for salt may also be symptoms, developing late in the disease course.”

“Addison's disease...Addison's disease, also called adrenal insufficiency, is an uncommon disorder that occurs when your body doesn't produce enough of certain hormones. In Addison's disease, your adrenal glands, located just above your kidneys, produce too little cortisol and, often, too little aldosterone. Addison's disease occurs in all age groups and both sexes, and can be life-threatening. Treatment involves taking hormones to replace those that are missing...See your doctor if you have common signs and symptoms of Addison's disease, such as: Darkening areas of skin (hyperpigmentation), Severe fatigue, Unintentional weight loss, Gastrointestinal problems, such as nausea, vomiting and abdominal pain, Lightheadedness or fainting, Salt cravings, Muscle or joint pains”

“Inactivation of Corticotropin-Releasing Hormone–Induced Insulinotropic Role by High-Altitude Hypoxia...We have shown that hypoxia reduces plasma insulin, which correlates with corticotropin-releasing hormone (CRH) receptor 1 (CRHR1) in rats, but the mechanism remains unclear. Here, we report that hypobaric hypoxia at an altitude of 5,000 m for 8 h enhances rat plasma CRH, corticosterone, and glucose levels, whereas the plasma insulin and pancreatic ATP/ADP ratio is reduced. In islets cultured under normoxia, CRH stimulated insulin release in a glucose- and CRH-level–dependent manner by activating CRHR1 and thus the cAMP-dependent protein kinase pathway and calcium influx through L-type channels. In islets cultured under hypoxia, however, the insulinotropic effect of CRH was inactivated due to reduced ATP and cAMP and coincident loss of intracellular calcium oscillations. Serum and glucocorticoid-inducible kinase 1 (SGK1) also played an inhibitory role. In human volunteers rapidly ascended to 3,860 m, plasma CRH and glucose levels increased without a detectable change in plasma insulin. By contrast, volunteers with acute mountain sickness (AMS) exhibited a marked decrease in HOMA insulin sensitivity (HOMA-IS) and enhanced plasma CRH. In conclusion, hypoxia may attenuate the CRH-insulinotropic effect by reducing cellular ATP/ADP ratio, cAMP and calcium influx, and upregulated SGK1. Hypoxia may not affect HOMA-IS in healthy volunteers but reduces it in AMS volunteers.”

“Adrenal, thyroid and gonadal axes are affected at high altitude...Humans cannot live at very high altitude for reasons, which are not completely understood. Since these reasons are not restricted to cardiorespiratory changes alone, changes in the endocrine system might also be involved. Therefore, hormonal changes during prolonged hypobaric hypoxia were comprehensively assessed to determine effects of altitude and hypoxia on stress, thyroid and gonadal hypothalamus–pituitary hormone axes. Twenty-one male and 19 female participants were examined repetitively during a high-altitude expedition. Cortisol, prolactin, thyroid-stimulating hormone (TSH), fT4 and fT3 and in males follicle-stimulating hormone (FSH),
luteinizing hormone (LH) and total testosterone were analysed as well as parameters of hypoxemia, such as SaO2 and paO2 at 550 m (baseline) (n = 40), during ascent at 4844 m (n = 38), 6022 m (n = 31) and 7050 m (n = 13), at 4844 m (n = 29) after acclimatization and after the expedition (n = 38). Correlation analysis of hormone concentrations with oxygen parameters and with altitude revealed statistical association in most cases only with altitude. Adrenal, thyroid and gonadal axes were affected by increasing altitude. Adrenal axis and prolactin were first suppressed at 4844 m and then activated with increasing altitude; thyroid and gonadal axes were directly activated or suppressed respectively with increasing altitude. Acclimatization at 4844 m led to normalization of adrenal and gonadal but not of thyroid axes. In conclusion, acclimatization partly leads to a normalization of the adrenal, thyroid and gonadal axes at around 5000 m. However, at higher altitude, endocrine dysregulation is pronounced and might contribute to the physical degradation found at high altitude.”

- “Effects of high-altitude hypoxia on the hormonal response to hypothalamic factors...Acute and chronic exposure to high altitude induces various physiological changes, including activation or inhibition of various hormonal systems. In response to activation processes, a desensitization of several pathways has been described, especially in the adrenergic system. In the present study, we aimed to assess whether the hypophyseal hormones are also subjected to a hypoxia-induced decrease in their response to hypothalamic factors. Basal levels of hormones and the responses of TSH, thyroid hormones, prolactin, sex hormones, and growth hormone to the injection of TRH, gonadotropin-releasing hormone, and growth hormone-releasing hormone (GHRH) were studied in eight men in normoxia and on prolonged exposure (3–4 days) to an altitude of 4,350 m. Thyroid hormones were elevated at altitude (+16 to +21%), while TSH levels were unchanged, and follicle-stimulating hormone and prolactin decreased, while leutinizing hormone was unchanged. Norepinephrine and cortisol levels were elevated, while no change was observed in levels of epinephrine, dopamine, growth hormone (GH), IGF-1, and IGFBP-3. The mean response to hypothalamic factors was similar in both altitudes for all studied hormones, although total T4 was lower in hypoxia during 45 to 60 min after injection. The effect of hypoxia on the hypophyseal response to hypothalamic factors was similar among subjects, except for the GH response to GHRH administration. We conclude that prolonged exposure to high-altitude hypoxia induces contrasted changes in hormonal levels, but the hypophyseal response to hypothalamic factors does not appear to be blunted. high altitude induces various physiological changes in sea level natives, both on acute and more prolonged exposure, including control of hormonal secretion. A substantial amount of work has been done on hormones regulating water and electrolytes handling or stress hormones at high altitude (for review, see Ref. 34). Other hormones dealing with metabolic regulations have been scarcely examined in hypoxic conditions. Thyroid hormones have been found increased at high altitude in most studies, although TSH secretion is not modified, and the mechanisms involved in this dissociation are still unclear (2). The reports on the effects of acute hypoxic exposure on sex hormones (18), prolactin (21), and growth hormone (5) are few and often contradictory. Some endocrine or neuroendocrine pathways are activated in response to the hypoxic stressor, while other pathways are blunted. For example, a cortisol release is activated while an aldosterone release is blunted by hypoxia, although these two hormones are secreted by adjoining zones in the same organ. A resistance appears to occur with certain stimuli, limiting the effects of the activated pathways. These down-regulation processes may counteract the numerous activation phenomena leading to an increase in stress hormones (cortisol, catecholamines) observed in
response to hypoxia. Finally, an optimal adaptation to the stressful environment would depend on an adequate balance between activation and resistance (33). To test the hypothesis that hypophyseal secretions are also subjected to a desensitization phenomenon during a prolonged (3 to 4 days) exposure to high altitude (4,350 m), the responses of thyroid hormones (TSH, T3, T4), prolactin, luteinizing hormone (LH), follicle-stimulating hormone (FSH), and growth hormone (GH) to the injection of hypothalamic factors have been evaluated in eight male sea-level natives.” [10.1152/ajpregu.00484.2010]

- “Hormones at high altitude...Humans cannot live at high altitudes because we cannot elicit long term physiological adaptation of the cardiorespiratory, metabolic and reproductive systems in such a hostile climate. As hormones play a key role in regulating these processes, von Wolff et al. investigated whether the endocrine system becomes significantly dysregulated at a certain altitude. This observational cohort study assessed the impact of high altitude on 21 male and 19 female participants during an expedition in Nepal. The effects of altitude and hypoxia on stress, thyroid and hypothalamic-pituitary-gonadal hormone axes were assessed at baseline (550m) and at altitudes of 4844, 6022 and 7050m. Hormone concentrations correlated with altitude but not with oxygen parameters, indicating that hypoxia was not a major driver of hormonal dysregulation in this context. Adrenal, thyroid and gonadal axes were affected by altitude, characterised by activation of the adrenal and thyroid axes and inhibition of the male reproductive endocrine axis. Acclimatisation at 4844m led to normalisation of adrenal and gonadal but not thyroid hormone axes. At higher altitudes (>5000m), endocrine dysregulation was pronounced, which may contribute to the incapability of humans to live permanently at very high altitude.” [https://www.endocrinology.org/endocrinologist/130-winter18/hot-topics/hormones-at-high-altitude/]

- “Effects of high-altitude hypoxia on the hormonal response to hypothalamic factors...Acute and chronic exposure to high altitude induces various physiological changes, including activation or inhibition of various hormonal systems. In response to activation processes, a desensitization of several pathways has been described, especially in the adrenergic system. In the present study, we aimed to assess whether the hypophyseal hormones are also subjected to a hypoxia-induced decrease in their response to hypothalamic factors. Basal levels of hormones and the responses of TSH, thyroid hormones, prolactin, sex hormones, and growth hormone to the injection of TRH, gonadotropin-releasing hormone, and growth hormone-releasing hormone (GHRH) were studied in eight men in normoxia and on prolonged exposure (3-4 days) to an altitude of 4,350 m. Thyroid hormones were elevated at altitude (+16 to +21%), while TSH levels were unchanged, and follicle-stimulating hormone and prolactin decreased, while leutinizing hormone was unchanged. Norepinephrine and cortisol levels were elevated, while no change was observed in levels of epinephrine, dopamine, growth hormone (GH), IGF-1, and IGFBP-3. The mean response to hypothalamic factors was similar in both altitudes for all studied hormones, although total T4 was lower in hypoxia during 45 to 60 min after injection. The effect of hypoxia on the hypophyseal response to hypothalamic factors was similar among subjects, except for the GH response to GHRH administration. We conclude that prolonged exposure to high-altitude hypoxia induces contrasted changes in hormonal levels, but the hypophyseal response to hypothalamic factors does not appear to be blunted.” [https://www.ncbi.nlm.nih.gov/m/pubmed/20926759/]

336
Altitude Diseases: Altered Glucoregulatory hormones

- “Glucoregulatory hormones in man at high altitude...Concentrations of glucose, lactic acid, free fatty acid (FFA), insulin, cortisol and growth hormone (GH) in the blood were monitored in 15 euglycaemic men (sojourners, SJ) at sea level (SL) and while at altitudes of 3500 m and 5080 m, in acclimatised low landers (ALL) and in high altitude natives (HAN). In SJ, blood glucose and insulin concentrations showed a significant increase on the 3rd and 7th day after arrival at high altitude (HA), thereafter returning to sea level values and remaining the same during the entire period of their stay at 3500 m. Subsequently, on arrival at higher altitude (5080 m) the glucose concentrations again showed an increase over the preceding values and returned to SL values on day 41 while at 5080 m. A significant increase in cortisol concentrations was seen on day 3 after arrival at HA and the increased levels were maintained until day 21 at 3500 m. The cortisol concentrations on day 30 after arrival at 5080 m came down to SL values and remained unchanged thereafter. No appreciable change in GH and FFA was seen during the sojourn at HA. On the other hand, blood lactic acid concentration decreased significantly. There was no difference between the fasting glucose concentrations in ALL at 3500 m and in HAN at 3500 m and 4200 m compared to values of SJ at SL, whereas ALL at 4200 m had higher glucose values. Concentrations of plasma insulin and GH in ALL and HAN were higher than the values of SJ at SL, whereas cortisol values did not show any difference. These observations indicated that at HA the glucose values were high for the insulin concentration observed and might have been due to increased secretion of GH by the pituitary gland.”

https://link.springer.com/article/10.1007/BF00571554
Altitude Diseases: Altered Erythropoietin Hormone

- “Erythropoietin is a hormone, produced mainly in the kidneys, which stimulates the production and maintenance of red blood cells... erythropoietin production will go up when moving to a high altitude. This is because the air pressure is lower, the pressure of oxygen is lower and so less oxygen is taken up by the blood therefore stimulating erythropoietin production. In low oxygen states people risk developing hypoxia - oxygen deprivation.”
https://www.yourhormones.info/hormones/erythropoietin/
Altitude Diseases: Altered Thyroid Hormones

- “Effect of High Altitude on Thyroid and Thyroid Stimulating Hormones Levels in Taif City...Conclusion: Thyroid hormones levels increase in high altitude area and this elevation may independent on hypothalamic-pituitary thyroid axis.”
- “Thyroid hormone changes and psychological response to high altitude stress: effect of ethnicity...Objective: Acclimatization to high-altitude is a dynamic process affecting the neuro-endocrine and physiological systems. Psychological well-being is also influenced by hypobaric-hypoxia. Psychic stress is known to influence the hypothalamo–pituitary–adrenal/thyroid axis. However, the involvement/contribution of ‘psychological-performance’ on hormone changes at high-altitude is not known. The objective of this study was to examine: i) the effect of ethnicity on cortisol, thyroid hormones and psychological performance during high-altitude exposure in lowlanders as compared to sea-level, and with high-altitude-natives (HAN) at high-altitude; ii) if there is any relation between psychological variables and hormones at high-altitude in the Indian population.  Methods: Male volunteers (20–50 years) belonging to Caucasoid/Indo-European (n=25), Mongoloid/Tibeto-Burman (n=31) and Australoid/Dravidian (n=28) ethnicities were studied at sea-level and after 3–4 weeks of stay at ~4500 m. High-altitude-natives (HAN, n=21) were studied at ~4500 m only. Plasma hormone (EIA/ELISA)/biochemical estimation, physiological and psychological evaluation was conducted on all subjects. Significance at P<0.05.  Results: In lowlanders, there was a significant change in loneliness, fear-of-death; thyroid hormones at high-altitude. Interactive effect between high-altitude×ethnicity was observed for psychological and hormone variables (except hopelessness, freeT3). Significant variation in hormones and psychological variables was observed between lowlanders and HAN at high-altitude (except memory, loneliness, TSH). Significant correlation was observed between fear-of-death/loneliness for Caucasoids (r=0.55) and Mongoloids (r=0.49); loneliness/freeT4 (r=−0.37) and fear-of-death/freeT4 (r=−0.36) for Mongoloids.”
  https://www.endocrine-abstracts.org/ea/0025/ea0025p344
Altitude Diseases: Altered Growth Hormones

- “Ghrelin, Growth Hormone and Growth Factors at High Altitude...Regulation of ghrelin, growth hormone and growth factors at high altitude and their change during ascent to high altitude has not been studied in depth yet. The study includes 33 volunteers (12f) investigated at sea level, 4 days after ascent to 3440m and 14 days after ascent to 5400-5900m. The investigators hypothesized that during ascent growth hormone levels would increase to compensate for the higher energy needs at high altitude.”
https://clinicaltrials.gov/ct2/show/NCT00966134
Altitude Diseases: Altered Sodium Hormones

- "Sodium Regulating Hormones at High Altitude: Basal and Post-Exercise Levels...High altitude (HA)-induced diuresis is associated with marked changes in sodium and water regulating hormones, particularly the renin-angiotensin-aldosterone system (RAAS) and atrial natriuretic hormone (ANH). These hormones are also strongly stimulated by physical exercise, which is a major component of daily activity at HA. In spite of the numerous studies in literature, a clear relationship between hormonal changes, HA diuresis, and physical exercise has not yet been established. We therefore evaluated the response of sodium regulating hormones to exhaustive exercise in a group of seven males exposed to prolonged HA hypoxia. The study was divided into four phases: sea level (SL1), after 7 (P1) and after 21 (P2) days at 5050 m (Italian National Research Council Pyramid Laboratory, Nepal), and back at sea level (SL2). At each phase plasma hematocrit (Ht), total body water (TBW), 24-hr sodium excretion (uNa), and urinary volume (uV) were evaluated together with PRA, plasma aldosterone, and ANH, in samples drawn basally from patients in upright position, and at the end of graded step-wise (30 W/2 min) maximal exercise. Levels of uNa and uV were raised at P1 and then declined at P2, with a parallel decrease in TBW and an increase in Ht. Basal PRA and aldosterone levels were suppressed both at P1 and P2 (from 1.9 ± 0.4 to 0.08 ± 0.03 and 0.5 ± 0.1 ng/mL/3 h, and from 7.9 ± 1.8 to 3.9 ± 0.4 and 4.5 ± 0.4 ng/dL, respectively; P < .05). Exhaustive exercise at HA did not induce any significant response in PRA and aldosterone, unlike SL1. Otherwise, at P1 ANH levels remained unchanged both basally and during exercise, while at P2 they decreased significantly vs. SL1, both basally and after exercise (from 13.3 ± 5.7 to 3.5 ± 1.2 and from 40.2 ± 10.2 to 17.5 ± 8.3, respectively; P < .05). Our data show that PRA and aldosterone levels were constantly suppressed at HA and were unresponsive to exercise, whereas the ANH response was significantly stimulated during acute HA exposure, but not during chronic exposure. This suggests that hypoxia-induced chemoreceptor stimulation may cause the natriuretic phenomenon through direct suppression of the RAAS."

https://academic.oup.com/jcem/article/83/2/570/2865510
Altitude Diseases: Altered Acetylcholine, Dopamine & Serotonin Hormones

- “Dopamine (DA, a contraction of 3,4-dihydroxyphenethylamine) is a hormone and a neurotransmitter that plays several important roles in the brain and body. It is an organic chemical of the catecholamine and phenethylamine families. Dopamine constitutes about 80% of the catecholamine content in the brain. It is an amine synthesized by removing a carboxyl group from a molecule of its precursor chemical L-DOPA, which is synthesized in the brain and kidneys. Dopamine is also synthesized in plants and most animals. In the brain, dopamine functions as a neurotransmitter—a chemical released by neurons (nerve cells) to send signals to other nerve cells. The brain includes several distinct dopamine pathways, one of which plays a major role in the motivational component of reward-motivated behavior. The anticipation of most types of rewards increases the level of dopamine in the brain,[2] and many addictive drugs increase dopamine release or block its reuptake into neurons following release. Other brain dopamine pathways are involved in motor control and in controlling the release of various hormones. These pathways and cell groups form a dopamine system which is neuromodulatory. [citation needed] In popular culture and media, dopamine is usually seen as the main chemical of pleasure, but the current opinion in pharmacology is that dopamine instead confers motivational salience;[3][4][5] in other words, dopamine signals the perceived motivational prominence (i.e., the desirability or aversiveness) of an outcome, which in turn propels the organism's behavior toward or away from achieving that outcome.[5][6] Outside the central nervous system, dopamine functions primarily as a local paracrine messenger. In blood vessels, it inhibits norepinephrine release and acts as a vasodilator (at normal concentrations); in the kidneys, it increases sodium excretion and urine output; in the pancreas, it reduces insulin production; in the digestive system, it reduces gastrointestinal motility and protects intestinal mucosa; and in the immune system, it reduces the activity of lymphocytes. With the exception of the blood vessels, dopamine in each of these peripheral systems is synthesized locally and exerts its effects near the cells that release it. Several important diseases of the nervous system are associated with dysfunctions of the dopamine system, and some of the key medications used to treat them work by altering the effects of dopamine. Parkinson's disease, a degenerative condition causing tremor and motor impairment, is caused by a loss of dopamine-secreting neurons in an area of the midbrain called the substantia nigra. Its metabolic precursor L-DOPA can be manufactured; Levodopa, a pure form of L-DOPA, is the most widely used treatment for Parkinson's. There is evidence that schizophrenia involves altered levels of dopamine activity, and most antipsychotic drugs used to treat this are dopamine antagonists which reduce dopamine activity.[7] Similar dopamine antagonist drugs are also some of the most effective anti-nausea agents. Restless legs syndrome and attention deficit hyperactivity disorder (ADHD) are associated with decreased dopamine activity.[8] Dopaminergic stimulants can be addictive in high doses, but some are used at lower doses to treat ADHD. Dopamine itself is available as a manufactured medication for intravenous injection: although it cannot reach the brain from the bloodstream, its peripheral effects make it useful in the treatment of heart failure or shock, especially in newborn babies.” [https://en.wikipedia.org/wiki/Dopamine]

- “Serotonin (/ˌsɛrəˈtoʊnɪn, ˌsɪərə-/)[7][8] or 5-hydroxytryptamine (5-HT) is a monoamine neurotransmitter. Its biological function is complex and multifaceted, modulating mood, cognition, reward, learning, memory, and numerous physiological processes such as vomiting
and vasoconstriction.[9] Biochemically, the indoleamine molecule derives from the amino acid tryptophan, via the (rate-limiting) hydroxylation of the 5 position on the ring (forming the intermediate 5-hydroxytryptophan), and then decarboxylation to produce serotonin.[10] Serotonin is primarily found in the enteric nervous system located in the gastrointestinal tract (GI tract). However, it is also produced in the central nervous system (CNS), specifically in the Raphe nuclei located in the brainstem, Merkel cells located in the skin and taste receptor cells in the tongue. Additionally, serotonin is stored in blood platelets and is released during agitation and vasoconstriction, where it then acts as an agonist to other platelets.[11] Approximately 90% of the human body's total serotonin is located in the enterochromaffin cells in the GI tract, where it regulates intestinal movements.[12][13] About 8% is found in platelets and 1%-2% in the CNS.[14] The serotonin is secreted luminally and basolaterally, which leads to increased serotonin uptake by circulating platelets and activation after stimulation, which gives increased stimulation of myenteric neurons and gastrointestinal motility.[15] The remainder is synthesized in serotonergic neurons of the CNS, where it has various functions. These include the regulation of mood, appetite, and sleep. Serotonin also has some cognitive functions, including memory and learning. Several classes of antidepressants, such as the SSRIs and the SNRIs among others, interfere with the normal reabsorption of serotonin after it is done with the transmission of the signal, therefore augmenting the neurotransmitter levels in the synapses. Serotonin secreted from the enterochromaffin cells eventually finds its way out of tissues into the blood. There, it is actively taken up by blood platelets, which store it. When the platelets bind to a clot, they release serotonin, where it can serve as a vasoconstrictor or a vasodilator while regulating hemostasis and blood clotting. In high concentrations, serotonin acts as a vasoconstrictor by contracting endothelial smooth muscle directly or by potentiating the effects of other vasoconstrictors (e.g. angiotensin II, norepinephrine). The vasoconstrictive property is mostly seen in pathologic states affecting the endothelium – such as atherosclerosis or chronic hypertension. In physiologic states, vasodilation occurs through the serotonin mediated release of nitric oxide from endothelial cells. Additionally, it inhibits the release of norepinephrine from adrenergic nerves.[16] Serotonin is also a growth factor for some types of cells, which may give it a role in wound healing. There are various serotonin receptors. Serotonin is metabolized mainly to 5-HIAA, chiefly by the liver. Metabolism involves first oxidation by monoamine oxidase to the corresponding aldehyde. The rate-limiting step is hydride transfer from serotonin to the flavin cofactor.[17] There follows oxidation by aldehyde dehydrogenase to 5-HIAA, the indole acetic-acid derivative. The latter is then excreted by the kidneys. Besides mammals, serotonin is found in all bilateral animals including worms and insects,[18] as well as in fungi and in plants. Serotonin's presence in insect venoms and plant spines serves to cause pain, which is a side-effect of serotonin injection.[19] Serotonin is produced by pathogenic amoebae, and its effect in the human gut is diarrhea.[20] Its widespread presence in many seeds and fruits may serve to stimulate the digestive tract into expelling the seeds.[21] Serotonin is also present in plants as phytoserotonin.”

- “Acetylcholine (ACh) is an organic chemical that functions in the brain and body of many types of animals (including humans) as a neurotransmitter—a chemical message released by nerve cells to send signals to other cells, such as neurons, muscle cells and gland cells.[1] Its name is derived from its chemical structure: it is an ester of acetic acid and choline. Parts in the body that use or are affected by acetylcholine are referred to as cholinergic. Substances that increase or decrease the overall activity of the cholinergic system are called cholinergics and anticholinergics, respectively. Acetylcholine is the neurotransmitter used at the neuromuscular
junction—in other words, it is the chemical that motor neurons of the nervous system release in order to activate muscles. This property means that drugs that affect cholinergic systems can have very dangerous effects ranging from paralysis to convulsions. Acetylcholine is also a neurotransmitter in the autonomic nervous system, both as an internal transmitter for the sympathetic nervous system and as the final product released by the parasympathetic nervous system.[1] Acetylcholine is the primary neurotransmitter of the parasympathetic nervous system.[2] In the brain, acetylcholine functions as a neurotransmitter and as a neuromodulator. The brain contains a number of cholinergic areas, each with distinct functions; such as playing an important role in arousal, attention, memory and motivation.[3] Acetylcholine has also been traced in cells of non-neural origins and microbes. Recently, enzymes related to its synthesis, degradation and cellular uptake have been traced back to early origins of unicellular eukaryotes. [4] The protist pathogen Acanthamoeba spp. has shown the presence of ACh, which provides growth and proliferative signals via a membrane located M1-muscarinic receptor homolog.[5] Partly because of its muscle-activating function, but also because of its functions in the autonomic nervous system and brain, many important drugs exert their effects by altering cholinergic transmission. Numerous venoms and toxins produced by plants, animals, and bacteria, as well as chemical nerve agents such as Sarin, cause harm by inactivating or hyperactivating muscles through their influences on the neuromuscular junction. Drugs that act on muscarinic acetylcholine receptors, such as atropine, can be poisonous in large quantities, but in smaller doses they are commonly used to treat certain heart conditions and eye problems. Scopolamine, which acts mainly on muscarinic receptors in the brain, can cause delirium and amnesia. The addictive qualities of nicotine are derived from its effects on nicotinic acetylcholine receptors in the brain.” https://en.wikipedia.org/wiki/Acetylcholine

- “Your Brain on Altitude- How altitude can cause or prevent depression?...In a 2005 study, the Naval Health Research Center measured mood changes in Marines who left seaside San Diego for 30 days of strenuous training in the Northern California mountains. Before training, the Marines completed a self-evaluation of their levels of anxiety, dejection, fatigue and bewilderment, among other mood symptoms. They completed the same evaluation after training ended, and then again 90 days later. While their physical fitness improved during training, their mental health disintegrated. Before training, the Marines reported more balanced mood levels than average college-aged men. By the time they finished, they described mood symptoms comparable to those of psychiatric patients. Ninety days later, they were just as sad and agitated….When we bring the brain chemistry into the equation though things get really interesting. Renshaw posits that when coming to altitude, people experience an increase in dopamine and a decrease in serotonin.” https://www.scienceofrunning.com/2014/11/your-brain-on-altitude-how-altitude-can.html?v=47e5dceea252#:~:text=Renshaw%20posits%20that%20when%20coming%20from%20the%20depressive%20like%20symptoms.

- “The Effect of Altitude on Cognitive Performance and Mood States...High-altitude environments can be debilitating to unacclimatized individuals exposed to elevations above 3,000 m (9,843 ft) for periods ranging from several hours to days. Moderate hypoxia induces substantial alterations in physiological and psychological parameters within a few hours (Bahrke and Shukitt-Hale, 1993). Immediately upon ascent to high altitude, there is decreased blood oxygenation, which reduces the oxygen supply throughout the periphery and in the brain. With time the body compensates, at least in part, for the lack of oxygen with a variety of physiological responses and adjustments. In aggregate, this is termed acclimatization. Adverse changes in mood states, as well as impairment in mental performance, occur during altitude
exposure (Bahrke and Shukitt-Hale, 1993). Although numerous reports have been published concerning the physiological alterations that occur under conditions of hypoxia, there have been few investigations of the mood and behavioral changes associated with altitude. This chapter discusses both field and laboratory studies conducted to assess changes in these parameters. Observed behaviors and personal anecdotes suggest that the initial mood experienced at altitude is euphoria, followed by depression. With time, individuals may also become quarrelsome, irritable, anxious, and apathetic. The cholinergic system is particularly vulnerable to hypoxia, and it appears that acetylcholine (ACh) is the neurotransmitter primarily affected (Gibson and Duffy, 1981). ACh is a neurotransmitter involved in the regulation of learning and memory processes (Freeman and Gibson, 1988). The rates of synthesis of other neurotransmitters (e.g., dopamine, serotonin, and the amino acids) are also sensitive to hypoxia.”

https://www.ncbi.nlm.nih.gov/books/NBK232882/

- “A Surprising Connection between Altitude and ADHD...Who would have thought that children living at higher altitudes are at increased risk for the development of ADHD? As the research described below suggests, however, this may be the case....Because this is a correlational study, one cannot conclude with certainty that variations in altitude play a causal role in the development of ADHD. However, in 2 large and nationally representative data sets, a clear and consistent association between altitude and ADHD prevalence was evident. This association remained after controlling for multiple other factors linked to variation in state-wide prevalence of ADHD and may help explain the geographic variation in ADHD prevalence that has been reported. While this demonstrated link between ADHD risk and altitude is surprising, there is also a plausible theoretical mechanism, i.e., living at higher altitude promotes increases in dopamine activity, that may explain it.” https://www.addrc.org/a-surprising-connection-between-altitude-and-adhd/

- “Researchers Examine Altitude's Role In Depression And Suicide...The Mountain West has some of the highest rates of depression and suicide. Researchers think the mountains, with a lack of oxygen at high altitude, could be interfering with people's mental health...Back in 1991, a crew of eight people stepped into a series of sealed glass rooms in Arizona. They didn't come out for two years and 20 minutes....As the months went by, the oxygen levels started dropping....It got down to about 14%, which is about the oxygen availability you'd expect on top of a 13,000 foot mountain...they started feeling pretty bad. They were low energy. Several developed sleep apnea. Three started talking to therapists on the phone. Finally, Mission Control injected a bunch of oxygen into the building....Withholding energy from the reasoning part of our brains could affect the ability to regulate emotions. Or maybe it messes with serotonin production, also important for mood...a growing number of studies backup the idea that oxygen could be involved, like one in Peru on electrical workers. The ones stationed at about 10,000 feet had more symptoms of depression and anxiety than their sea-level colleagues. Or the study on a small group of Marines before, during and after a month of altitude training. They showed more symptoms of depression. So did medical students who moved higher up for residency.” https://www.npr.org/2019/08/19/752292543/researchers-examine-altitudes-role-in-depression-and-suicide

- “Living high in the mountains could bring you down. With gain in elevation comes increased risk of suicide and depression, research finds...researchers at the University of Utah who think there’s a link between high altitudes and depression. It’s the result of less oxygen and its subsequent ill effect on brain chemistry, and the effect may also hinder the usefulness of common drug treatments...There is apparently something about low oxygen concentration
above 3,000 feet that may cause people to have lower serotonin...Renshaw said the drug sertraline, brand name Zoloft, was found in animal studies to be “the most effective SSRI antidepressant at altitude...It’s important to note that not everybody who moves to high altitude has low serotonin, and Renshaw acknowledged that the complexity of brain chemistry makes generalization difficult. He mentioned dopamine, another neurotransmitter associated with good feelings that is boosted by exercise and other activities, as an additional factor to consider. “Increased brain dopamine levels (which frequently occur in going to the mountains) will make whatever one is doing more fun and enjoyable,” he said.”

“High and Low. Does elevation trigger depression?...Some call it the Las Vegas threshold. It’s the sensation, when you drive out of Vegas down I-15 toward the Pacific, of becoming happier, lighter. Dr. Perry Renshaw attributes this phenomenon to how high you got in Vegas. But not like that. Vegas sits at 2,000 feet above sea level, and Renshaw, who studies the effects of altitude on emotional well-being, thinks that’s the exact elevation where a person’s mood starts to shift...Renshaw’s research draws on the experiences of people like Mark Matthews. When Matthews moved from Maui to Taos, New Mexico, he immediately noticed a change. He traveled a lot for work, and every time he returned to the Sangre de Cristo Mountains — elevation 7,000 feet — he felt immense dread. “I’d come home, and a couple of days later, everything would get heavy,” he tells me. “It was full-on depression, and there were no triggers, so I started to think, Could it be the elevation? It was the one factor that I couldn’t account for.”...Recently, Renshaw and his team started looking into why altitude might trigger depression. He thinks the explanation may lie with decreased oxygen, which starts to affect people right at that 2,000-foot Vegas threshold. At sea level, air consists of 21 percent oxygen. In Vegas, it drops to 19 percent, and at the top of Mount Everest, it’s around 7 percent. For some people, when their brains receive less oxygen, they start to produce less serotonin and more dopamine. Renshaw says that, in animals, serotonin levels can decline by as much as 30 percent in a day at altitude. A similar drop in a human brain could lead to devastating depression.”

“Longevity: Why there’s more depression, anxiety and suicide at high altitude...Higher altitude can worsen mental health. Observed behaviors and personal anecdotes suggest the initial mood experienced at altitude is euphoria followed by depression. Multiple symptoms can emerge over time, including irritability, anxiety and apathy. That’s according to “Hypoxia,” a 1963 study conducted by Edward Van Liere and J. Clifford Stickney. The initial euphoria is a result of increased dopamine, the neurotransmitter contributing to feelings of pleasure, when entering high altitude. Dopamine is a short-burning fire, and then it’s gone, Goodwin explained. “So, when the ‘Rocky Mountain high’ burns off, then what we’re left with is depleted dopamine and serotonin,” she said.”

“Living High and Feeling Low: Altitude, Suicide, and Depression...: Suicide and major depressive disorder (MDD) are complex conditions that almost certainly arise from the influences of many interrelated factors. There are significant regional variations in the rates of MDD and suicide in the United States, suggesting that sociodemographic and environmental conditions contribute. Here, we review epidemiological evidence that increases in the altitude of residence are linked to the increased risk of depression and suicide. We consider the possibility that chronic hypobaric hypoxia (low blood oxygen related to low atmospheric pressure)
contributes to suicide and depression, which is suggested by animal models, short-term studies in humans, and the effects of hypoxic medical conditions on suicide and depression. We argue that hypobaric hypoxia could promote suicide and depression by altering serotonin metabolism and brain bioenergetics; both of these pathways are implicated in depression, and both are affected by hypoxia. Finally, we briefly examine treatment strategies to address hypoxia-related depression and suicidal ideation that are suggested by these findings, including creatine monohydrate and the serotonin precursors tryptophan and 5-hydroxytryptophan.”

- "Dopamine and serotonin: Brain chemicals explained...Dopamine and serotonin are chemical messengers, or neurotransmitters, that help regulate many bodily functions. They have roles in sleep and memory, as well as metabolism and emotional well-being. People sometimes refer to dopamine and serotonin as the “happy hormones” due to the roles they play in regulating mood and emotion. They are also involved in several mental health conditions, including low mood and depression." [https://www.medicalnewstoday.com/articles/326090](https://www.medicalnewstoday.com/articles/326090)

- "Serotonin vs. dopamine: A guide to the two mood-regulating hormones and how they can affect your health...Serotonin helps you feel happier, calmer, and more focused — while dopamine makes you feel motivated, accomplished, and productive. Serotonin and dopamine both play a role in regulating our digestion, by suppressing or increasing our appetite according to our body's needs. A lack of serotonin, dopamine, or both neurotransmitters have been linked to certain mental health conditions like addiction and depression." [https://www.insider.com/serotonin-vs-dopamine](https://www.insider.com/serotonin-vs-dopamine)

- "What’s the Difference Between Dopamine and Serotonin?...Dopamine system dysfunction is linked to certain symptoms of depression, such as low motivation. Serotonin is involved in how you process your emotions, which can affect your overall mood." [https://www.healthline.com/health/dopamine-vs-serotonin#other-psychological-conditions](https://www.healthline.com/health/dopamine-vs-serotonin#other-psychological-conditions)

- “What Does Dopamine Do? 18 Surprising Health Effects...1) Responsible for Motivation...2) Increases the Anticipation of Pleasure...3) Helps with Memory and Learning...4) Increases Attention and Focus...5) Makes People More Social and Extroverted...6) Important for Love (Romantic Attachments)...7) Helps Establish Maternal Behavior...8) May Decrease Inflammation Due to Th1 and Th17 Dominance...9) Influences the Sleep Cycle....10) Helps Increase Bone Strength...11) Increases Creativity....12) Speeds up Our Internal Clock...13) Relieves Nausea...14) Inhibits Prolactin...15) Helps Movement...16) Helps Prevent Parkinson’s Disease...17) Helps Prevent Nearsightedness (Myopia)...18) Stimulates Sexual Drive” [https://selfhacked.com/blog/dopamine/#comments](https://selfhacked.com/blog/dopamine/#comments)

- “What Is Dopamine Deficiency? Low Dopamine Symptoms to Watch For...SIGNS OF LOW DOPAMINE. Dopamine affects many brain functions and physical symptoms, so signs of low dopamine may vary greatly. Some of them include: Depression. Problems with motivation or concentration. Working memory issues, such as difficulty remembering the first part of a sentence a person just spoke. Restless leg syndrome. Shaking hands or other tremors. Changes..." [https://selfhacked.com/blog/dopamine/#comments](https://selfhacked.com/blog/dopamine/#comments)
in coordination. Low sex drive. Inability to feel pleasure from previously enjoyed activities. Symptoms of attention-deficit hyperactivity (ADHD). Symptoms of schizophrenia, such as hearing voices or believing things that cannot be true. Symptoms of dementia, such as problems with executive functioning, short-term memory, managing daily tasks, or solving simple cognitive problems” https://www.goodtherapy.org/blog/what-is-dopamine-deficiency-low-dopamine-symptoms-to-watch-for-0926197

- “Dopamine deficiency: What you need to know...Vital brain functions that affect mood, sleep, memory, learning, concentration, and motor control are influenced by the levels of dopamine in a person’s body...Some signs and symptoms of conditions related to a dopamine deficiency include: muscle cramps, spasms, or tremors; aches and pains; stiffness in the muscles; loss of balance; constipation; difficulty eating and swallowing; weight loss or weight gain; gastroesophageal reflux disease (GERD); frequent pneumonia; trouble sleeping or disturbed sleep; low energy; an inability to focus; moving or speaking more slowly than usual; feeling fatigued; feeling demotivated; feeling inexplicably sad or tearful; mood swings; feeling hopeless; having low self-esteem; feeling guilt-ridden; feeling anxious; suicidal thoughts or thoughts of self-harm; low sex drive; hallucinations; delusions; lack of insight or self-awareness” https://www.medicalnewstoday.com/articles/320637

- “Symptoms of Dopamine Deficiency...Depression...Rapid Weight Gain...Oversleeping and Trouble Waking Up in the Morning...Low Sex Drive (Libido)...Procrastination, Struggling to Finish Projects or Tasks...Restless Leg Syndrome...Parkinsonian Tremor.” https://www.anftherapy.com/symptoms-of-dopamine-deficiency/
Altitude Diseases: Altered Male Hormones

- “Acute Mountain Sickness Is Associated With a High Ratio of Endogenous Testosterone to Estradiol After High-Altitude Exposure at 3,700 m in Young Chinese Men...Background: A large proportion of populations suffer from acute mountain sickness (AMS) after exposure at high altitude. AMS is closely related with age and gender implying that the sex hormones may play critical roles in AMS. Our observational study aimed to identify the association between the endogenous testosterone (T), estradiol (E2) and AMS. Methods: A total of 113 subjects were recruited in 2012. The participants were evaluated at 500 m and after acute (1 day) and short-term (7 days) high-altitude exposure at 3,700 m. The subjects also completed a case report form questionnaire and underwent blood pressure measurements and an echocardiography examination. The red blood cell (RBC) count, Hb concentration ([Hb]), hematocrit (HCT), E2, T, and erythropoietin (EPO) were measured. Results: Upon acute high-altitude exposure, E2 and EPO were significantly lower in AMS+ group, and T/E2 and stroke volume were higher. On the 1st day, AMS score correlated positively with the T/E2 ratio while it negatively correlated with E2. After 7 days at 3,700 m, the AMS+ subjects had higher erythropoietic parameters: EPO, T, and T/E2 were significantly higher in the AMS+ group. [Hb], RBC count, HCT, EPO, T and T/E2 were also correlated with AMS score. EPO, HCT, and the RBC count were also correlated with T/E2. Regression analyses indicated that T/E2 significantly correlated to AMS score and T/E2 on the 1st day was an independent predictor for AMS on the 7th day. Conclusion: AMS was correlated with T/E2 ratio and EPO. After short-term exposure, higher T/E2 may contribute to AMS together with EPO via erythropoiesis. Furthermore, T/E2 level at high altitude in the early stage was an independent predictor for AMS in the latter stage.”

- “Stress hormone response in men at high altitude: effect of ethnicity...Background and objective: Adaptive process to hypoxia of altitude involves changes in the homeostatic steady state of several endocrine variables which precede and contribute- to many physiologic adaptations. Physiologic responses to altitude-stress exhibit ethnic variation. However, there has been limited characterization of ‘ethnicity effect’ on endocrine responses to high-altitude stress. This is true for enzyme-immunoassay method (EIA) of plasma hormone analysis. Little is known in this regard about the Indian population. Ethnic variation in physiologic and psychological performance during altitude-stress has been reported in this population. The objective of this study was to examine the effect of ethnicity on plasma stress hormones during high-altitude exposure in lowlanders as compared to sea-level, and with high-altitude natives (HAN) at high-altitude in the Indian population. Methods: Healthy male soldiers (n=115) between 20–50 years were enrolled for the study. Lowlanders belonging to Rajput (n=25), Gorkha (n=30) and South-Indian (n=35) ethnicities were studied at sea-level and after 3–4 weeks of stay at ~4500 m. Ladakhis (HAN, n=25) were studied at ~4500 m only. Estimation of plasma cortisol-CORT, testosterone-T, prolactin-PRL, arginine vasopressin-AVP and proatrial natriuretic peptide-proANP1–98 was measured by EIA. Results: In lowlanders, there was a significant (P<.001) change in PRL, AVP and proANP1–98 (within physiological-range) during high-altitude exposure. Also, ethnicity of the subject was found to have a significant (P<.001) effect on hormonal changes at high-altitude. Among lowlanders, difference in plasma hormones was observed between north- (Rajput, Gorkha) and South- Indians at high-altitude. Except cortisol, significant (P<.001) variation in plasma hormones was observed between lowlanders
and HAN at high-altitude. Conclusions: Plasma stress hormone changes during high-altitude stress are influenced by ethnicity with regard to the Indian population.”

“High serum testosterone levels are associated with excessive erythrocytosis of chronic mountain sickness in men...Chronic mountain sickness (CMS) is characterized by excessive erythrocytosis (EE) secondary to hypoventilation. Erythropoietin (Epo) and testosterone regulate erythrocyte production. Low thyroid hormone levels are also associated to hypoventilation. Hence, these hormones can play a role in etiopathogeny of EE...High-altitude natives present similar levels of gonadotropins and thyroid hormones but lower dehydroepiandrosterone sulphate (DHEAS) levels (P < 0.01) and greater Epo (P < 0.01), 17α-hydroxyprogesterone (P < 0.01), and testosterone levels (P < 0.01) than those at 150 m. Serum testosterone levels (524.13 ± 55.91 μg/dl vs. 328.14 ± 53.23 ng/dl, means ± SE; P < 0.05) and testosterone/DHEAS ratios are higher (7.98 ± 1.1 vs. 3.65 ± 1.1; P < 0.01) and DHEAS levels lower in the EE group (83.85 ± 14.60 μg/dl vs. 148.95 ± 19.11 ug/dl; P < 0.05), whereas Epo was not further affected. Testosterone levels were highest and DHEAS levels lowest in the EE
group at all times after hCG stimulation. In conclusion, high androgen activity could be involved in the etiopathogeny of CMS.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2692401/

- "The 'male menopause'. Some men develop depression, loss of sex drive, erectile dysfunction, and other physical and emotional symptoms when they reach their late 40s to early 50s. Other symptoms common in men this age are: mood swings and irritability, loss of muscle mass and reduced ability to exercise, fat redistribution, such as developing a large belly or "man boobs" (gynaecomastia), a general lack of enthusiasm or energy, difficulty sleeping (insomnia) or increased tiredness, poor concentration and short-term memory” https://www.nhs.uk/conditions/male-menopause/

- "Test 4 Key Hormones That Help Determine a Man's Overall Well-being. This at-home test looks at four hormones that can affect mood, weight balance, sex drive, muscle mass, and energy levels...Cortisol...DHEA...Estradiol...Testosterone.”
https://www.everywell.com/products/mens-health-test/?utm_source=google&utm_medium=cpc&utm_campaign=mens_health&gclid=EA1alQobChMIoPvMxbj4gIvFqrsCh2C4Ab4EAMYAyAAEgKB7vD_BwE

- “What Is Testosterone Therapy?...Symptoms of low T may include sexual dysfunction, low energy, and the loss of some male characteristics.”
https://www.everydayhealth.com/drugs/testosterone

- “Is testosterone therapy safe? Take a breath before you take the plunge...Signs of low testosterone. MIND: Depression, Reduced self-confidence, Difficulty concentrating, Disturbed sleep. BODY: Declining muscle and bone mass. Increased body fat, Fatigue, Swollen or tender breasts, Flushing or hot flashes. SEXUAL FUNCTION: Lower sex drive, Fewer spontaneous erections, Difficulty sustaining erections.”
https://www.health.harvard.edu/mens-health/is-testosterone-therapy-safe-take-a-breath-before-you-take-the-plunge

- “Erectile Dysfunction: Testosterone Replacement Therapy...What Changes Occur in the Body Due to Low Testosterone? Low testosterone can cause the following physical changes: Decrease in muscle mass, with an increase in body fat, Changes in cholesterol levels, Decrease in hemoglobin and possibly mild anemia, Fragile bones (osteoporosis), Decrease in body hair, Changes in cholesterol and lipid levels”
https://www.webmd.com/erectile-dysfunction/guide/testosterone-replacement-therapy#3-8

- “Hormone Therapy Side Effects...Although most men may experience only a few of these symptoms, the list of potential effects of testosterone loss is long: hot flashes, decreased sexual desire, loss of bone density and increased fracture risk (osteoporosis), erectile dysfunction, fatigue, increased risk of diabetes and heart attacks, weight gain, decreased muscle mass, anemia, and memory loss. “Bad” cholesterol levels rise, particularly LDL and total cholesterol, and muscle tends to get replaced by fat, especially around the abdomen.”
https://www.pcf.org/about-prostate-cancer/prostate-cancer-side-effects/hormone-therapy-side-effects/

- “Low Testosterone Therapy: Risks and Benefits...Despite all the recent advertising campaigns, awareness of low T and its importance for men’s health remains very poorly recognized by both the public and by physicians...Men with low T die sooner than men with normal levels of testosterone...On testosterone, we see that fat mass goes down while muscle mass goes up...Besides its sexual benefits, TRT can improve a man's mood and energy level while reducing irritability and anger...Testosterone therapy can raise a man's risk for blood clots and stroke. Eisenberg says that men can offset that risk by occasionally donating blood. Uncommon
side effects include sleep apnea, acne, and breast enlargement.”
https://www.webmd.com/men/features/low-testosterone-therapy-risks-benefits#1


Altitude Diseases: Altered Female Hormones

- “High-Altitude Medical Research in China...A Comparison of Perimenopausal Sex Hormone Levels Between Tibetan Women at Various Altitudes and Han Women at Sea Level... These results suggested that a different oxygen partial pressure (PaO2) at moderate and high altitude, or at sea level, has no effect on the Tibetan female hormonal reproductive system. Studies on the maternal-placental-fetal system in Tibetan women have suggested that people living at high altitudes for generations might develop genetic adaptations against hypoxia. Our study has identified a similar adaptive phenomenon, providing further evidence to support the belief that Tibetans are highly adapted to high-altitude living.”

- “Hormone profile during the menstrual cycle at high altitude...Results: The pre-ovulatory follicle diameter was lower (P < 0.001) at high altitude than at sea level. Ovulation after LH peak occurred earlier at high altitude than at sea level. Serum FSH levels were higher at late luteal phase and early follicular phase at high altitude than at sea level (P < 0.05). The serum LH and FSH peaks were similar in women at sea level and at high altitude. During the early follicular phase serum estradiol levels were significantly higher at high altitude than at sea level (P < 0.05). During the late follicular phase the production of estradiol was higher at sea level than at high altitude (P < 0.05). The peak of serum estradiol was at day −1 in Lima and in day 0 at high altitude. At ovulation, the serum estradiol levels in women at sea level were 55.1% of the peak, but remained at high levels (80% of the peak) in women at high altitude (P < 0.05). The second increase of serum estradiol occurred earlier at sea level than at high altitude. From days +12 to +15, there was a significant decline in serum estradiol levels in women at sea level (P < 0.05) but not in those from high altitude (P > 0.05). Serum progesterone levels at days +5, and +8 to +12 were significantly higher at sea level than at high altitude. Conclusion: Our data suggest that hormone profile during menstrual cycle is different at high altitude than at sea level, probably as an effect of low barometric pressure.”

- “Physiological effects of high‐altitude trekking on gonadal, thyroid hormones and macrophage migration inhibitory factor (MIF) responses in young lowlander women...Altitude hypoxia is often associated with impairment of human reproduction. In this study, hormones and macrophage migration inhibitory factor (MIF, a proinflammatory cytokine with key roles in human reproduction) were determined in seven regularly menstruating, lowlander native women living at sea level participating in 14 days of trekking at moderate and high altitude. Blood and saliva samples were collected from each subject at high altitude (5050 m a.s.l. [above sea level]), and at sea level before and after the expedition. Testosterone level was lowered by high altitude and was restored after the end of the expedition, while progesterone decreased significantly in all participants at the end of the expedition, although most of the participants were in the luteal phase. The salivary concentration of MIF decreased greatly at altitude, but its levels were completely restored after the return to sea level. Our findings showed high sensitivity and rapid changes in the determined parameters in response to the high-altitude hypoxic environment, particularly MIF.”

- “Hypoestrogenism, or estrogen deficiency, refers to a lower than normal level of estrogen, the primary sex hormone in women. In general, lower levels of estrogen may cause differences in...
the breasts, genitals, urinary tract, and skin. Hypoestrogenism is most commonly found in women who are postmenopausal, have premature ovarian failure, or are suffering from amenorrhea; however, it is also associated with hyperprolactinemia and the use of gonadotropin-releasing hormone (GnRH) analogues in treatment of endometriosis. It has also been linked to scoliosis and young women with type 1 diabetes mellitus. Presentations of low estrogen levels include hot flashes, headaches, lowered libido, and breast atrophy. Reduced bone density leading to secondary osteoporosis and atrophic changes such as pH change in the vagina[1] is also linked to hypoestrogenism. Low levels of estrogen can lead to dyspareunia and limited genital arousal because of changes in the four layers of the vaginal wall.[2] Hypoestrogenism is also considered one of the major risk factors for developing uncomplicated urinary tract infections (UTIs) in postmenopausal women who do not take hormone replacement therapy.”

- “What Are the Symptoms of Low Estrogen in Women and How Are They Treated?...Common symptoms of low estrogen include: painful sex due to a lack of vaginal lubrication, an increase in urinary tract infections (UTIs) due to a thinning of the urethra, irregular or absent periods, mood swings, hot flashes, breast tenderness, headaches or accentuation of pre-existing migraines, depression, trouble concentrating, fatigue. You may also find that your bones fracture or break more easily. This may be due to a decrease in bone density. Estrogen works in conjunction with calcium, vitamin D, and other minerals to keep bones strong. If your estrogen levels are low, you may experience decreased bone density. If left untreated, low estrogen can lead to infertility in women.”

- “What happens when estrogen levels are low?...Symptoms of low estrogen may include the following: Irregular periods: Estrogen is one of the main hormones driving the menstrual cycle. Low estrogen may lead to missed or irregular periods. Infertility: Low estrogen levels can prevent ovulation and make getting pregnant difficult, leading to infertility. Weak bones: Estrogen helps keep the bones healthful and strong. As estrogen levels decrease, bone loss may occur. For example, women who are post-menopausal are at an increased risk of developing osteoporosis and bone fractures. Painful intercourse: Estrogen can affect vaginal lubrication. If levels become too low, vaginal dryness can occur, which often leads to painful sex. Hot flashes: Hot flashes often happen during menopause due to low estrogen levels. Depression: Estrogen is thought to increase serotonin, which is a chemical in the brain that boosts mood. Estrogen deficiency may cause a decline in serotonin that contributes to mood swings or depression. Increase in urinary tract infections: Increased urinary tract infections may occur due to the thinning of the tissue in the urethra, which can develop with decreased estrogen.”

- “Hormonal Contraceptives and Travel to High Altitude... Most healthy women can safely use HC when traveling to high altitude, but should be aware of the potential risks and inconveniences.”
Altitude Diseases: Hormone Induced Insomnia

- “Sleep Issues & Aging: A Case Study...About 70% of my practice consists of people in menopause or andropause. Insomnia is usually one of their chief complaints at our initial visit...If we look deeply enough, we will find that most of our aging patients with recent-onset insomnia are dealing with significant hormone imbalance...Avoid gluten, dairy, and almonds for 4 weeks, as these are the 3 foods that, in my clinical experience, come back the most often with elevated IgG antibodies...Multivitamin with iron. Extra iron and vitamin C, BID. 10 000 IU vitamin D3 for 4 weeks, then reduce to 5000 IU/day. Methyl-B12 sublingually. 5000 µg/day. DHEA, 10 mg each morning. Pregnenolone, 30 mg at night. Dessicated thyroid, 0.5 grain per day (half of her previous dose). Effervescent magnesium malate/citrate in water, at night...She maintains a dairy- and gluten-free lifestyle, and sleeps well. She is off her restless legs syndrome medication, and has great energy and a renewed zest for life. Anna’s case is a great example of how a problem as complicated and intricate as insomnia, can be solved.”
https://ndnr.com/anxietydepressionmental-health/sleep-issues-aging-a-case-study/

- “Are Hormones To Blame For Your Lack Of Sleep?...hormonal imbalances are a big reason for sleep disturbance. Hormone imbalances create vicious cycles—often triggered by underlying issues and then circling around to make those very same issues even worse...Here are ten hormone imbalances that could be jeopardizing your sleep: 1. Low progesterone...2. Low estrogen...3. High cortisol...4. Low cortisol...5. Low melatonin...6. Low DHEA...7. Overactive or underactive thyroid...8. Leptin resistance...9. Low testosterone...10. High androgen levels.”
https://www.mindbodygreen.com/0-28953/are-hormones-to-blame-for-your-lack-of-sleep.html

- “Chronic Insomnia, Poor Sleep and Hormones?...when she reached her mid 40’s, her periods started changing and she began experiencing sleep problems. First, she would just have insomnia the night before starting her period. As her periods became more irregular, she started waking up in the middle of the night around 2 or 3 am and would find herself wide awake and unable to go back to sleep. With so little sleep, she would be exhausted the next morning...suffered from a very common sleep disorder that occurs with declining levels of estrogen and/or progesterone that accompany perimenopause and/or menopause. It is characterized by wakefulness in the middle of the night and can be very debilitating when it continues long-term. The typical patient with this type of insomnia often becomes addicted to prescription sleeping pills. Bonnie’s insomnia totally resolved after her estrogen and progesterone levels were normalized.”

- “Testosterone, Sleep, and Sexual Health...Changes in testosterone levels occur naturally during sleep, both in men and women. Testosterone levels rise during sleep and decrease during waking hours. Research has shown that the highest levels of testosterone happen during REM sleep, the deep restorative sleep that occurs mostly late in the nightly sleep cycle. Sleep disorders, including interrupted sleep, lack of sleep, and reductions in the amount of REM sleep, will frequently lead to low testosterone levels. This is important for men and women. There’s strong evidence of a relationship between testosterone and sleep-disordered breathing, including obstructive sleep apnea. Studies have shown that low testosterone levels frequently occur in men with obstructive sleep apnea. Men with obstructive sleep apnea are also more likely to suffer from complications to their sexual function, including low libido, erectile dysfunction, and impotence.”
https://www.sleepdata.com/blog-2/testosterone-sleep-and-sexual-
Altitude Diseases: Gender Dysphoria

- “I became aware during my time in high altitude astronomy that some workers would develop Gender Dysphoria (GD).” Steven Magee CEng MIET – Q

- “Gender Dysphoria...Gender dysphoria (formerly known as gender identity disorder in the fourth version of the Diagnostic and Statistical Manual of Mental Disorders, or DSM) is defined by strong, persistent feelings of identification with another gender and discomfort with one's own assigned gender and sex; in order to qualify for a diagnosis of gender dysphoria, these feelings must cause significant distress or impairment. People with gender dysphoria often desire to live in accordance with their gender identity and may dress and use mannerisms associated with the gender with which they identify in order to achieve this goal... Adults with gender dysphoria typically feel uncomfortable being regarded by others as their assigned gender and often desire to be rid of the physical sex characteristics associated with it.”
  https://www.psychologytoday.com/us/conditions/gender-dysphoria

- “Gender Dysphoria (GD) in high altitude astronomy workers was occurring as low as 2,423m (7,949ft).” Steven Magee CEng MIET - Q

- “Gender dysphoria (GD) is the distress a person feels due to their birth-assigned sex and gender not matching their gender identity. People who experience gender dysphoria are typically transgender. Evidence from studies of twins suggests that gender dysphoria not only has psychological causes, but may have biological causes as well.[4] The diagnostic label gender identity disorder (GID) was used by the DSM until its reclassification as gender dysphoria in 2013, with the release of the DSM-5. The diagnosis was reclassified to better align it with medical understanding of the condition and to remove the stigma associated with the term disorder.[5][6] The American Psychiatric Association, publisher of the DSM-5, stated that gender nonconformity is not the same thing as gender dysphoria,[7] and that "gender nonconformity is not in itself a mental disorder. The critical element of gender dysphoria is the presence of clinically significant distress associated with the condition."[1] Some transgender people and researchers support declassification of the condition because they say the diagnosis pathologizes gender variance and reinforces the binary model of gender.[5][8] Treatment for gender dysphoria may involve supporting the person through changes in gender expression. Hormone therapy or surgery may be used to assist such changes.[2] Treatment may also include counseling or psychotherapy.[2]”
  https://en.wikipedia.org/wiki/Gender_dysphoria

- “16 Facts on Gender Confusion”
  https://fwipetitions.org/fwi/16-facts-on-gender-confusion/

- “Gender dysphoria...Adults with gender dysphoria can feel trapped inside a body that doesn't match their gender identity. They may feel so unhappy about conforming to societal expectations that they live according to their anatomical sex, rather than the gender they feel themselves to be. They may also have a strong desire to change or get rid of physical signs of their biological sex, such as facial hair or breasts.”
  https://www.nhs.uk/conditions/gender-dysphoria/

- “Rapid-onset gender dysphoria...This month, a Brown University researcher published the first studyto empirically describe teens and young adults who did not have symptoms of gender dysphoria during childhood but who were observed by their parents to rapidly develop gender
dysphoria symptoms over days, weeks or months during or after puberty.”

- “4,000% Explosion in Kids Identifying as Transgender, Docs Perform Double Mastectomies on Healthy Teen Girls...Gender dysphoria is also a growing problem in the United Kingdom. In the UK, young people referred for "gender treatment" has increased from 97 in 2009 to 2,510 in 2017-2018, an over 4,000 percent increase in 10 years.”

- “High altitude astronomy was the only field that I worked in where workers had changed gender during their time there. Two males became females and one female that had been previously attracted to males later became attracted to females. I had not heard of this in other fields that I had worked in.”

- “While I was aware of three workers that had disclosed their gender issues during their time in high altitude astronomy, I was not aware of how many more were staying silent about it.”

- “Dr. John Nash Ott...discovered ways to change the gender of plants merely by varying the light source color-temperature...Ott's experiments led him to believe that only a full spectrum of natural light (including natural amounts of infrared and ultraviolet) could promote full health in plants, animals, and humans.”

- “I though that it was strange that people were changing gender in high altitude astronomy until I read Dr. John Nash Ott's books and his discussions about how he was changing the gender of plants and animals using distinctly different spectrum's of light from commercial lighting products. The spectrum of light at high altitudes is distinctly different to that at sea level.”

- “Why Autism is linked to Insufficient Deep Sleep...Over the last 10 years there has been a significant increase in gender dysphoria. This means feeling as though one’s “gender” does not match the sexual organs one was born with. Though babies are born with male or female genitalia the sexual development of the brain is dependent on the release of sex hormones during deep sleep throughout childhood. Sexualizing the brain to match the genitalia is a nightly, chemical event that is followed by the pubertal physical changes that make us recognizably male or female. My patient experience has shown that teen boys who still have a feminine body shape, once sleeping normally, can transition to a masculine body shape even after significant pubertal delay. So both the social interaction and the body shape are determined by having the right amount of deep sleep during childhood.”

- “During my time in high altitude astronomy, I became aware of workers having gender issues. Many years later I discovered that sex hormones were affected by high altitude exposures.”

- “What Is the Recommended Dosage of DHEA?...Other possible side effects may include masculinization or feminization in women and men, respectively.”

- "Is Your Depression Linked to Low DHEA Levels? DHEA Has Potential to Relieve Depression...In my experience, low levels of DHEA are one of many important factors that may..."
contribute to a depressed mood. Yet, routine testing for DHEA levels and DHEA supplementation is not considered a component of traditional medical or psychiatric practice... It is the most abundant hormone in the human body and a precursor to all of our sex hormones: estrogen, progesterone, testosterone, and the stress hormone cortisol." [https://www.psychologytoday.com/us/blog/the-breakthrough-depression-solution/201107/is-your-depression-linked-low-dhea-levels]

- “Intermittent Hypoxia and Hypercapnia Reproducibly Change the Gut Microbiome and Metabolome across Rodent Model Systems... In Ldlr−/− mice, we reported significant shifts in the bacterial and chemical composition of the gut on IHH exposure. The key chemical alterations included changes in microbe-dependent metabolites such as gut-derived estrogen-like molecules (phytoestrogens) and bile acids.” [https://msystems.asm.org/content/4/2/e00058-19]

- "Mercury and Toxic Metal Effects on the Kidneys, Urinary System & Fertility...Mercury accumulates in the ovaries, testes, and prostate gland. In addition to having estrogenic effects, mercury has other documented hormonal effects including effects on the reproductive system resulting in lowered sperm counts, defective sperm cells, damaged DNA, aberrant chromosome numbers rather than the normal 46, chromosome breaks, and lowered testosterone levels in males and menstrual disturbances and infertility in women." [http://amalgam.org/369-2/]

- “Pharmaceuticals in Our Water Supply Are Causing Bizarre Mutations to Wildlife. Federal officials are studying the effects of pharmaceuticals such as pain killers and depression medicine in our water supply...From inter-sex fish in the Potomac River to frog mutations in Wisconsin, federal officials are spending this summer studying the effects of pharmaceuticals such as pain killers and depression medicine on the environment, because the drugs have turned up in America's drinking water.” [https://www.alternet.org/story/59305/pharmaceuticals_in_our_water_supply_are_causing_bizarre_mutations_to_wildlife]

- “Research Proves 'Gender-Bending' Chemicals Affect Reproduction...It is believed that phthalates have these adverse effects because they reduce testosterone synthesis by interfering with an enzyme needed to produce the male hormone. In one study, women who had higher concentrations of two types of phthalates (DEHP and DBP) also had boys who appeared more feminized in their personality while playing.” [https://articles.mercola.com/sites/articles/archive/2010/11/18/research-proves-genderbending-chemicals-affect-reproduction.aspx]

- “I was aware of approximately 50 high altitude workers histories during my time in astronomy. For 3 of those workers to be displaying Gender Dysphoria (GD) puts the rate at 6%. The rate is probably higher, as I suspect that some workers were hiding it.” Steven Magee CEng MIET - Q

- “I have the rate of Gender Dysphoria (GD) estimated at 6% of high altitude workers that I know that disclosed the condition. I suspect the rate is higher due to some workers not disclosing it and the actual rate may be approximately 12%.” Steven Magee CEng MIET - Q

- “There appeared to be an abnormally large number of lesbian, gay, bisexual, and transgender (LGBT) people working in high altitude astronomy, which was consistent with high altitude induced sex hormone damage.” Steven Magee CEng MIET - Q

- “Why are LGBT Americans so prone to dementia?...LGBT Americans are almost 30% more likely to suffer memory loss and confusion than people who are heterosexual and identify with their birth sex. The findings were presented this month at the Alzheimer’s Association International Conference in Los Angeles.” [https://considerable.com/lgbt-americans-dementia/]

- “Astronomy workers changing gender? Yes, it is a well known occurrence from the effect of...”
high altitude induced alterations of the human sex hormones.” Steven Magee CEng MIET - Q
Altitude Diseases: Autoimmune Diseases

- “People with autoimmune diseases may be more likely to develop psychosis, according to new research...What exactly causes autoimmune diseases — where the body mistakenly targets and attacks its own tissues — is a bit of a mystery. But what is known is that if you have one autoimmune disorder, such as type 1 diabetes, an overactive or underactive thyroid, or multiple sclerosis, your chances of developing another one are higher...When looking at specific disorders in the second part of the study, psychosis was more prevalent in people who had pernicious anaemia (a vitamin B12 deficiency), pemphigoid (a blistering disease), psoriasis (a skin disorder), coeliac disease (gluten allergy), and Graves' disease (a thyroid problem)....The reasons people develop psychotic disorders is already complicated — researchers don't yet fully understand what causes schizophrenia, for example. There's also evidence of people experiencing psychosis at very high altitudes, such as when climbing Mount Everest.” [https://www.businessinsider.com/psychosis-linked-with-autoimmune-diseases-2018-7]

- “Antiphospholipid Syndrome: The Risk of Travel at High Altitudes...Antiphospholipid syndrome (APS) is an autoimmune clotting disorder that may present catastrophically with multiple thromboses over a short period of time. In this article, we examine the case of a woman with undiagnosed APS whose first symptoms presented during a long-haul flight. A review of the literature on thrombosis at high altitudes and during long duration travel helps us understand potential treatment and prevention of the same in APS patients...Individuals ascending to altitudes greater than 2,400–3,000 meters have demonstrated hypobaric hypoxia and its effects on the coagulation system, including decreased tissue oxygenation and sympathetic compensatory changes. In 2006, Peter Bärtsch, MD, described healthy mountaineers suffering from altitude-induced thrombosis and subsequent death. Hypoxemia activates transcription factor early growth response-I (EGR-1), which results in vascular fibrin deposition. This is amplified by a concomitant suppression of fibrinolysis by upregulation of plasminogen activator inhibitor-1. Additional studies have demonstrated an independent, increased risk of thrombosis with prolonged (longer than four hours) air, bus, car or train travel described by some to be equivalent to the risk of thrombosis with oral contraceptives. Further analysis of risk factors demonstrates the need to address the role of comorbidities, such as diabetes, coronary artery disease and hyperlipidemia, in having a greater risk of sudden cardiac death at higher altitudes.” [https://www.the-rheumatologist.org/article/antiphospholipid-syndrome-the-risk-of-travel-at-high-altitudes/?singlepage=1&theme=print-friendly]

- “Smoking under hypoxic conditions: a potent environmental risk factor for inflammatory and autoimmune diseases...Cigarette smoke and hypoxia both lead to increased oxidative stress and production of reactive oxygen species and other free radicals, which have various effects including the generation of autoreactive pro-inflammatory T cells and autoantibodies, reductions in T regulatory (Treg) cell activity, and enhanced expression of pro-inflammatory mediators [e.g., interleukin-6 (IL-6), interleukin-4 (IL-4) and interleukin-8 (IL-8)]. Accordingly, smoking and hypoxic environments may synergistically act as potent environmental risk factors for inflammatory and autoimmune diseases.” [https://mmrjournal.biomedcentral.com/articles/10.1186/s40779-018-0158-5]

- “Influence of high altitude exposure on the immune system: a review...High altitude may be defined as elevations as low as 1500 meters to those as high as 8800 meters. Very few studies have been conducted so far at high altitude for the specific purpose of monitoring different
immune parameters in humans. Military personnel and mountaineers may be required to perform in environmental extremes such as high altitude. The stressors they experience are numerous and varied, e.g., high altitude, humidity and the availability of food and water, prolonged moderate to heavy physical activities, limited or inadequate sleep, increased susceptibility to infection and injury, etc. In this article we review the immunological consequences of high altitude exposure.”

https://www.ncbi.nlm.nih.gov/m/pubmed/20380520/
Altitude Diseases: Drug Hazards

- “Company drug use was common in very high altitude workers.” Steven Magee CEng MIET - Q
- “Specific criteria for diagnosing drug-induced lupus have not been formally established. However, symptoms often overlap with those of systemic lupus erythematosus (SLE). These include: muscle and joint pain sometimes with swelling. flu-like symptoms of fatigue and fever. serositis (inflammation around the lungs or heart that causes pain or discomfort). certain laboratory test abnormalities. While the symptoms of drug-induced lupus are similar to those of systemic lupus, only rarely will any major organs be affected.” [https://www.lupus.org/resources/about-drug-induced-lupus](https://www.lupus.org/resources/about-drug-induced-lupus)
- “What Is Drug-Induced Lupus?...Lupus is a condition that can happen when your body’s immune system attacks your healthy tissues and organs. Drug-induced lupus is when it's caused by taking certain prescription medicines for months or years at a time. While lupus may damage your kidneys or lungs, drug-induced lupus rarely affects your body’s major organs. It’s also temporary. Once you stop the medicine that causes it, symptoms usually clear up within a few weeks or months. You’re more likely to get drug-induced lupus if you’re age 50 or older.”
- “In 2019 it had emerged that I was having chronic fatigue reactions to over the counter medications and to prescription medications. I have a history of five years of regular company drug use atop the biologically toxic summit of Mauna Kea. This is called ‘Drug Intolerance’.” Steven Magee CEng MIET - Q
- “Drug intolerance or drug sensitivity refers to an inability to tolerate the adverse effects of a medication, generally at therapeutic or subtherapeutic doses. Conversely, a patient is said to be 'tolerating' a drug when they can tolerate its adverse effects. It is not to be confused with a drug allergy, which is a form of drug intolerance, but requires an immune-mediated component. It is also not to be confused with drug tolerance ('drug resistance,' or tachyphylaxis) which refers to a lack of adverse effects even at higher than average doses. Some instances of drug intolerance are known to result from genetic variations in drug metabolism.” [https://en.wikipedia.org/wiki/Drug_intolerance](https://en.wikipedia.org/wiki/Drug_intolerance)
- “Multiple Drug Intolerance Syndrome...Multiple drug intolerance syndrome is defined as having greater than 3 or more unrelated drug intolerances or allergies. Based on medical record data, about 2 to 5% of the population that uses health care may have multiple drug intolerance syndrome in North America and Europe, with higher rates seen in hospitalized patients. Multiple drug intolerance syndrome is more likely to occur with increasing age as the number of life-time drug exposures increases. It is more common in females and in individuals being treated for higher numbers of different specific health conditions. Multiple drug intolerance syndrome can appear in patients with true allergies as have been reported in patients allergic to penicillin and quinolones antibiotics.” [https://www.aaaae.org/conditions-and-treatments/library/allergy-library/multiple-drug-intolerance](https://www.aaaae.org/conditions-and-treatments/library/allergy-library/multiple-drug-intolerance)
- "Gluten-related disorders...Causes. When enteropathy develops in early childhood, symptomatic disease is more rapidly evident. A survey of geriatrics with celiac disease in Finland revealed that the incidence of disease was much higher than the general population.[57] Allergic disease may rise or fall with age; certain evidence points to the increased or daily use of non-steroidal anti-inflammatory factors (aspirin, ibuprofen) as an increased risk factor for urticaria or anaphylaxis, and the sensitizing dose may include low-dose aspirin therapy used in
the treatment of heart disease. NCGS may be a late-onset condition: in a prospective study performed among adults of 18 to 80 years, the median age of disease onset was found to be 55 years, with a six times higher prevalence in females than in males.[5] The pathogenesis of NCGS is not yet well understood. There is evidence that not only gliadin (the main cytotoxic antigen of gluten), but also other proteins named ATIs which are present in gluten-containing cereals (wheat, rye, barley, and their derivatives) may have a role in the development of symptoms. ATIs are potent activators of the innate immune system.[32][40] FODMAPs, especially fructans, are present in small amounts in gluten-containing grains and have been identified as a possible cause of some gastrointestinal symptoms in persons with NCGS.[32][5] [40][58] As of 2019, reviews have concluded that although FODMAPs may play a role in NCGS, they only explain certain gastrointestinal symptoms, such as bloating, but not the extra-digestive symptoms that people with NCGS may develop, such as neurological disorders, fibromyalgia, psychological disturbances, and dermatitis.[40][41][32]" https://en.wikipedia.org/wiki/Gluten-related_disorders
Altitude Diseases: Mercury Poisoning

- “I was surprised when I discovered my mercury poisoning that the astronomy team had changed its mercury handling policies years earlier and had not informed me.” Steven Magee CEng MIET - Q
- “Mercury poisoning: Symptoms and treatment...Mercury is a heavy metal that is highly toxic to humans...If mercury poisoning is related to a person's workplace or environmental exposure, doctors may suggest that the person change their environment to reduce their exposure, or that the workplace puts new safety measures in place.” https://www.medicalnewstoday.com/articles/320563.php
- “Mercury Exposure and Children’s Health...Acute or chronic mercury exposure can cause adverse effects during any period of development. Mercury is a highly toxic element; there is no known safe level of exposure. Ideally, neither children nor adults should have any mercury in their bodies because it provides no physiological benefit. Prenatal and postnatal mercury exposures occur frequently in many different ways. Pediatricians, nurses, and other health care providers should understand the scope of mercury exposures and health problems among children and be prepared to handle mercury exposures in medical practice. Prevention is the key to reducing mercury poisoning. Mercury exists in different chemical forms: elemental (or metallic), inorganic, and organic (methylmercury and ethyl mercury). Mercury exposure can cause acute and chronic intoxication at low levels of exposure. Mercury is neuro-, nephro-, and immunotoxic. The development of the child in utero and early in life is at particular risk. Mercury is ubiquitous and persistent. Mercury is a global pollutant, bio-accumulating, mainly through the aquatic food chain, resulting in a serious health hazard for children. This article provides an extensive review of mercury exposure and children’s health.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3096006/
- “Understanding Mercury Poisoning...Mercury poisoning can also disrupt fetal and early childhood development. Infants and young children who’ve been exposed to high levels of mercury may have delays in: cognition, fine motor skills, speech and language development, visual-spatial awareness...High amounts of mercury can lead to long-term and sometimes permanent neurological changes. The dangers are especially notable in young children who are still developing. Mercury exposure can lead to developmental problems in the brain, which can also affect physical functions such as motor skills. Some children who are exposed to mercury at a young age may develop learning disabilities...Adults with mercury poisoning may have permanent brain and kidney damage. Circulatory failure is another possible type of complication.” https://www.healthline.com/health/mercury-poisoning#complications
- “Mercury & Food Intolerances: Connections with Ulcerative Colitis, IBS, Crohn’s, Skin Conditions, & More...Mercury and food intolerances are linked as a common causes of chronic conditions related to leaky gut and intestinal dysfunction, such as ulcerative colitis, IBS, Crohn’s, eczema, psoriasis, food allergies, arthritis, ADHD, and autoimmune disease; treatments that improve these conditions...Brain inflammation or hypoglycemia related to toxic metal exposures, food intolerances, etc. have been found to be common causes of ADHD, impulsivity, juvenile delinquency, criminality, and violence. Detoxification, diet measures, and supplementation for deficient vitamins and minerals have been found to usually improve such conditions.” http://amalgam.org/education/scientific-evidenceresearch/mercury-food-intolerances-connections-ulcerative-colitis-ibs-crohns-skin-conditions/
“Could Mercury Toxicity Be Causing Your Symptoms?...Mercury levels can build up in your body, causing immune dysfunction, fatigue, anxiety, depression, cardiovascular disease, and many other complaints...we often see patients with complex medical histories and symptoms that don’t fit inside the usual diagnostic categories of the conventional medical world. As a result, they are often given a prescription for an antidepressant and assured that they are perfectly healthy, or they are otherwise left unaided after multiple physicians just don’t know the cause of their seemingly mysterious complaints...In searching for the underlying cause of chronic illness, I’m often surprised by how frequently we find high levels of toxic metals, especially mercury. Mercury is a common environmental contaminant, and many of us are unknowingly predisposed to mercury toxicity.”

“Mercury: Get This Heavy-Metal Poison Out of Your Body...mercury is the most alarming, disease-causing source of environmental toxicity that I see daily in my practice. Many of patients have toxic levels of mercury—and they’re not alone...I felt weak, tired, and couldn’t think. I had muscle pain and twitches, insomnia, digestive problems, food allergies, depression, and anxiety. And it was only by discovering high levels of mercury in my hair and urine — and slowly detoxifying myself — that I was able to get better. I have seen this over and over in my patients, too. From chronic fatigue and fibromyalgia, to depression, anxiety, obesity, dementia, Parkinson’s disease, cancer, heart failure, and heart disease, the message is clear …We are being poisoned!”

“Multiple Chemical Sensitivity After Being Mercury Poisoned...I had no problems with chemical sensitivities until AFTER I was mercury poisoned...Nine days later my head had a burning sensation that felt like my brain was "on fire." I developed electrical surges throughout my body for a few seconds and my brain felt like it was vibrating inside my skull...I had severe memory loss, vertigo, floaters in my eyes, food allergies, muscles aches, chronic fatigue, numbness and tingling throughout my body after being exposed to the mercury...To recover from multiple chemical sensitivities, one needs to remove all sources of toxicities to the body and use chelation drugs/ supplements/ sauna to detox the body.”

“Could You Have Heavy Metal Poisoning and Not Know It?...I first tried a normal dose of the zeolite in each glass of water...And my urine smelled. Like metal. For over 2 months....There are many things that have been used to support the body to excrete heavy metals includes: antioxidants. Taurine. NAC. lipoic acid. liposomal glutathione. EDTA. DMSA. Sweating.”

“Just Another Story of Chronic Mercury Poisoning...After a ten-year quest to understand my twenty years of health issues -- vision problems, increasing fatigue, intolerance to fragrances and fumes, digestive problems, and daily spells of acute physical and cognitive dysfunction -- I read Amalgam Illness: Diagnosis and Treatment, a technical book on chronic mercury poisoning by Andrew Cutler, an independent chemical engineer...After more than a year on the Cutler protocol, many of my symptoms are gone, others are vastly reduced, and I’m looking forward to a full recovery.”

“Mercury Toxicity: Associated Symptoms and Conditions...Up to 80% of inhaled mercury vapour is absorbed through the lungs. From here it travels to all the other tissues and organs of the body in the circulation, but particularly concentrates within the kidney, liver and brain… There are a wide range of illnesses that have been linked with mercury poisoning including:

• “Cleaning Up a Small Mercury Spill...Mercury health effects. Breathing small amounts of mercury vapor can harm the nervous system of unborn babies, nursing infants and children. Breathing larger amounts of mercury vapor can cause irritability, tremors, or memory loss; shortness of breath; respiratory & eye irritation; chest pain; high blood pressure; kidney damage.”
https://www.health.ny.gov/environmental/chemicals/mercury/docs/cleaning_up_a_small_mercury_spill.htm

• “Toxic Exposure of the Urinary Tract...To understand the inherent limitations in the detection of early renal injury, we consider here several elements of normal renal function. In the sections that follow, we treat the mechanisms that lead to renal toxicity once exposure to a nephrotoxic substance occurs, the host factors that modify the response and the nature and extent of the physiologic adjustments to injury; it is presumably the responses to injury that give rise to the various markers described in later chapters.”
https://www.ncbi.nlm.nih.gov/books/NBK232061/

• “Urine Changes...What causes changes in urine?...Reddish urine could also be a sign of lead or mercury poisoning.”
https://my.clevelandclinic.org/health/diseases/15357-urine-changes

• “Mercury and Toxic Metal Effects on the Kidneys, Urinary System & Fertility...Mercury has been found to be nephrotoxic (toxic to kidneys)... The government’s toxic level for mercury in urine is 30 mcg/L, but adverse effects have been seen at lower levels and low levels in urine often mean high mercury retention and chronic toxicity problems. For this reason, urine tests are not a reliable measure of mercury toxicity...chronic exposure to mercury vapor and anesthetics found increased health problems compared to controls, including significantly higher liver, kidney, and neurological diseases.”
http://amalgam.org/369-2/

• “Urinary Tract Infection or Mercury Poisoning?...MERCURY POISONING IN DISGUISE. While the frequency of UTIs is very real, especially among American adults, the symptoms mirror those of a urinary system that has been poisoned by mercury. Dr. J. Trowbridge, author of the Yeast Syndrome, is on the forefront of researching the possible correlation between UTIs and mercury poison. In his book, he states that several doctors report that 98% of patients with chronic UTI also exhibit high levels of mercury toxicity. This alarmingly high percentage of UTI patients begs the question: do these individuals have a UTI, or are they experiencing similar symptoms that are brought about by mercury poisoning?”
https://assureasmile.com/uncategorized/urinary-tract-infection-or-mercury-poisoning/

• “I had a mysterious prolonged UTI of unknown cause in 2007 that all medical UTI testing proved negative. A year later in 2008 my doctor was stating ‘He has a plethora of multi-system complaints with no specificity.’ I had been working at an astronomical facility that used a large amount of mercury and had been handling rubber filled mercury systems with no personal protective equipment, such as gloves and respirators. The Kitt Peak National Observatory (KPNO) where I worked provided no industry recognized training in the safe handling of mercury.”
Steven Magee CEng MIET - Q

• “The endocrine effects of mercury in humans and wildlife...Mercury (Hg) is well studied and research continues as our knowledge of its health risks increases. One expanding area of research not well emphasized to date is the endocrine effects of Hg. This review summarizes the existing literature on the effects of Hg on the endocrine system and identifies gaps in the
knowledge. It focuses on the thyroid, adrenal, and reproductive systems, including the accumulation of Hg in the endocrine system, sex differences that are manifested with Hg exposure, reproductive effects in male and female animals including humans, and Hg effects on the thyroid and adrenal systems. We concluded that there are five main endocrine-related mechanisms of Hg across these systems: (a) accumulation in the endocrine system; (b) specific cytotoxicity in endocrine tissues; (c) changes in hormone concentrations; (d) interactions with sex hormones; and (e) up-regulation or down-regulation of enzymes within the steroidogenesis pathway. Recommendations for key areas of research to better understand how the endocrine effects of Hg affect human and wildlife health were developed, and include increasing the amount of basic biological information available about Hg and wildlife species, exploring the role of Hg in the presence of other stressors and chemicals, understanding sublethal and indirect effects of Hg on adverse outcomes, developing better methods to extrapolate effects across species, and understanding the effects of Hg on multiple organ systems following exposure of an animal. Greater inclusion of endocrine endpoints in epidemiological and field studies on humans and wildlife will also advance the research in this area.”

- “Environmental Mercury and Its Toxic Effects...Mercury has profound cellular, cardiovascular, hematological, pulmonary, renal, immunological, neurological, endocrine, reproductive, and embryonic toxicological effects...Mercury exposure has been associated with the induction of over 250 symptoms which can complicate accurate diagnosis.”
- “How I Recovered from Mercury Poisoning...I struggled for many years feeling badly-so I was used to being tired. I was used to being unable to keep my house clean. And I was used to staying home because I could never “catch up”. But, I wasn't used to the debilitating headaches, insomnia, and generally feeling awful that rendered me unable to function... It all seemed to point to mercury poisoning–adrenal fatigue, hormonal dysfunction, anxiety, insomnia, liver problems, thyroid-type symptoms, candida, and chronic fatigue.”
- “Getting the Mercury Out...At the age of 30, Aine Ni Cheallaigh began to develop mysterious symptoms. Her health was eroding and she felt that she was aging faster than everyone around her. Suspecting that toxins were to blame, she had her mercury fillings removed. But restoring her health wasn't going to be that simple. Over the following months, she found herself catapulted into a nightmare of mental and physical illness. Getting the Mercury Out follows this ordinary woman's quest to solve her health mystery. Can she cure a disease that the medical establishment won't even admit is real? Can she find a treatment that will restore her to health and sanity? Sometimes funny, often heart-wrenching, this book is a deeply engaging story of personal struggle and endurance. It's an eye-opener for those who are curious about mercury poisoning, and an absolute must-read for anyone grappling with the desperate search for healing.”
- “Mercury Poisoning: The Undiagnosed Epidemic: How to detox...It is impossible to avoid exposure to toxic heavy metals in today’s world. This book explains how to diagnose mercury poisoning and shows how to safely remove mercury, lead, arsenic and other toxic metals from your body. The case histories in this book demonstrate how exposure to these heavy metals can
lead to allergies, anxiety, chronic fatigue, fibromyalgia, colitis, autism, ADHD, multiple sclerosis, Parkinson’s disease, amyotrophic lateral sclerosis and mental illnesses such as bipolar disorder and schizophrenia. The Environmental Protection Agency’s limit for mercury is an intake of 7 micrograms per day for a 70 kg person. If you have dental amalgams (these silver colored fillings are actually 50% mercury) the World Health Organization estimates you are exposed to 4 to 21 micrograms per day. Over decades this adds up to hundreds of milligrams of the element that toxicologists consider the most toxic non-radioactive element. If you eat 100 grams (3.5 ounces) of tuna, you take in another 35 micrograms, or 5 times the daily limit for the average adult. We are also exposed to mercury through some vaccines and pharmaceutical products. At home there are mercury containing CFL light bulbs and fructose syrup. At the same time, the environment is contaminated with several hundred times the level of lead that our pre-industrial ancestors were exposed to. In animal experiments, mercury increased the toxicity of lead by a factor of 14. It is no wonder that so many people are experiencing chronic health problems. Perhaps mercury or another heavy metal is the source of your health problems.”

- “HEAVY METALS DETOX: The fast-track to a healthier version of YOU!...Depression, fatigue, insomnia, anxiety, brain fog, weakness, it doesn't matter what your doctor calls it, it ALWAYS involves toxicity — Dr. Sherry Rogers. Rest assured, this book contains everything you need to keep your health on track. Inside, we'll cover what heavy metals are, how they get inside us, and what you can do to remove them. When aluminum, mercury, lead, arsenic, cadmium, and chromium are gently purged from the body, a stronger, clearer-thinking version of YOU comes to the surface. As an added bonus, detoxification helps protect against accelerated aging and sickness. Secure your copy by clicking the button now! In 1974 the World Health Organization reported that 82% of all chronic degenerative disease was caused by toxic metal poisoning! Since then, heavy metals have continued to find their way into our food, our water, and even the air we breathe!”
Altitude Diseases: Mercury Hazards

- “Mercury was in use in high altitude astronomy.” Steven Magee CEng MIET - Q
- “Material Safety Data Sheet. Mercury MSDS...Potential Acute Health Effects: Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, permeator). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.” [http://www.sciencelab.com/msds.php?msdsId=9927224]
- “Mercury and most of its compounds are extremely toxic and must be handled with care...Mercury can be absorbed through the skin and mucous membranes and mercury vapors can be inhaled, so containers of mercury are securely sealed to avoid spills and evaporation.” [https://en.wikipedia.org/wiki/Mercury_(element)#Toxicity_and_safety]
- “Potential Hazards from Exposure to Elemental Mercury and Mercury Salts. Although most people know that elemental mercury and mercury salts are virulent poisons, it is commonly presumed that the danger is from oral ingestion. However, mercury is extremely volatile and the vapors are readily absorbed through the respiratory tract or unbroken skin. Mercury acts as a cumulative poison because the rate of elimination by body functions is low.” [https://water.usgs.gov/admin/memo/policy/wrdpolicy82.112.html]
- “Mercury poisoning is a type of metal poisoning due to mercury exposure.[3] Symptoms depend upon the type, dose, method, and duration of exposure.[3][4] They may include muscle weakness, poor coordination, numbness in the hands and feet, skin rashes, anxiety, memory problems, trouble speaking, trouble hearing, or trouble seeing.[1] High level exposure to methylmercury is known as Minamata disease.[2] Methylmercury exposure in children may result in acrodynia (pink's disease) in which the skin becomes pink and peels.[2] Long-term complications may include kidney problems and decreased intelligence.[2] The effects of long-term low-dose exposure to methylmercury is unclear.” [https://en.wikipedia.org/wiki/Mercury_poisoning]
- “Elemental mercury toxicity (which usually occurs in the vaporized form) can cause: mood swings, nervousness, irritability, and other emotional changes, insomnia, headache, abnormal sensations, muscle twitching, tremors, weakness, muscle atrophy, and decreased cognitive functions. High exposures of elemental mercury can cause kidney malfunction, respiratory failure, and death.” [https://www.emedicinehealth.com/mercury_poisoning/article_em.htm#what_are_the_symptoms_of_mercury_poisoning]
- “Erethism, also known as erethism mercurialis, Mad hatter disease, or mad hatter syndrome is a neurological disorder which affects the whole central nervous system, as well as a symptom complex derived from mercury poisoning. Erethism is characterized by behavioral changes such as irritability, low self-confidence, depression, apathy, shyness[1][2] and timidity, and in some extreme cases with prolonged exposure to mercury vapors, delirium, personality changes and memory loss. People with erethism often have difficulty with social interactions. Associated physical problems may include a decrease in physical strength, “headaches, general pain, and...
tremors after exposure to metallic mercury”[3] as well as an irregular heartbeat…After chronic exposure to the mercury vapours, hatters tended to develop characteristic psychological traits, such as pathological shyness and marked irritability” https://en.wikipedia.org/wiki/Erethism

- “"Mad as a hatter" is a colloquial English phrase used in conversation to suggest (lightheartedly) that a person is suffering from insanity. It is believed to emanate from Denton, Tameside in the North of England where men in the area predominantly worked in the hattery business which used mercury in the hat making process. Mercury poisoning causes symptoms similar to madness and death often occurred with the accumulation of mercury in the body. The earliest known appearance of the phrase in print is in an 1829 issue of Blackwood's Edinburgh Magazine.” https://en.wikipedia.org/wiki/Mad_as_a_hatter

- “Minamata disease (Japanese: 水俣病 Hepburn: Minamata-byō), sometimes referred to as Chisso-Minamata disease (チッソ水俣病 Chisso-Minamata-byō), is a neurological syndrome caused by severe mercury poisoning. Signs and symptoms include ataxia, numbness in the hands and feet, general muscle weakness, loss of peripheral vision, and damage to hearing and speech. In extreme cases, insanity, paralysis, coma, and death follow within weeks of the onset of symptoms. A congenital form of the disease can also affect fetuses in the womb.” https://en.wikipedia.org/wiki/Minamata_disease

- “When I worked at Columbia University and Dartmouth College we would handle the rubber filled mercury mirror support system with bare hands and no respiratory protection. What was ironic was that we were visually inspecting it for leaks and that microscopic leaks could be entering our bodies through our bare skin and respiratory tracts. I had no industry recognized training in correctly handling mercury systems, dealing with unexpected spills, the health hazards and the correct storage protocols. When I reflect on the mercury filled rubber mirror support band, it was just one of the many incompetence's that astronomers were subjecting their unsuspecting staff to.” Steven Magee CEng MIET - Q

- “Identify floors that may emit mercury vapor...Not all health hazards in schools are well-recognized. Until recently, very few people had heard that some rubber-like floors in school gyms, tracks, and other locations can emit mercury vapor.” https://www.njea.org/identify-floors-may-emit-mercury-vapor/

- “On August 14, 1996, Karen Wetterhahn, a chemistry professor working at Dartmouth College, spilled a small amount of dimethylmercury on her latex glove. She began experiencing the symptoms of mercury poisoning five months later and, despite aggressive chelation therapy, died a few months later from brain malfunction due to mercury intoxication.[22][23]” https://en.m.wikipedia.org/wiki/Mercury_poisoning

- “Like Karen Wetterhahn, I was mercury poisoned in the employment of Dartmouth College. Unlike Karen Wetterhahn, I survived the extremely sickening mercury poisoning.” Steven Magee CEng MIET - Q

- “It is probably a good thing that Karen Wetterhahn died from mercury poisoning, as if she had survived, she would have discovered the horrible Dartmouth College workers compensation experience for occupational disease.” Steven Magee CEng MIET - Q

- “In the space of less than a year, mercury poisoning took me from being sponsored for an exceptional ability green card by Dartmouth College to being shown the door.” Steven Magee CEng MIET - Q

- “Show someone the door - to tell someone to leave or make it clear you want someone to leave.” https://dictionary.cambridge.org/us/dictionary/english/show-someone-the-door

371
• “Mercury poisoning wrecked my health and career.” Steven Magee CEng MIET - Q
• “Unraveling the Mystery of Chronic Fatigue & Fibromyalgia...The exposure to heavy metals such as lead, mercury, arsenic, or cadmium will lead to deposits in the body that are not detected in blood work unless it is an acute exposure. Heavy metal accumulation is well known to disturb the neurologic, endocrine and immune systems. Chelation is a process of giving a substance that will bind to metals and pull the metals out of storage so they can then be eliminated in the urine.” https://imcwc.com/html5-blank/unraveling-the-mystery-of-chronic-fatigue-fibromyalgia/
• “Mercury poisoning will take you into a very dark place and chelation will bring you back into the light.” Steven Magee CEng MIET - Q
• “While astronomers have been studying Mercury, I have been living with mercury.” Steven Magee CEng MIET - Q
• “Mercury is a hot and inhospitable world. Like the planet Mercury, mercury poisoning creates a hot and inhospitable world within the human.” Steven Magee CEng MIET - Q
• “How Just Two Drops of Organic Mercury Can Destroy Your Brain. This famous ’80s case study is a terrifying glimpse into acute mercury poisoning.” https://www.popularmechanics.com/science/health/a14442546/two-drops-mercury-poisoning/
• “OSHA began its inspection in March 2016, after Environmental Remediation Services Inc. employees complained about mercury exposure and lack of personal protective equipment. The employees were removing liquid mercury and mercury-contaminated soil and wood from the third and fourth floors of Building 5 of the Main Plant. The agency’s inspection found that several employees inhaled or absorbed excessive levels of mercury vapor or liquid mercury through their skin. Biological monitoring confirmed the workers had symptoms consistent with respiratory mercury exposure. These symptoms can include neurological impairment, fever, fatigue, memory loss, tremor, feeling pins and needles in the skin, damage to the gums, and skin damage.” https://advancedsafetyhealth.com/blog/employees-needlessly-sickened-when-exposed-to-mercury-poisoning/
• “Last week, the U.S. Occupational Safety and Health Administration (OSHA) cited a Connecticut contractor, Manafort Brothers, with two willful and six serious violations because they exposed the workers at the demolition of Eversource’s Schiller Station in Portsmouth, New Hampshire project site to hazards related to mercury, respirators, protective clothing and sanitary conditions. Along with the citations, Manafort Brothers also faces total fines of $329,548.” https://www.groundforcetraining.com/blog/2018/01/03/mercury-hazards-draw-330k-osha-fine/
• “Controlling Mercury Spills in Laboratories with A Thermometer Exchange Program...Several Occupational Exposure Limits (OELs) have been established for limiting exposure to airborne inorganic mercury vapors. The federal Occupational Safety and Health Administration Permissible Exposure Limits (OSHA PEL) is 0.1 milligrams per cubic meter of air (mg/m3). This is a “Ceiling” limit, which must not be exceeded during any part of the workday. The American Conference of Governmental Industrial Hygienists Threshold Limit Value (ACGIH TLVTM) is 0.025 mg/m3. This is an eight-hour-time-weighted-average. The National Institute for Occupational Safety and Health(NIOSH) established three Recommended Exposure Limits for inorganic mercury. These include a 0.05 mg/m3 eight-hour-time-weighted-average, a 0.1 mg/m3 Ceiling and a 10 mg/m3 Immediately Dangerous to Life or Heath (IDLH) level. An IDLH is an atmospheric concentration of any toxic, corrosive or asphyxiating substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or
would interfere with an individual’s ability to escape from a dangerous atmosphere. The ACGIH and NIOSH have both given inorganic mercury a “Skin Notation”, indicating that skin absorption is a route of exposure. It is important to note that the federal OSHA PEL is a legally enforceable limit, whereas both the ACGIH and NIOSH criteria are recommended limits.”

- “Mercury Contamination. Review of a Residential Response...RIDEM notified EPA Region I, since the reportable quantity for elemental mercury is 1 lb. One pound of elemental mercury is equivalent to 2 tablespoons; 25 lb equals 1 quart. EPA emergency response guidelines for residential mercury contamination were employed (Singhvi, Mehra & McGuire, 2004; see “Six Rs of Emergency Response” sidebar on p. 54). RIDEM, EPA Region 1, Rhode Island Department of Health Office of Environmental Health (EHEALTH) assumed joint command for the response.”

- “Mercury Spill - Mercury is Extremely Dangerous...Elemental mercury is a hazardous material that is designated as having reproductive critical effects. Liquid mercury is a highly toxic chemical that’s commonly found in thermometers, barometers, float valves, switches, relays and electric components...You should never attempt to clean a mercury spill using a standard vacuum cleaner as vacuum cleaner will force microscopic particles of the mercury into the air rather than keeping it contained and worsen the contamination. Another mistake is sweeping it with a broom, doing that will also spread the contamination.”

- “Mercury Toxicity and Treatment: A Review of the Literature...Mercury toxicity is not often included in the differential diagnosis of common subjective complaints such as fatigue, anxiety, depression, odd paresthesias, weight loss, memory loss, and difficulty concentrating, but these are the symptoms of low-grade chronic mercury exposure described by the investigators cited previously. Given the ability of the various forms of mercury to deposit in most parts of the human body, the range of symptoms potentially caused by mercury is quite large. Animal studies linking mercury toxicity to neurodegenerative diseases [117, 118] raise clinical concern, as do a series of associations between mercury and neurodegenerative diseases in humans [119–123].”

- “Chelation therapy is a medical procedure that involves the administration of chelating agents to remove heavy metals from the body.[1] Chelation therapy has a long history of use in clinical toxicology[2] and remains in use for some very specific medical treatments, although it is administered under very careful medical supervision due to various inherent risks...For the most common forms of heavy metal intoxication – lead, arsenic, or mercury – a number of chelating agents are available. Dimercaptosuccinic acid (DMSA) has been recommended for the treatment of lead poisoning in children by poison control centers around the world.[11] Other chelating agents, such as 2,3-dimercaptopropanesulfonic acid (DMPS) and alpha lipoic acid (ALA), are used in conventional and alternative medicine. Some common chelating agents are ethylenediaminetetraacetic acid (EDTA), 2,3-dimercaptopropanesulfonic acid (DMPS), and thiamine tetrahydrofurfuryl disulfide (TTFD).”

- “I was attending the doctor from 2006 through to 2008 for strange skin sensations, tingling/pains/numbness in my head, face, hands and legs, fatigue, stress, gastrointestinal problems, breathing difficulties and chest tightness/pains when exercising while working at an astronomical observatory that had a large amount of mercury stored on site. In 2009 it had progressed to include heart issues, fatigue, weakness and dizziness and I suggested to my doctor that my symptoms matched Eosinophilia and may be Lyme disease encephalitis or multiple
sclerosis. Many years later in 2018 I showed a positive response to mercury chelation therapy.”

- “Using the Andy Cutler Protocol to Address Mercury Poisoning...The Cutler protocol may use any of three different chelators: ALA (alpha lipoic acid), DMPS (2,3-dimercapto-1-propanesulfonic acid) and DMSA (dimercaptosuccinic acid). ALA removes mercury, arsenic and antimony; DMPS removes mercury and arsenic; and DMSA removes mercury, cadmium, antimony, arsenic and lead. ALA is the most important chelator because it is fat-soluble and can enter cells and cross the blood-brain barrier. ALA is available over-the-counter and is found in many products, and for most people, it will be the only chelator they will need to use. However, it is essential to use ALA carefully because it can wreak tremendous havoc with improper chelation.”

- “In 2019 it had emerged that I had been mercury poisoned while working in high altitude astronomy.”

- “Reflecting on my time at the 2006 to 2008 observatory, I started to lose my voice in management meetings after extensively handling the rubber mercury mirror support system and the large glass jars of on-site stored mercury with my bare hands and no respiratory protection.”

- “Eosinophilia occurs when a large number of eosinophils are recruited to a specific site in your body or when the bone marrow produces too many eosinophils. This can be caused by a variety of factors, including: Parasitic and fungal diseases. Allergies including allergies to medications or food. Adrenal conditions. Skin disorders. Toxins. Autoimmune disorders. Endocrine disorders. Tumors.”

- “The symptoms of eosinophilia are those of the underlying condition. For example, eosinophilia due to asthma is marked by symptoms such as wheezing and breathlessness, whereas parasitic infections may lead to abdominal pain, diarrhoea, fever, or cough and rashes. Medicine reactions often give rise to skin rashes, and they often occur after taking a new drug. Rarer symptoms of eosinophilia can include weight loss, night sweats, lymph node enlargement, other skin rashes, and numbness and tingling due to nerve damage.”

- “Drug Rash with Eosinophilia and Systemic Symptoms Caused by Topical Application of Mercury.”

- “Immune Reactive Conditions: The Mercury Connection to Inflammatory & Immune Reactive Conditions...The incidence of allergic and immune reactive conditions, such as allergies, asthma, lupus, and allergic contact disease has been increasing rapidly in the United States over the last decade. The prevalence of asthma doubled over the last decade to approximately 31 million (11.5% of the total population). At least 50 million have allergies (19%), and the largest increase has been in infants, with approximately 10% of infants—approximately 15 million in the U.S. with systemic eczema. Approximately 12% have had chronic sinusitis. Inflammation has been found to be a major factor in many chronic health conditions, including cardiovascular problems, diabetes, arthritis, depression, osteoporosis, periodontal disease, joint stiffness, chronic fatigue, fibromyalgia, age-related immune dysfunction, etc. Many studies have found exposure to mercury and other heavy metals to be common causes of such conditions.”
andrenal systems are the most commonly affected organ systems in mercury exposure. Mercury poisoning is usually misdiagnosed because of the insidious onset, nonspecific signs and symptoms, and lack of knowledge within the medical profession. Acute exposure caused by inhaled elemental mercury can lead to pulmonary symptoms. Initial signs and symptoms, such as fever, chills, shortness of breath, metallic taste, and pleuritic chest pain, may be confused with metal fume fever. Other possible symptoms could include stomatitis, lethargy, confusion, and vomiting. [https://www.state.nj.us/health/ceohs/documents/eohap/haz_sites/gloucester/franklin_township/kiddie_kollege/diner05_toxicity_mercury.pdf]

- “Occupational Safety and Health Administration...Mercury is naturally occurring and exists in several forms. High mercury exposure results in permanent nervous system and kidney damage. Exposure is most likely to occur during mining, production, and transportation of mercury, as well as mining and refining of gold and silver ores. Mercury is commonly found in thermometers, manometers, barometers, gauges, valves, switches, batteries, and high-intensity discharge (HID) lamps. It is also used in amalgams for dentistry, preservatives, heat transfer technology, pigments, catalysts, and lubricating oils.” [https://www.osha.gov/SLTC/mercury/index.html]

- “OSHA Standards State Standards...This section highlights OSHA standards, directives (instruction to OSHA staff), letters of interpretation (official letters of interpretation of the standards), and recommended exposure limits related to mercury.” [https://www.osha.gov/SLTC/mercury/standards.html]

- “Storing, Transporting and Disposing of Mercury...Packaging Mercury for Storage and Transportation. Place all mercury-containing products or containers of mercury inside a larger container with a tight fitting lid. Place kitty litter or oil-absorbent matter around the product to protect it from breaking or sudden shocks. Clearly label storage container as "Mercury - DO NOT OPEN."” [https://www.epa.gov/mercury/storing-transporting-and-disposing-mercury]

- “Mercury and its compounds: safe handling and dealing with spillages. Highly toxic, mercury requires special handling procedures. Lisa Bushby briefly discusses these, and the risks associated with mercury and its compounds, and describes some of the measures that should be taken in the event of a spillage.” [https://app.croneri.co.uk/feature-articles/mercury-and-its-compounds-safe-handling-and-dealing-spillages]

- “Mercury regulation in the United States...Mercury regulation in the United States is a set of laws and regulations limiting the maximum concentrations of mercury (Hg) that is permitted in air, water, soil, food and drugs. These laws and regulations are promulgated by U.S. Federal Agencies such as the Environmental Protection Agency (EPA) and Food and Drug Administration (FDA), as well as a variety of State and local authorities.” [https://en.wikipedia.org/wiki/Mercury_regulation_in_the_United_States]

- “Don’t Mess with Mercury’: Videos for teachers highlight spill awareness, response...As a new school year gets underway, the Agency for Toxic Substances and Disease Registry has released two teacher training videos as part of a campaign intended to call attention to the dangers of mercury exposure.” [https://www.safetyandhealthmagazine.com/articles/17430-dont-mess-with-mercury-videos-for-teachers-highlight-spill-awareness-response]

- “There were numerous large glass bottles of mercury stored at high altitude astronomical facilities. It seemed to be an uncontrolled substance that was accessible to anyone at the facility.” Steven Magee CEng MIET - Q

- “Mercury Clean Up Techniques and Case Studies” [https://www.michigan.gov/documents/mdch/375]
“The problem with worker contamination by mercury is that the workers may cross contaminate a wide variety of items, such as computers, furniture, offices, tools, workshops, cars, restrooms, their personal items, their own homes, their partner, and so on.” Steven Magee CEng MIET - Q

“Dangerous Mercury Spills Still Trouble Schoolchildren. Thousands of kids are still exposed to dangerous liquid mercury in schools and homes. Contamination can last years, and cleanups are costly...The local fire department alerted him that the home of a student at Agua Fria High School was contaminated with liquid mercury that apparently had been taken from a science classroom. The next day, emergency crews descended on the school in haz-mat suits, discovering a toxic trail of mercury vapors in classrooms, locker rooms, and buses...Mercury spills inside schools and houses, often unreported, can release vapors into the air for weeks, even years.” https://www.scientificamerican.com/article/mercury-spills-trouble-schoolchildren/

“Teen unaware of mercury risk...But around that time, Michael said, he developed a rash all over his body. An emergency room doctor told Estes that it was a simple allergic reaction. Soon, Estes said, the rash faded. But over the last few weeks, Michael felt his energy draining. He began to miss school and lock himself up in his room, which had the highest levels of mercury contamination in the home. His fingers tingled, and he couldn't run. Mercury poisoning, which comes from exposure to the vapors from the liquified metal, causes personality changes, nervousness and trembling. Michael said he found refuge by taking as many as six hot baths a day. "I felt good when I was in there,' he said.” https://lasvegassun.com/news/2004/jan/15/teen-unaware-of-mercury-risk/

“After handling the observatory mercury systems, I had to start taking daily baths to calm down my hot skin pains. The baths were the only refuge from the terrible pains.” Steven Magee CEng MIET - Q

“Mercury Exposure: Effects Across the Lifespan...The dissolved mercury vapor can oxidize to form inorganic mercuric mercury, a process that is inhibited by ethanol. Elimination is slow, with an average half-life of about 8 weeks for the body and possibly years for the brain.” https://neuro.psychiatryonline.org/doi/full/10.1176/jnp.2008.20.4.iv

“Mercury poisoning is a type of metal poisoning due to exposure to mercury.[3] Symptoms depend upon the type, dose, method, and duration of exposure.[3][4] They may include muscle weakness, poor coordination, numbness in the hands and feet, skin rashes, anxiety, memory problems, trouble speaking, trouble hearing, or trouble seeing...Long-term complications may include kidney problems and decreased intelligence...Common symptoms of mercury poisoning include peripheral neuropathy, presenting as paresthesia or itching, burning, pain, or even a sensation that resembles small insects crawling on or under the skin (formication); skin discoloration (pink cheeks, fingertips and toes); swelling; and desquamation (shedding or peeling of skin)...Exposure to mercury can occur from breathing contaminated air,[9] from eating foods that have acquired mercury residues during processing,[10] from exposure to mercury vapor in mercury amalgam dental restorations,[11] and from improper use or disposal of mercury and mercury-containing objects, for example, after spills of elemental mercury or improper disposal of fluorescent lamps...In humans, approximately 80% of inhaled mercury vapor is absorbed via the respiratory tract, where it enters the circulatory system and is distributed throughout the body.[36] Chronic exposure by inhalation, even at low concentrations in the range 0.7–42 μg/m3, has been shown in case–control studies to cause effects such as tremors, impaired cognitive skills, and sleep disturbance in workers. Acute inhalation of high concentrations causes a wide variety of cognitive, personality, sensory, and motor disturbances.
The most prominent symptoms include tremors (initially affecting the hands and sometimes spreading to other parts of the body), emotional lability (characterized by irritability, excessive shyness, confidence loss, and nervousness), insomnia, memory loss, neuromuscular changes (weakness, muscle atrophy, muscle twitching), headaches, polyneuropathy (paresthesia, stocking-glove sensory loss, hyperactive tendon reflexes, slowed sensory and motor nerve conduction velocities), and performance deficits in tests of cognitive function.”

https://en.wikipedia.org/wiki/Mercury_poisoning

- “Mercury Quick Facts. Health Effects of Mercury Exposure...Can vaporize (evaporate) into the air in your house. The vapor cannot be seen or smelled. Can be toxic to people’s nervous system, lungs and kidneys...Breathing mercury vapors in air is the most common way to be exposed to elemental mercury, and is the most harmful to your health...How much mercury spilled in a room will make air in the room unsafe? Any amount of mercury spilled indoors can be hazardous. The more mercury is spilled, the more its vapor will build up in air and the more hazardous it will be. Even a small spill, such as from a broken thermometer, can produce hazardous amounts of vapor if a room is small enough, warm enough and people spend a good deal of time there, as in a small bedroom....Health effects caused by long-term exposure to mercury vapors • Anxiety • Excessive shyness • Anorexia • Sleeping problems • Loss of appetite • Irritability • Fatigue • Forgetfulness • Tremors • Changes in vision • Changes in hearing.”


- “Mercury and health...Exposure to mercury – even small amounts – may cause serious health problems, and is a threat to the development of the child in utero and early in life...Mercury may have toxic effects on the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes. Mercury is considered by WHO as one of the top ten chemicals or groups of chemicals of major public health concern...Mercury exists in various forms: elemental (or metallic) and inorganic (to which people may be exposed through their occupation); and organic (e.g., methylmercury, to which people may be exposed through their diet). These forms of mercury differ in their degree of toxicity and in their effects on the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes...Health effects of mercury exposure. Elemental and methylmercury are toxic to the central and peripheral nervous systems. The inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested. Neurological and behavioural disorders may be observed after inhalation, ingestion or dermal exposure of different mercury compounds. Symptoms include tremors, insomnia, memory loss, neuromuscular effects, headaches and cognitive and motor dysfunction. Mild, subclinical signs of central nervous system toxicity can be seen in workers exposed to an elemental mercury level in the air of 20 μg/m³ or more for several years. Kidney effects have been reported, ranging from increased protein in the urine to kidney failure.”

https://www.who.int/news-room/fact-sheets/detail/mercury-and-health

- “If you know that you are working at a facility that uses mercury and you are slowly becoming sick, then it is a good idea to leave for your next job before that strange sickness progresses.”

Steven Magee CEng MIET - Q

- “The large amount of mercury at the observatory facility was one of the reasons why I wanted Occupational Health and Safety Administration (OSHA) to visit the facility and provide legal guidance. I attribute my mercury poisoning to be directly related to the observatory management preventing the arranged OSHA visit from taking place.”

Steven Magee CEng
“The Ivy League is developing a sad history of preventable mercury poisoned employees that has led to death in at least one case.” Steven Magee CEng MIET - Q

“The Ivy League is an American collegiate athletic conference comprising sports teams from eight private universities in the Northeastern United States. The term Ivy League is typically used to refer to those eight schools as a group of elite colleges beyond the sports context.[2] The eight members are Brown University, Columbia University, Cornell University, Dartmouth College, Harvard University, the University of Pennsylvania, Princeton University, and Yale University. Ivy League has connotations of academic excellence, selectivity in admissions, and social elitism.” [https://en.wikipedia.org/wiki/Ivy_League](https://en.wikipedia.org/wiki/Ivy_League)

“I accept no responsibility whatsoever for anything that I did while I had mercury poisoning.” Steven Magee CEng MIET – Q
Altitude Diseases: Mercury Lung Hazards

- “Acute respiratory syndrome following accidental inhalation of mercury vapor...At room temperature, mercury is highly volatile and can vaporize, and its volatility increases with heat. Inhalation of mercury vapor causes chemical pneumonia that can evolve to respiratory distress, respiratory failure, and death...A 19-year-old man with no prior morbidity presented to the emergency unit with a 2-day history of chest pain, dry cough, and febrile sensation. One day before the onset of symptoms, he was using a liquid-in-glass mercury thermometer that accidentally broke and spilled mercury across the left axillary and pectoral region, after which he took a hot shower...His urinary mercury concentration was found to be 172 μg (normal: 11.50-36.50 μg)...significant exposure may occur through acute inhalation, which can cause acute pneumonia, adult respiratory distress syndrome, and death. In this patient, it is probable that the hot shower immediately after exposure increased the volatility of the mercury spilled over the skin and, therefore, the amount of mercury inhaled...The clinical picture of mercury vapor poisoning has three phases. The initial phase, during the first 1-3 days after exposure, manifests as a flu-like illness that includes fever, dry cough, dyspnea, and chest pain as experienced by this patient. The intermediate phase may be accompanied by severe multiorgan symptoms, and the last phase may involve symptoms of the central nervous system.”

- “Mercury inhalation poisoning and acute lung injury...The toxic effects of acute mercury vapor inhalation have been described. The clinical picture evolving may be divided into three phases. The initial phase is manifested as a flu-like illness. The intermediate phase involves a period in which severe multi-organ symptoms may manifest. The late phase consists of a period when central nervous symptoms persist. Rare cases with very high acute exposure to mercury vapor have been reported, in which severe respiratory symptoms dominate the clinical picture. The cause of death in all lethal cases is progressive respiratory failure and the pathologic findings in the lungs at autopsy reveal various stages of acute lung injury, similar to those found in the acute respiratory distress syndrome (ARDS)...He became ill with paroxysmal cough, dyspnea, chest pain, nausea and vomiting, but he was unaware of the cause of his illness...Transbronchial lung biopsy revealed a chemical pneumonitis, suggestive of pulmonary change of early acute lung injury induced by the exposure to mercury vapors...Elemental mercury vapor is absorbed rapidly through the alveolar membrane and transported by blood to the brain and other parts of the nervous system. Mercury is rapidly converted to mercuric ions (Hg++), which are then excreted in the urine and feces. Elimination of elemental mercury occurs primarily in the urine with a half-life of about 60 days.”
  [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4531943/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4531943/)

- “Medical Management Guidelines for Mercury...The major route of exposure to elemental mercury is inhalation of mercury vapor. Symptoms of acute toxicity following high-level exposure to mercury vapor occur within hours of the exposure. Respiratory symptoms include corrosive bronchitis with fever chills and dyspnea, which can progress to pulmonary edema or fibrosis. Abdominal cramps, diarrhea, renal dysfunction, visual disturbances, and central nervous system damage leading to neuropsychiatric disturbances and intention tremors may also occur. Mercury vapor can cross the blood-brain and placental barriers. It is also excreted in breast milk. Children may be at increased risk for pulmonary toxicity and are more likely to develop respiratory failure.”
Altitude Diseases: Mercury Kidney Hazards

- "Mercury was in use at every astronomical observatory I had worked at." Steven Magee CEng MIET - Q
- "Heavy metal detoxification...Mercury. Common sources of mercury exposure include mining, production, and transportation of mercury, as well as mining and refining of gold and silver ores. Other more common sources can be found in silver dental fillings, fluorescent bulbs. High mercury exposure results in permanent nervous system and kidney damage."
- "Mercury poisoning...Mercury poisoning is a type of metal poisoning due to exposure to mercury.[3] Symptoms depend upon the type, dose, method, and duration of exposure.[3][4] They may include muscle weakness, poor coordination, numbness in the hands and feet, skin rashes, anxiety, memory problems, trouble speaking, trouble hearing, or trouble seeing.[1] High-level exposure to methylmercury is known as Minamata disease.[2] Methylmercury exposure in children may result in acrodynia (pink disease) in which the skin becomes pink and peels.[2] Long-term complications may include kidney problems and decreased intelligence.[2] The effects of long-term low-dose exposure to methylmercury are unclear."
- "I was riddled with memory issues that became so severe at the age of 45 that I had to apply for disability benefits. At the age of 50, my mental functioning is in decline with severe short term memory issues, concentration problems and chronic fatigue. My kidneys are testing bad on blood tests. The USA has refused all applications for occupational disease and disability benefits." Steven Magee CEng MIET - Q
Altitude Diseases: Long Term Effects Of Mercury Poisoning

- “Mercury Exposure: Effects Across the Lifespan...Both acute and chronic exposure to toxic substances may contribute to the development of neurodegenerative diseases such as Alzheimer’s disease, Parkinson’s disease, and amyotrophic lateral sclerosis. 8, 45, 46 Injury can occur by direct mechanisms and/or indirectly by altering susceptibility at later ages to disease development. For example, elevated levels of mercury have been found in both blood and brain in patients with Alzheimer’s disease, suggesting that its accumulation may be a factor in the development of this disease. 47 Proposed mechanisms for delayed effects include mercury-induced increased formation of insoluble β-amyloid, mercury-induced increased formation of reactive oxygen species during oxidative stress, excitotoxicity due to inhibition of glutamate reuptake, and increased glial reactivity promoting neuroinflammatory processes. In summary, mercury has been known since antiquity to be both a useful and a harmful heavy metal. As one examines patients across the lifespan, significant exposures at younger ages are most devastating. However, chronic lower level exposures at any age can also lead to neuropsychiatric symptomology and reaffirms the necessity to include poison/toxin exposure questions in a clinical interview.”


- “Mercury poisoning...Breathing in a small amount of elemental mercury will cause very few, if any, long-term side effects. However, breathing in larger amounts can lead to a long hospital stay. Permanent lung damage is likely. There may be brain damage. Very large exposures will likely cause death. A large overdose of inorganic mercury may cause massive blood and fluid loss, kidney failure, and likely death. Chronic brain damage from organic mercury poisoning is difficult to treat. Some people never recover, but there has been some success in people who receive chelation treatment.”

https://ufhealth.org/mercury-poisoning

- “Mercury poisoning: Symptoms and treatment...High levels of mercury in the blood may put a person at risk for long-term neurological damage. These effects may be more pronounced in children who are still developing. A study in the Journal of Preventive Medicine and Public Health noted that many incidents of mercury poisoning have led to long-term nerve damage, which can cause: intelligence disorders and low IQ, slow reflexes, damaged motor skills, paralysis, numbness, problems with memory and concentration, symptoms of ADHD. Reproductive effects. Mercury poisoning also poses a risk to the reproductive system. It may cause reduced sperm count or decreased fertility and may also cause problems with the fetus. Possible effects of mercury poisoning include deformity and a decreased survival rate of the fetus, and reduced growth and size of the newborn at birth. Cardiovascular risks. Mercury helps promote the accumulation of free radicals in the body, which puts the cells at risk for damage. This may lead to an increased risk of heart problems, including heart attack and coronary heart disease.”

https://ufhealth.org/mercury-poisoning

- “Mercury and health...Exposure to mercury – even small amounts – may cause serious health problems, and is a threat to the development of the child in utero and early in life. Mercury may have toxic effects on the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes...Elemental and methylmercury are toxic to the central and peripheral nervous systems. The inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney
toxicity if ingested. Neurological and behavioural disorders may be observed after inhalation, ingestion or dermal exposure of different mercury compounds. Symptoms include tremors, insomnia, memory loss, neuromuscular effects, headaches and cognitive and motor dysfunction. Mild, subclinical signs of central nervous system toxicity can be seen in workers exposed to an elemental mercury level in the air of 20 μg/m³ or more for several years. Kidney effects have been reported, ranging from increased protein in the urine to kidney failure.”

“Mercury Toxicity and Treatment: A Review of the Literature...Elemental or Metallic (Hg₀) Mercury. Approximately 80% of metallic mercury vapor outgassed from amalgams is absorbed through inhalation [10, 14, 15], compared with about 7 to 10% absorption of ingested metallic mercury [5], and about 1% absorption of metallic mercury through skin contact [5]. On entry to the body, mercury vapor has great affinity for sulfhydryl groups and bonds to sulfur-containing amino acids throughout the body. Mercury vapor is transported to the brain [16], either dissolved in serum or adherent to red cell membranes. Metallic mercury passes easily through the blood brain barrier [17] and through the placenta, where it lodges in the fetal brain [18]. Metallic mercury is, however, rapidly oxidized to mercuric mercury on entry to the bloodstream [5], although not so quickly as to prevent considerable uptake by the central nervous system while still in the metallic form. In addition to the brain [16, 19–26], metallic mercury is also deposited in the thyroid [5, 19, 21], breast [27], myocardium [28, 29], muscles [5, 21], adrenals [5], liver [5, 30–32], kidneys [5, 7, 8, 19, 20, 23, 30–32], skin [5, 7, 8], sweat glands [5], pancreas [5], enterocytes [5, 30], lungs [5, 23, 30], salivary glands [5], testes, and prostate [5] and may be associated with dysfunction of those organs. Mercury also has affinity for binding sites on the surface of T cells and for sulfhydryl groups influencing T cell function [33, 34]. Mercury deposits readily in placenta and fetal tissues and is found in breast milk. [5, 18, 31, 35] Metallic mercury is largely excreted as mercuric mercury [5]. The excretory half lives of metallic and mercuric mercury vary widely, depending on the organ of deposition and redox state, with values ranging from a few days to several months [5], with some pools (e.g., CNS) having a half life exceeding several years [5]. Hair mercury does not correlate with brain content of metallic mercury [5]. These complexities make accurate assessment of body burden challenging (see Section 9 hereinafter)….Metallic Mercury Vapor. Mercury in all forms poisons cellular function by altering the tertiary and quaternary structure of proteins and by binding with sulfhydryl and selenohydryl groups. Consequently, mercury can potentially impair function of any organ, or any subcellular structure. The chief target organ of mercury vapor is the brain, but peripheral nerve function, renal function, immune function, endocrine and muscle function, and several types of dermatitis have been described [49]. With massive acute exposure to mercury vapor, erosive bronchitis and bronchiolitis potentially leading to respiratory failure may be accompanied by CNS symptoms such as tremor or erethism [50]. Chronic exposure to clinically significant doses of mercury vapor usually produces neurological dysfunction. At low-level exposures, nonspecific symptoms like weakness, fatigue, anorexia, weight loss, and gastrointestinal disturbance have been described [51]. Higher exposure levels are associated with mercurial tremor: fine muscle fasciculations punctuated every few minutes by coarse shaking. Eretism may also be observed: severe behavior and personality changes, emotional excitability, loss of memory, insomnia, depression, fatigue, and in severe cases delirium and hallucination [10]. Gingivitis and copious salivation have been described [5]. These symptoms may regress with cessation of exposure, but in many cases do not. Persistent neurological symptoms are common [52]….Mercury toxicity is not often included in the
differential diagnosis of common subjective complaints such as fatigue, anxiety, depression, odd paresthesias, weight loss, memory loss, and difficulty concentrating, but these are the symptoms of low-grade chronic mercury exposure described by the investigators cited previously. Given the ability of the various forms of mercury to deposit in most parts of the human body, the range of symptoms potentially caused by mercury is quite large. Animal studies linking mercury toxicity to neurodegenerative diseases [117, 118] raise clinical concern, as do a series of associations between mercury and neurodegenerative diseases in humans [119–123]. Mercury exposure is not insignificant according to WHO, as cited previously, and the NHANES reports suggest widespread exposure in the United States, especially among women.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3253456/
Altitude Diseases: Broken Mercury Filled Florescent Lamps – Hazards

- “I never received any industry recognized training in astronomy on how to safely clean up smashed mercury filled florescent tubes.” Steven Magee CEng MIET - Q
- “Factsheet: the three main health risks associated with energy saving lamps (CFLs)... Mercury. Energy saving lamps contain mercury, a substance which is extremely harmful for humans, animals and the ecosystem in general. It is especially toxic to the brain, the nervous system, the liver and the kidneys. Fetuses, babies and infants are the most vulnerable, as mercury exposure negatively influences the development of the brain (eg. lower IQ) and nervous system. Mercury can also damage the cardiovascular, immune and reproductive systems and possibly lead to tremors, emotional instability, memory loss, insomnia, neuromuscular changes, headaches, cancer and Alzheimer’s” https://lowenergylampsinfo.wordpress.com/2009/03/14/factsheet-the-three-main-health-risks-associated-with-energy-saving-lamps-cfls/
- “Avoiding Mercury Exposure from Fluorescent Bulbs. Metallic mercury poses health risks from inhalation and skin exposure. Tubular or compact fluorescent bulbs contain small amounts of the metal mercury sealed inside. If fluorescent bulbs are broken, small amounts of mercury will be released into the environment. Proper cleanup will reduce workers’ exposure to the low levels of mercury anticipated when a fluorescent bulb is accidentally broken.” https://www.osha.gov/Publications/osha3536.pdf
- “Protecting Workers from Mercury Exposure While Crushing and Recycling Fluorescent Bulbs...Reducing Mercury Exposure in the Workplace. All workplaces where fluorescent bulbs are deliberately broken or crushed should have: A cleanup plan that informs workers how to safely clean up incidental mercury releases from broken bulbs. Brooms should not be used to clean up broken fluorescent bulbs because they will spread the mercury. A vacuum cleaner should only be used if it is specifically designed to collect mercury. A regular vacuum cleaner will increase air levels of mercury and the vacuum will become contaminated. Contact with broken glass should be avoided.” https://www.osha.gov/Publications/mercuryexposure_fluorescentbulbs_factsheet.pdf
Altitude Diseases: Broken Mercury Filled Spectral Lamps - Hazards

- “Wavelength calibration lamps containing mercury and other elements were in use in astronomy.” Steven Magee CEng MIET - Q
- “The wavelength calibration lamps normally used with the Goodman spectrograph are: HgAr, CuHeAr, Ne, and Ar. An Fe lamp is also available.” [http://www.ctio.noao.edu/soar/content/goodman-comparison-lamps-updated](http://www.ctio.noao.edu/soar/content/goodman-comparison-lamps-updated)
- “HgAr = Mercury Argon, CuHeAr = Copper Helium Argon, Ne = Neon, Ar = Argon Fe = Iron” Steven Magee CEng MIET
- “The Finder module contains spectral calibration (Ne, Ar, Hg-Ne & Xe) and flat field lamps.” [http://mdm.kpno.noao.edu/13_manual/mgh06.html](http://mdm.kpno.noao.edu/13_manual/mgh06.html)
- “The finder unit also houses a set of comparison lamps - an incandescent flat bulb, and Ne, Hg, Ar, and Xe discharge lamps - for calibrating spectra.” [http://mdm.kpno.noao.edu/Manuals/mdmguide_current.html#mis](http://mdm.kpno.noao.edu/Manuals/mdmguide_current.html#mis)
- “Chemical elements alphabetically listed” [https://www.lenntech.com/periodic/name/alphabetic.htm](https://www.lenntech.com/periodic/name/alphabetic.htm)
- “Neon light...If the signs are broken, the only hazardous element is the mercury. There are policies that neon signs have to go through to make sure it is safe if they are broken. If such a thing happens, the area needs to be well ventilated because concentrated amounts of the neon, argon, or whatever gas has been used, is not good to inhale and can cause side effects that are harmful to the body...Although neon gas is not poisonous or explosive, the small amount of mercury found in some neon lights is not dangerous as long as the tube is not damaged. Some neon sign shops will not repair neon lights when mercury has been used in the manufacturing process.” [http://creationwiki.org/Neon_light](http://creationwiki.org/Neon_light)
- “We were not told by the management teams to ventilate the area and to leave the area after breaking astronomical spectral lamps.” Steven Magee CEng MIET - Q
- “It was common to be exposed to smashed mercury filled spectral calibration lamps in astronomy.” Steven Magee CEng MIET - Q
- “The entire astronomical observatory team were installing a mercury argon spectral lamp (HgAr) during a training session when one of the workers smashed the mercury filled spectral lamp. We continued the training session with a new spectral lamp from stock. A week later I was at the doctors complaining of a variety of health conditions that were classic mercury poisoning.” Steven Magee CEng MIET - Q
- “In all of the workplaces that I have been in, broken mercury lamps were swept up with the nearest brush and pan and the broken glass thrown into the closest trash can. There were no records kept of mercury releases or where they had occurred.” Steven Magee CEng MIET - Q
- “During my career, I never received any training on how to deal with broken mercury lamps and the health hazards of the mercury released.” Steven Magee CEng MIET - Q
- “I had taken an obsolete astronomical spectral gas tube home from the observatory for use as an ornament. Many years later I broke the specialized gas tube in the home. In the days afterwards I started experiencing sickness that I had been reporting to my doctor during working at the high altitude observatory. My notes state: During the last few days my bones are starting to ache again and nerves are twitching in my body and face like they were when I worked at the Kitt Peak National Observatory (KPNO)...headaches...insomnia...zoning
out...tired...forgettable...confusion. 5 days earlier I had been atop Kitt Peak mountain and 4 days later the sheriff disconnected my electricity.” Steven Magee CEng MIET - Q

- “Had I been educated by my employers as to how hazardous mercury filled spectral lamps were, I would never have taken an obsolete mercury filled spectral lamp home.” Steven Magee CEng MIET - Q

- “I consider myself fortunate that I no longer live in the home where I broke a mercury filled astronomical spectral lamp.” Steven Magee CEng MIET - Q

- “Never buy a home from a mad scientist.” Steven Magee CEng MIET – Q
Altitude Diseases: Industrial Gas Hazards

- “When discharging industrial gas into the indoor environment in high altitude astronomy, we never wore protective breathing respirators that fed us oxygenated air at above the legally required 19.5% oxygen levels.” Steven Magee CEng MIET - Q
- “Industrial liquid gas containers were left open and venting gas into the indoor environment in high altitude astronomy. On reflection, I realized that I routinely observed mental and physical effects that match those of a low oxygen environment in staff that I supervised.” Steven Magee CEng MIET - Q
- “The toxicity of medical and industrial gas to the human depends on where it is used. A gas that is regarded as safe in a well ventilated environment at sea level may be a toxic gas in an indoor environment at high altitude.” Steven Magee CEng MIET - Q
- “An open flask of industrial liquid gas that is venting into the indoor environment should be thought of as the same as a smoldering fire, as they both create a dangerous oxygen deficient environment for the human.” Steven Magee CEng MIET - Q
- “During my time in high altitude astronomy, I routinely witnessed workers breathing medical oxygen, industrial carbon dioxide, nitrogen and helium gas as part of their daily indoor work routine.” Steven Magee CEng MIET - Q
- “When I worked in high altitude astronomy, the worst sickness that I experienced was not at the 13,796 feet very high altitude summit of Mauna Kea Observatory (MKO) in Hawaii, it was at Kitt Peak National Observatory (KPNO) in Arizona at the much lower altitude of 6,875 feet. Due to my very high altitude experiences, I knew that this strange sickness was not primarily caused by altitude sickness and was most likely Sick Building Syndrome (SBS). After reporting various behavioral problems in all of the staff to the upper management team, my contract was not renewed, I was unable to legally protect the health and safety of the workers that I was responsible for, troubleshooting of this environmental problem stopped and I left in a sickened state for my next position before I could find the root cause.” Steven Magee CEng MIET - Q
- “Asphyxiation Hazard: When cryogenic liquids form a gas, the gas is very cold and usually heavier than air. This cold, heavy gas does not disperse very well and can accumulate near the floor. Even if the gas is non-toxic, it displaces air. When there is not enough air or oxygen, asphyxiation and death can occur. Oxygen deficiency is a serious hazard in enclosed or confined spaces. Small amounts of liquid can evaporate into very large volumes of gas. Toxic Hazards: Each gas can cause specific health effects.”
  http://www.hsc.wvu.edu/safety/Laboratory-Safety/Cryogenic-Liquids.aspx
- “Asphyxiation Hazard...Small amounts of liquid can evaporate into very large volumes of gas. For example, one litre of liquid nitrogen vapourizes to 695 litres of nitrogen gas when warmed to room temperature (21°C). Toxic Hazards: Each gas can cause specific health effects. For example, liquid carbon monoxide can release large quantities of carbon monoxide gas, which can cause death almost immediately.”
  https://www.ccohs.ca/oshanswers/chemicals/cryogenic/cryogen1.html
- “Asphyxiation - nitrogen, argon and helium: Releasing nitrogen, argon or helium may produce local oxygen-deficient atmospheres, which will produce asphyxia if inhaled....BOC recommend that, as a precaution, oxygen deficiency monitors should be used....Asphyxiation - carbon
dioxide: Carbon dioxide is essentially an asphyxiant gas but also has mild toxic properties. The Health and Safety Executive's guidance note EH40 indicates that the recommended exposure limit for carbon dioxide is 5,000 ppm (0.5%) by volume - calculated as an eight hour time-weighted average concentration in air - or 15,000 ppm (1.5%) for a 15 minute period. For these reasons, a carbon dioxide monitor should be used when there is a risk of CO2 exposure, rather than an oxygen deficiency monitor.”


• “When humans breathe in an asphyxiant gas, such as pure nitrogen, helium, neon, argon, sulfur hexafluoride, methane, or any other physiologically inert gas(es), they exhale carbon dioxide without re-supplying oxygen. Physiologically inert gases (those that have no toxic effect, but merely dilute oxygen) are generally free of odor and taste. As such, the human subject detects little abnormal sensation as the oxygen level falls. This leads to asphyxiation (death from lack of oxygen) without the painful and traumatic feeling of suffocation (the hypercapnic alarm response, which in humans arises mostly from carbon dioxide levels rising), or the side effects of poisoning. In scuba diving rebreather accidents, there is often little sensation but euphoria—however, a slow decrease in oxygen breathing gas content has effects which are quite variable. By contrast, suddenly breathing pure inert gas causes oxygen levels in the blood to fall precipitously, and may lead to unconsciousness in only a few breaths, with no symptoms at all.”


• “HYPOXIA: If the bag has a device that will remove CO2 repeated breaths would deplete the oxygen, but no CO2 would accumulate. The person would be unlikely to experience severe dyspnoea, and might not be aware of the shortage of oxygen until too late (unconsciousness occurs), but the respiratory minute volume (RMV) would begin to increase due to hypoxia. In about the same time he would become unconscious and eventually die from hypoxia. There would be very little discomfort and he might feel rather euphoric and unconcerned about the situation; euphoria is a typical and characteristically dangerous aspect of hypoxia.”

http://archive.rubicon-foundation.org/xmlui/bitstream/handle/123456789/6041/SPUMS_V27N1_13.pdf?sequence=1

• “Dangers of oxygen-deficient atmospheres: Effects of exposure to low oxygen concentrations can include giddiness, mental confusion, loss of judgment, loss of coordination, weakness, nausea, fainting, loss of consciousness and death.”


• “I have memories from my time in high altitude astronomy of being euphoric and giddy after discharging large amounts of industrial gas into the indoor environment. The effects would last hours and resembled being drunk and intoxicated.” Steven Magee CEng MIET - Q

• “Euphoric: Psychology. in a state of happy and confident well-being sometimes exaggerated in pathological states as mania.”

http://www.dictionary.com/browse/euphoric

• “Giddy: 1. affected with vertigo; dizzy. 2. attended with or causing dizziness: a giddy climb. 3. frivolous and lighthearted; impulsive; flighty.”

http://www.dictionary.com/browse/giddy?s=t

• “Some of the typical long-term effects of hypoxic ischemic encephalopathy (HIE) include the following: Cerebral palsy; Epilepsy, seizure disorders; Severe hearing impairments; Blindness or severe vision impairments; Problems learning, thinking and speaking. These are called cognitive developmental problems and are often accompanied by a low mental development index (MDI) score; Problems with walking and coordination, also called motor and behavioral developmental problems. These result in a low psychomotor development index (PDI) score.”
“What Happens After A Lack of Oxygen to the Brain? Common long-term effects of oxygen deprivation can include: Damage to specific brain regions deprived of oxygen...Changes in mood or personality...Difficulty with memory...Changes in motor skills...Chronic pain...The inability to feel pain, or to correctly respond to pain signals...Difficulties with impulse control...Symptoms of mental illnesses such as depression or anxiety....Dementia-like symptoms, including confusion, memory difficulties, and signs of rapid brain aging.”

“Risk Factors For Oxygen Deprivation: Cerebral hypoxia has a variety of potential causes—anything that interferes with the body's ability to process and distribute oxygen could lead to deprivation in the brain. This could include: Severe asthma attacks; Chronic work in a nitrogen-rich environment; Extremely high altitude without a pressurization mechanism; Choking or strangulation; Drowning; Chronic smoke inhalation; Crushing of the trachea. Any situation in which you are unable to breathe normally can lead to cerebral hypoxia and eventual brain damage, which in turn can increase your risk for developing a form of dementia.”
https://www.dementia.org/oxygen-deprivation-dementia


“5 Most Common OSHA Violations” http://safetyculture.blr.com/safety-culture-5-most-common-osha-violations-infographic/

“1910.134(a)(1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to this section.” https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=STANDARDS

“Employee exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.” https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=STANDARDS

“Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.” https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=STANDARDS


“The Air check O2 Deficiency Monitor is used in restaurants where CO2 and nitrogen are used to dispense beverages, Tire sales and repair centers to protect employees when filling tires with nitrogen, MRI facilities to protect against helium leaks used to cool the magnets, and Food processing facilities to alert personnel of nitrogen leaks from freezer tunnels. PureAire’s Air check O2 continuous monitor can provide comfort in protecting your employees from entering potentially hazardous situations if a leak occurs.” https://www.pureairemonitoring.com/all-categories-gas-monitors-air-check-o2-oxygen-deficiency-monitor-for-co2-n2-storage-areas/
“Drugs Associated with the Development of Interstitial Lung Disease...Aspirin, Oxygen, Radiation” [http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement/pulmonary/interstitial-lung-disease/]

“Low-level continuous or intermittent exposure to irritant gases or chemical vapors may lead to chronic bronchitis” [http://www.merckmanuals.com/professional/pulmonary-disorders/environmental-pulmonary-diseases/irritant-gas-inhalation-injury]

“At the age of 46 I was diagnosed with lung issues.” Steven Magee CEng MIET - Q [http://environmentalradiation.com/High%20Resolution%20CT%20Radiation%20Scan%20Experience.pdf]

“During almost a decade of working in high altitude astronomy with liquid cryogenics and industrial gas, I have no recollection of ever being sent on an industry recognized training course in the safe handling and use of them.” Steven Magee CEng MIET - Q

“One of my astronomy managers used to tell me that liquid nitrogen was harmless and was just liquid air. He would pour it onto his bare hands to demonstrate how safe he thought it was. I was later to realize that incompetence was a feature of high altitude astronomy.” Steven Magee CEng MIET - Q

“Dirty air can harm your brain and stress the body. Studies show pollution can alter brain function in students and disrupt hormones...Yet even today, air pollution sickens and kills people. Lots of people. A 2016 study reported that breathing dirty air is now the fourth-leading cause of deaths worldwide.” [https://www.sciencenewsforstudents.org/article(dirty-air-can-harm-your-brain-and-stress-body]

“The air we breathe could be changing our behaviour in ways we are only just beginning to understand...It’s also clear that exposure to various pollutants can cause inflammation in the brain and can damage brain structure and neural connections. “So what could be happening is that these air pollutants are damaging the pre-frontal lobe,” says Younan. This is the very area important for controlling our impulses, our executive function and self-control.”
http://www.bbc.com/future/story/20190415-how-air-pollution-is-doing-more-than-killing-us


- “I was never aware of any professional astronomy summit worker that had received formal industry recognized training in the safe handling of cryogenic fluids and industrial gasses.” Steven Magee CEng MIET - Q

- “Three Dead After Dry Ice Stunt At Russian Blogger’s Party Goes Wrong...Three partygoers have died and seven others have been left injured after dry ice was thrown into a swimming pool at a blogger’s birthday party in Russia. The victims were left with chemical burns and unable to breath at Ekaterina Didenko’s 29th birthday party, when her husband, Valentin Didenko, threw 25 kilograms of dry ice into the pool in a bid to create a dramatic ‘visual effect’.” https://www.unilad.co.uk/news/three-dead-after-dry-ice-stunt-at-bloggers-party-goes-wrong/

- "I consider myself fortunate that I was an electronics engineer and not an optics engineer, as it was the optics team that was discharging massive amounts of carbon dioxide into the indoor environment at the Mauna Kea Observatories." Steven Magee CEng MIET - Q
**Altitude Diseases: Ethnicity**

- “Thyroid hormone changes and psychological response to high altitude stress: effect of ethnicity...The objective of this study was to examine: i) the effect of ethnicity on cortisol, thyroid hormones and psychological performance during high-altitude exposure in lowlanders as compared to sea-level, and with high-altitude-natives (HAN) at high-altitude; ii) if there is any relation between psychological variables and hormones at high-altitude in the Indian population…In lowlanders, there was a significant change in loneliness, fear-of-death; thyroid hormones at high-altitude. Interactive effect between high-altitude×ethnicity was observed for psychological and hormone variables (except hopelessness, freeT3). Significant variation in hormones and psychological variables was observed between lowlanders and HAN at high-altitude (except memory, loneliness, TSH). Significant correlation was observed between fear-of-death/loneliness for Caucasoids (r=0.55) and Mongoloids (r=0.49); loneliness/freeT4 (r=−0.37) and fear-of-death/freeT4 (r=−0.36) for Mongoloids.” [https://www.endocrine-abstracts.org/ea/0025/ea0025p344](https://www.endocrine-abstracts.org/ea/0025/ea0025p344)
Altitude Diseases: Altered Lifespan

- “My observations of high altitude observatory workers is that they seem to have elevated levels of behavioral problems that eventually progresses into ill health, disease and premature death for some.” Steven Magee CEng MIET - Q
- “Effects of Living at Higher Altitudes on Mortality: A Narrative Review... mortality from COPD and probably also from lower respiratory tract infections is rather elevated…Whereas living at higher elevations may frequently protect from development of diseases, it could adversely affect mortality when diseases progress.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4113517/
- “How Living At Altitude Can Help -- Or Hurt -- Your Life Span...He and his colleagues have found that people living at higher altitude in mountain states like Colorado experience no net increase or decrease in life expectancy, though living at altitude may decrease a person's chances of getting heart disease.” http://www.cpr.org/news/story/how-living-altitude-can-help-or-hurt-your-life-span
- “High-altitude living can prolong your life. Except when it doesn’t...Altitude can protect against heart disease but can also damage the lungs and aggravate pre-existing conditions. And those who have not lived at high altitude long-term may want to think twice before retiring in mountain towns...Aging at high altitude can prolong life and provide a host of other benefits, but only for those accustomed to the conditions, such as long-time residents or natives...Respiratory diseases, on the other hand, are more prevalent at high altitudes” https://denverite.com/2016/07/27/coloradans-age-better/
- “High Altitudes and Health...They found that the 10 million Americans residing in counties above 4,900 feet live one to three years longer on average than those living near sea level. The higher the altitude, the greater the longevity benefit...The “thinner air” (that is, lower oxygen levels) at higher altitudes may improve cardiac efficiency, have beneficial vascular effects and be cardioprotective in other ways, the researchers speculated. At the same time, even modestly lower oxygen levels can be hazardous for people with already-impaired breathing, as in COPD.” http://www.berkeleywellness.com/fitness/active-lifestyle/article/high-altitudes-and-health
- “Extended longevity at high altitude: Benefits of exposure to chronic hypoxia...BACKGROUND: Acute exposure to hypobaric hypoxia can give rise to acute mountain sickness, and rarely, high altitude pulmonary edema, and high altitude cerebral edema. However, with gradual adaptation to “chronic hypoxia”, following the Adaptation to High Altitude Formula (Adaptation = time / altitudeΔ), the organism does remarkably well. High altitude residents are perfectly adapted to their environment. The cities of La Paz (3100–4100 m) and El Alto (4100 m) stand as living proof of this with 2.7 million inhabitants living perfectly normal lives, undisturbed by hypoxia and most even unaware of its existence. All the cells of the organism adapt to a lower arterial oxygen arterial partial pressure (PaO2) and likewise to a lower arterial partial pressure of carbon dioxide (PaCO2), an essential component that linked to an increased compensatory hemoglobin explain the paradox of increased “tolerance to hypoxia” at high altitude. METHODS: We reviewed the > 70 years old population historic records of the official Bolivian registration service SEGIP. Two groups were analyzed: those greater than 90 years of age, and those greater than 100 years of age according to the different altitude departments in Bolivia. RESULTS: As the altitude increases, the
longevity increases. Santa Cruz at 416m and La Paz at 3800m (average), both with around 2.7 million inhabitants each, have 6 versus 48 centenarians respectively. CONCLUSIONS: Life under chronic hypoxia is not only tolerable, but also is, in fact, favorable to improve or treat many pathological conditions such as asthma, coronary artery disease, obesity and even giving rise to improved longevity. Sea level residents (when compared to high altitude residents) suffer a disability: poor tolerance to hypoxia.”

- “DO WOMEN AGE FASTER AT HIGH ALTITUDES?...Women living in high altitude areas like the Rocky Mountains die younger and are more susceptible to disease, and new research conducted in Peru suggests they age faster, too. A recent study found lower concentrations of the hormones DHEA and DHEAS, important for both physical and mental wellness, in women age 60 to 70 living above 13,000 feet in the Peruvian Andes. While levels of the hormones naturally decline as women age, scientists found that the Peruvian women in high altitude areas never produced concentration levels as high as those living in areas just 500 feet above sea level. DHEA and DHEAS are steroid hormones produced by the adrenal gland. They are naturally found in the bloodstream and brain tissue of all healthy people. Scientists said the study might indicate that women age earlier in high altitude areas, including the Rockies, Andes, Alps and Himalayas. Other studies on DHEA have shown that besides affecting the aging process, it has a role in countering obesity and cancer.”

- “High altitude 'speeds up ageing'...Women who live at high altitudes are likely to age faster, research suggests. Scientists drew their conclusions after finding lower concentrations of hormones, which are important for maintaining health and youthfulness, in women living in the mountainous areas of Peru...They found DHEA levels in mountain-living women aged between 60 and 70 were only at about 40% of the levels found in the control group…Other studies have shown the importance of DHEA and DHEAS in the ageing process. One found that when DHEA was fed to mice it increased their life expectancy by a third. The treated mice seemed younger and had a lower incidence of the typical diseases of ageing, including diabetes and cardiovascular complications...If you give synthetic DHEA to people who are deficient, their energy levels improve, their bones get a little thicker and their libido sometimes improves.”

- “Effect of aging on blood pressure in Leh, Ladakh, a high-altitude (3524 m) community, by comparison with a Japanese town...The effect of aging on blood pressure (BP) and heart rate (HR) was investigated in a cross-sectional study in the high-altitude community of Leh, Ladakh (altitude: 3524 m) and a Japanese community in U town, Hokkaido (altitude: 25 m). BP and HR were obtained in a sitting position from 332 subjects 13–81 years of age in Ladakh, and from 216 Japanese citizens, 24–79 years of age. Measurements were taken after a 2-min rest, using a semi-automated BP device (UA-767 PC, A&D Co. LTD, Tokyo). High-altitude people showed higher diastolic BP and HR values than lowland people (83.2 vs. 76.9 mmHg and 78.6 vs. 69.2 bpm, P < 0.001), but no difference in systolic BP. Highland people also showed a steeper BP increase with age than the lowland people (systolic BP: 0.7476 vs. 0.3179 mmHg/year, P < 0.0005; diastolic BP: 0.3196 vs. 0.0750 mmHg/year, P < 0.001). This chronocelogic investigation in Ladakh examined the circulation as a physiological system at high-altitude. Our data indicate the need for a more comprehensive cardiovascular assessment for a better diagnosis and a more fruitful treatment. Longitudinal observations of effects of socio-ecologic factors on the cardiovascular system should help prevent strokes and other cardiovascular
events, especially at high altitude.”

- “Aging, High Altitude, and Blood Pressure: A Complex Relationship...Both aging and high altitude exposure may induce important changes in BP regulation, leading to significant increases in BP levels. By inducing atherosclerotic changes, stiffening of large arteries, renal dysfunction, and arterial baroreflex impairment, advancing age may induce progressive increases in systolic BP levels, promoting development and progression of arterial hypertension. It is also known, although mainly from studies in young or middle-aged subjects, that exposure to high altitude may influence different mechanisms involved in BP regulation (i.e., neural central and reflex control of sympathetic activity), leading to important increases in BP levels. The evidence is less clear, however, on whether and to what extent advancing age may influence the BP response to acute or chronic high altitude exposure. This is a question not only of scientific interest but also of practical relevance given the consistent number of elderly individuals who are exposed for short time periods (either for leisure or work) or live permanently at high altitude, in whom arterial hypertension is frequently observed. This article will review the evidence available on the relationship between aging and blood pressure levels at high altitude, the pathophysiological mechanisms behind this complex association, as well as some questions of practical interest regarding antihypertensive treatment in elderly subjects, and the effects of antihypertensive drugs on blood pressure response during high altitude exposure.”
Altitude Diseases: Dementia

- “The amnestic disorders are a group of disorders that involve loss of memories previously established, loss of the ability to create new memories, or loss of the ability to learn new information. As defined by the mental health professional's handbook, the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision (2000), also known as DSM-IV-TR, the amnestic disorders result from two basic causes: general medical conditions that produce memory disturbances; and exposure to a chemical (drug of abuse, medication, or environmental toxin).” [http://www.minddisorders.com/A-Br/Amnestic-disorders.html](http://www.minddisorders.com/A-Br/Amnestic-disorders.html)

- "Dementia from oxygen deprivation is not always treatable, because it usually stems from some form of permanent brain damage. If a person facing low levels of oxygen is restored to adequate levels fast enough, the damage may be minimal or reversible. But if the damage is long-term and causes the onset of dementia, there is little that can be done short of managing the symptoms." [https://www.dementia.org/oxygen-deprivation-dementia](https://www.dementia.org/oxygen-deprivation-dementia)
Altitude Diseases: Mental Health

- “A person exhibiting confusion at high altitude will commonly forget to take oxygen to alleviate it.” Steven Magee CEng MIET - Q
- “I am at one with crazy.” Steven Magee CEng MIET - Q
- “Am I mentally ill or am I just a mad scientist?” Steven Magee CEng MIET - Q
- “Living at Higher Altitudes Could Be Bad for Mental Health...people who live at higher altitudes are somewhat less likely to die from coronary artery disease or stroke. But increased elevation may also enhance psychological problems, such as panic attacks…One reasonable explanation could be the effects of hypoxia, or a deficiency in the amount of oxygen reaching the tissues. This can influence the body’s metabolism of serotonin, one of the neurotransmitters related to aggressive behavior and suicide. Several studies suggest that chronic hypoxia increases mood disturbances, especially in patients with emotional instability.”
- "My Brother Tom’s Schizophrenia...He had been a skier, a camper, a mountain climber. He was strong and fit, with a wide-ranging intellect and a practical mind, and, in his early twenties, when he was still a student at the University of Colorado (5,345 feet), he had done things like bike through Europe and climb a forbidding Alaskan mountain called the Moose’s Tooth. (10,300 ft)...His symptoms were as bad as they had ever been—“both auditory and visual hallucinations, pacing, and some symptoms of mania, including not sleeping for periods up to 24 hours,” read the doctor’s notes."  https://www.newyorker.com/culture/personal-history/my-brother-toms-schizophrenia?utm_source=pocket-newtab
- "The Moose's Tooth (or simply Moose's Tooth, Mooses Tooth) is a rock peak on the east side of the Ruth Gorge in the Central Alaska Range, 15 miles (24 km) southeast of Denali. Despite its relatively low elevation, it is a difficult climb. It is notable for its many large rock faces and its long ice couloirs, which are famous in mountaineering circles, and have seen a number of highly technical ascents."  https://en.wikipedia.org/wiki/The_Moose%27s_Tooth
- "At CU, Altitude Is The Buffs' Best Friend...BOULDER — Wherever athletic endeavors are contested on the University of Colorado campus, the number 5,345 feet is clearly evident. That number is CU’s elevation — and it's an intimidating number for visiting athletes...So without preparing and getting ready, a visit to Boulder can turn ugly for an athlete competing in any sport, not just in endurance sports."  https://cubuffs.com/news/2016/3/24/210829487.aspx
Altitude Diseases: Social Isolation Hazards

- “High altitude observatories are commonly on remote mountain tops that isolate workers from society.” Steven Magee CEng MIET - Q
- “Extreme night shift work was alone working for up to eighteen hours per night for several nights on the very high altitude summit of Mauna Kea. “ Steven Magee CEng MIET - Q
- “High altitude workers are typically recruited from all over the world and relocated to the remote astronomical observatory area. The downside to this is that it isolates them from their existing friends and family.” Steven Magee CEng MIET - Q
- “Social isolation is a risk factor for mental illness including dementia, depression and anxiety. Precisely how social isolation affects mental wellbeing is an emerging field of study, although early indications suggest that persistent loneliness may lead to changes in self-perception and behaviour, creating a self-reinforcing negative loop. Perceived lack of social support is another factor which appears to impact on mental health.”
- “What message can we take from these stories of endurance and despair? The obvious one is that we are, as a rule, considerably diminished when disengaged from others. Isolation may very often be the “sum total of wretchedness”, as the writer Thomas Carlyle put it. However, a more upbeat assessment seems equally valid: it is possible to connect, to find solace beyond ourselves, even when we are alone. It helps to be prepared, and to be mentally resilient. But we shouldn’t underestimate the power of our imagination to knock over prison walls, penetrate icy caves or provide make-believe companions to walk with us.”
- “Even Americans of a few generations ago used to benefit from a richness of community life that has all but disappeared, as we've witnessed a long, slow retreat into the hermetically sealed comfort of our fortress-like homes . . . deep friendships replaced by screens, gadgets, and exhausted couch-potato stupor. The toll? Increased vulnerability to mental illness. Social isolation is a huge risk factor for the onset of major depression, which has more than doubled in prevalence over the past decade. And there's growing evidence that isolation increases vulnerability to various forms of addiction, as well.”
  https://www.psychologytoday.com/blog/the-depression-cure/200907/social-isolation-modern-plague
- “Mental illness is a hard condition to deal with. If you do not have the correct support system behind you the results can be unimaginable. Recent studies have shown the direct correlation between social isolation and mental illness. Social interaction is a necessity of life. Now, I am not talking social interaction as being in a relationship with someone at all times, but interaction in general. This interaction could be going to the movies with a friend, talking to your cousin on the phone, or going to a restaurant with your mother.”
  https://www.interventionservicesinc.com/social-isolation-and-mental-illness/
- “Could Working Remotely Be As Bad For Your Health As Smoking? Some psychologists believe that social isolation could be the cause for a lot of health problems.”
  https://www.fastcompany.com/3069124/could-working-remotely-be-as-bad-for-your-health-as-smoking
- “In 1973 the US sociologist Robert Weiss divided loneliness into two categories: emotional and
social isolation. While these two forms of isolation sometimes overlap, it’s not always the case. One individual might feel inner loneliness despite having a good social network, or being married, while another might feel lonely because of not belonging to a social group. But whether a sense of isolation is emotional or social, its harmful effects on our health are the same, according to evidence.”

https://www.mentalhealth.org.uk/sites/default/files/the_lonely_society_report.pdf

- “People experience social isolation for a variety of reasons such as discrimination, lack of employment, being homeless or generally being in situations where they feel like their ideas and opinions are not valued. Social isolation can lead to very serious mental and physical health risks.”


- “Overworked and isolated - work pressure fuels mental illness in academia ...Heavy workloads, lack of support and isolation are the key factors contributing to mental illness, according to respondents, who range from PhD students to vice-chancellors...Just under half of respondents say they feel isolated, and others raise concerns around a "bullying culture", job insecurity and a culture of long working hours.”

https://www.theguardian.com/higher-education-network/blog/2014/may/08/work-pressure-fuels-academic-mental-illness-guardian-study-health

- “How extreme isolation warps the mind...When people are isolated from human contact, their mind can do some truly bizarre things...mind began to slip after about two months into her incarceration. She heard phantom footsteps and flashing lights...One of the most disturbing effects was the hallucinations...“In the periphery of my vision, I began to see flashing lights, only to jerk my head around to find that nothing was there,” she wrote in the New York Times in 2011. “At one point, I heard someone screaming, and it wasn’t until I felt the hands of one of the friendlier guards on my face, trying to revive me, that I realised the screams were my own.”...Chromically lonely people have higher blood pressure, are more vulnerable to infection, and are also more likely to develop Alzheimer’s disease and dementia. Loneliness also interferes with a whole range of everyday functioning, such as sleep patterns, attention and logical and verbal reasoning. The mechanisms behind these effects are still unclear, though what is known is that social isolation unleashes an extreme immune response – a cascade of stress hormones and inflammation...isolating six volunteers for 48 hours in sound-proofed rooms in a former nuclear bunker. The results were similar. The volunteers suffered anxiety, extreme emotions, paranoia and significant deterioration in their mental functioning. They also hallucinated: a heap of 5,000 empty oyster shells; a snake; zebras; tiny cars; the room taking off; mosquitoes; fighter planes buzzing around...But we shouldn’t underestimate the power of our imagination to knock over prison walls, penetrate icy caves or provide make-believe companions to walk with us.”


- “Antarctic Researcher Stabs Colleague At Remote Outpost...An Antarctic researcher at a remote Russian science station has been charged with attempted murder after stabbing his colleague in a sudden outburst of violence. According to Russia’s Interfax news agency, Sergey Savitsky attacked his fellow scientist on October 9, possibly after suffering an emotional breakdown, stabbing him at least once.”


- “Dieting Can Make You Lose Your Mind Part 2...We can't separate the diet of the biospherians from the low light, increasingly low oxygen (turns out oxygen was reacting with the concrete
structure, leading to gradually and continuously lower levels, until the biospherians had sleep apnea and couldn't complete sentences, so eventually oxygen had to be piped in during the second year), and the difficulty of isolation. For the last 14 months of the first mission, the eight crew members were split into two factions and would not make eye contact or speak to each other unless absolutely necessary.” https://www.psychologytoday.com/us/blog/evolutionary-psychiatry/201104/dieting-can-make-you-lose-your-mind-part-2?amp
Altitude Diseases: Summit Brain

- “‘Summit Brain’ was a term that the Mauna Kea Observatory management teams would use to describe the forgetfulness and confusion that would develop in their workers when at very high altitudes.” Steven Magee CEng MIET BEng Hons
- “The need to use oxygen daily to offset ‘Summit Brain’ was never discussed during my job interview. The need to use oxygen daily came as a nasty surprise once I started working at the Mauna Kea Observatories.” Steven Magee CEng MIET BEng Hons
- “The short term effects of very high altitude ‘Summit Brain’ tend to progress into long term neurological and physical impairments.” Steven Magee CEng MIET BEng Hons
- “Once I started to develop ‘Summit Brain’ away from the very high altitude workplace, it was all downhill from there.” Steven Magee CEng MIET BEng Hons
- “The high-altitude brain...The highest place on our planet, Mount Everest (8850m), appears to be close to the limit of how high an acclimatized human can go, albeit slowly. In this paper, I will explore the possibility that what limits human performance at such extreme degrees of hypoxia is the availability of oxygen to the brain. Also, one of the known costs of such extreme exposure is residual mild impairment of performance on neuropsychometric tests after return to sea level, implying injury to brain cells. That such injury could occur in the absence of any overt impairment of function, much less without loss of consciousness, is unexpected. I will speculate about physiological mechanisms that might cause or contribute to both decrements in real-time performance while at altitude and residual deficits for a time after return to low elevations; the effects of hypoxia on brain cells are an even greater puzzle at the present time.”

https://jeb.biologists.org/content/204/18/3129
Altitude Diseases: Mental Response to High Altitudes

- “A Review of the Physiology and Nutrition in Cold and in High-Altitude Environments by the Committee on Military Nutrition Research...Mental Response to High Altitudes. A hypoxic person often experiences personality changes, beginning with euphoria and then depression, with compromised ability to make decisions, especially when severe cold is a confounding factor (Nelson, 1982; Shukitt and Banderet, 1988; Tune, 1964). As noted by Schoene (see Chapter 17 in this volume), high altitudes "dull the spirit and engender a loss of spontaneity." He also noted, "the higher you go, the slower you go." As hypoxia worsens, there is increasing sensory and mental impairment, with the potential for paranoia and hostility. Patterns of mental response differ with individuals and the time course of acclimatization. Affect and emotions are altered at 14,000 ft (4,267 m) and above to the extent that cohesive groups, such as small military units, may experience a social breakup or dysfunction (Nelson, 1982; Shukitt and Banderet, 1988; Tune, 1964). There may also be decreased ability to perform small motor tasks which may persist after acclimatization. Sleep is disturbed at altitudes of 14,000 ft (4,267 m) and above. Sleep becomes periodic, often with Cheyne-Stokes breathing and periodic awakening accompanied by gasping for breath. There may be as much as a 50 percent reduction in total sleeping time, and a decrease in REM sleep (Anholm et al., 1992; Goldenberg et al., 1992; Normand et al., 1990; Sutton et al., 1979; Weil, 1985; White et al., 1987). This disturbed sleep pattern usually corrects within 3 to 5 days, but in some individuals may last for weeks. The general and REM sleep deprivation may contribute to personality changes.”

https://www.ncbi.nlm.nih.gov/books/NBK232855/

- “A Review of the Physiology and Nutrition in Cold and in High-Altitude Environments by the Committee on Military Nutrition Research...The Effect of Altitude on Cognitive Performance and Mood States. Physiological changes associated with exposure to altitudes above 10,000 ft (3,048 m) are often accompanied by changes in mood, performance, and appetite (see Chapters 17 and 22 in this volume). The limited available data are based on self-evaluation and suggest that there is mood impairment at high altitudes, including unfriendliness, impaired thinking, and dizziness (Bahrke and Shukitt-Hale, 1993; Van Liere and Stickney, 1963). Other data indicated fatigue, which may have been exacerbated by physical exertion and increased oxygen demand (Shukitt and Banderet, 1988; Shukitt-Hale et al., 1990). In an altitude chamber, subjects exhibited significant mood deterioration with increases in hypoxic conditions and duration of exposure (Lieberman et al., 1991). Available data thus are suggestive of mood deficits, but more studies are needed. Data on cognitive performance under hypoxic conditions are also limited. Some results indicate impairment at high altitudes (10,000 ft [3,048 m]), including deficits in reaction time, vigilance, memory, and reasoning ability (Lieberman et al., 1991). Complex task performance also deteriorates, with increased error rate and slowing of performance (Lieberman et al., 1991). Simulation studies in altitude chambers (hypoxic conditions) suggest that such adverse changes increase in severity with greater hypoxia and duration of exposure (Lieberman et al., 1991). There appears to be individual variability in susceptibility to these effects of altitude/hypoxia. Moreover, rate of ascent (onset of hypoxia) influences onset and severity of symptoms (Hansen et al., 1967; Shukitt-Hale et al., 1991a).”

https://www.ncbi.nlm.nih.gov/books/NBK232855/

- “Human behaviour and development under high-altitude conditions...Although we are far from a universally accepted pattern of impaired function at altitude, there is evidence indicating
motor, perceptual, memory and behavioural deficits in adults. Even relatively low altitudes (2500 m) may delay reaction time, and impair motor function. Extreme altitude exposure (>5000 m) may result in more pronounced impairment that can persist after returning to the lowlands. Research into the effects of altitude exposure earlier in development is lacking by comparison. Un-acclimatized children can suffer from acute mountain sickness, and, in native populations born at altitude, subtle cognitive and behavioural deficits suggest incomplete adaptation to hypoxia. The study of neurobehavioural functioning at altitude may provide important information about the effects of clinical hypoxia on the human brain and behavioural development.” http://hera.ugr.es/doi/16657470.pdf

- “New HI-SEAS missions launch on Mauna Loa...Two back-to-back missions began late last year, the first of which was led by Canadian researchers testing devices to measure cognitive fatigue, said Musilova, who was the commander on that endeavor. Crew members wore EEG devices through the mission and tracked changes in memory, decision making, learning, attention and perception, she said. “At the end of the mission, (it was) found they could indeed measure a very clear trend of fatigue on every crew member’s brain.””
Altitude Diseases: Working Memory Attenuation

- “Long-term exposure to high altitude attenuates verbal and spatial working memory: Evidence from an event-related potential study...This study aimed to determine the neurocognitive basis underlying the effects of long-term high-altitude (HA) exposure on working memory (WM). Using event-related potentials (ERPs), we compared the performance of an HA group (individuals who had lived at HA for 3 years but were born and raised at low altitude [LA]) to that of an LA group (individuals who had only lived at LA) on verbal and spatial n-back tasks (i.e., 1- and 2-back memory load). Response accuracy of the HA group was significantly decreased in comparison to the LA group in both the verbal and spatial 2-back tasks. The P2 amplitude was larger in the HA than in the LA group in the spatial, but not the verbal 2-back task. A smaller late-positive potential (LPP) amplitude was found in the HA group in both the verbal and spatial 2-back tasks. These results suggest that HA impairs the matching (P2) process in spatial WM tasks and the maintenance (LPP) process in both verbal and spatial WM tasks, indicating that HA had a different effect on verbal and spatial 2-back task performance.”

- "The Effects of Short-Term and Long-Term Exposure to a High Altitude Hypoxic Environment on Neurobehavioral Function...Aims: Examined the change in neurobehavioral function of individuals acclimated to high altitudes and those native to high altitudes. Methods: A neurobehavioral core test battery approved by the WHO (WHO-NCTB) was used to evaluate the effects of high altitude hypoxia on neurobehavioral function. The WHO-NCTB is composed of seven individual tests: a mood state profile, simple reaction time test, digit span test, Santa Ana manual dexterity test, digit symbol test, Benton visual retention test, and pursuit aiming test. Results: The values from the Santa Ana manual dexterity test, digit symbol test, and pursuit aiming test from sea-level subjects acclimated for 5 days at 3700 m were significantly decreased when compared with the same subjects at sea level. The values from the digit span, Santa Ana manual dexterity, digit symbol, Benton visual retention and pursuit aiming tests in subjects native to high altitudes of 3700, 4500, and 5100 m were significantly decreased when compared with subjects at sea level and compared with sea-level subjects acclimated for 5 days at 3700 m. Conclusions: These results demonstrate that high altitude hypoxia induces damage to neurobehavioral functions, and the long-term deficit in neurobehavioral function was more severe than the short-term changes."
  https://www.researchgate.net/publication/259497810_The_Effects_of_Short-Term_and_Long-Term_Exposure_to_a_High_Altitude_Hypoxic_Environment_on_Neurobehavioral_Function
**Altitude Diseases: Amnestic Disorders**

- “Three attributes of a good mountaineer are high pain threshold, bad memory, and ... I forget the third.” Joke in a mountaineering Internet chat room.

- “After the onset of a wide range of memory problems while working at the Mauna Kea Observatories (MKO), I was diagnosed with amnestic disorders.” Steven Magee CEng MIET BEng Hons

- “Amnestic Disorder. Amnestic Disorders are a group of disorders that involve loss of memories previously established, loss of the ability to create new memories, or loss of the ability to learn new information. In general, Amnestic Disorders are caused by structural or chemical damage to parts of the brain. People who suffer from Amnestic Disorders usually experience difficulty recalling events that happened in the past or facts they have learned prior to diagnosis. This type of amnesia is known as retrograde amnesia. Some people may also experience symptoms of anterograde amnesia, which involves the inability to learn new facts or retain new memories. There are various causes of Amnestic Disorders, which range from severe trauma to brain disorders such as Alzheimer’s disease, stroke, encephalitis, and seizures.”

- “Amnesia...Amnesia is a deficit in memory caused by brain damage or disease,[1] but it can also be caused temporarily by the use of various sedatives and hypnotic drugs. The memory can be either wholly or partially lost due to the extent of damage that was caused.[2] There are two main types of amnesia: retrograde amnesia and anterograde amnesia. Retrograde amnesia is the inability to retrieve information that was acquired before a particular date, usually the date of an accident or operation.[3] In some cases the memory loss can extend back decades, while in others the person may lose only a few months of memory. Anterograde amnesia is the inability to transfer new information from the short-term store into the long-term store. People with anterograde amnesia cannot remember things for long periods of time. These two types are not mutually exclusive; both can occur simultaneously.[4] Case studies also show that amnesia is typically associated with damage to the medial temporal lobe. In addition, specific areas of the hippocampus (the CA1 region) are involved with memory. Research has also shown that when areas of the diencephalon are damaged, amnesia can occur. Recent studies have shown a correlation between deficiency of RbAp48 protein and memory loss. Scientists were able to find that mice with damaged memory have a lower level of RbAp48 protein compared to normal, healthy mice.[5][citation needed] In people suffering with amnesia, the ability to recall immediate information is still retained,[6][full citation needed][better source needed] and they may still be able to form new memories. However, a severe reduction in the ability to learn new material and retrieve old information can be observed. Patients can learn new procedural knowledge. In addition, priming (both perceptual and conceptual) can assist amnesiacs in the learning of fresh non-declarative knowledge.[1] Amnesic patients also retain substantial intellectual, linguistic, and social skill despite profound impairments in the ability to recall specific information encountered in prior learning episodes.[7][8][9] The term is from Ancient Greek, meaning 'forgetfulness'; from ἀ- (a-), meaning 'without', and μνήσις (mnesis), meaning 'memory’.”

- “Anterograde amnesia is a loss of the ability to create new memories after the event that caused amnesia, leading to a partial or complete inability to recall the recent past, while long-term memories from before the event remain intact. This is in contrast to retrograde amnesia, where
memories created prior to the event are lost while new memories can still be created. Both can occur together in the same patient. To a large degree, anterograde amnesia remains a mysterious ailment because the precise mechanism of storing memories is not yet well understood, although it is known that the regions involved are certain sites in the temporal cortex, especially in the hippocampus and nearby subcortical regions.”
https://en.wikipedia.org/wiki/Anterograde_amnesia
Altitude Diseases: Cognition

- “There were numerous times that I was trying and failing to shut down the world’s largest telescopes at the end of the extreme night shift. I would eventually have to leave it to the day shift, as my confusion from prolonged exposure to abnormal environmental conditions was too severe to complete the task.” Steven Magee CEng MIET - Q
- “Telescope coordinates are 12 numbers long. After a couple of years working extreme night shifts on the very high altitude summit of Mauna Kea, I could no longer remember the numbers that were read out to me by astronomers.” Steven Magee CEng MIET - Q
- “Long-term exposure to high altitude attenuates verbal and spatial working memory: Evidence from an event-related potential study...This study aimed to determine the neurocognitive basis underlying the effects of long-term high-altitude (HA) exposure on working memory (WM)...These results suggest that HA impairs the matching (P2) process in spatial WM tasks and the maintenance (LPP) process in both verbal and spatial WM tasks, indicating that HA had a different effect on verbal and spatial 2-back task performance...Oxygen is essential for maintaining normal human brain function; therefore, the most important and influential aspect of living in high-altitude (HA) areas is hypoxia. Chronic exposure to HA leads to deficits in cognition such as in attention, memory, and executive function.”

- “Cognitive performance in high-altitude Andean residents compared with low-altitude populations: From childhood to older age...To assess cognition in populations born and living at high altitude (HA; 3,700 m) and low altitude (LA; 500 m) in Bolivia, who were similar for both socioeconomic status and genetic ancestry. To determine whether HA hypoxia influences cognitive decline across the life span. Method: In total, 191 healthy participants aged 4 to 85 years were assessed at HA (N = 94; 33; 35% male) and LA (N = 97; 46, 47% male) on a battery of cognitive tasks: fluid intelligence, attention, short- and long-term memory, and psychomotor speed. Saliva samples were obtained for evaluation of genetic ancestry. Results: HA participants were significantly slower on measures of processing speed and speed of attention than individuals born and living at LA. HA participants had slightly higher percentage of native Andean ancestry than LA participants, but this was not associated with cognitive performance. Conclusions: This is the first study of HA residence and neurocognition across the life span. Given the physiological challenges of HA living, the impact on cognition appears to be subtle and related only to the speed of more complex cognitive operations, rather than to their accuracy. Moreover, the impact on cognition does not appear to differ with increasing age or for different degrees of genetic admixture. Further studies recruiting HA participants with a broader range of native Andean ancestry will help to address the issue of to what extent Amerindian ancestry provides neuroprotection to chronic hypoxia in those living at HA.”

https://psycnet.apa.org/record/2014-18275-001
- “Effects on Cognitive Functioning of Acute, Subacute and Repeated Exposures to High Altitude...Neurocognitive functions are affected by high altitude, however the altitude effects of acclimatization and repeated exposures are unclear. We investigated the effects of acute, subacute and repeated exposure to 5,050 m on cognition among altitude-naïve participants compared to control subjects tested at low altitude...Selective and sustained attention are impaired at altitude and improves with acclimatization. The observed changes are associated, in part, with AMS score and SpO2. The gains in cognition with acclimatization during a first
exposure are not carried over to repeated exposures...High altitude exposure has a detrimental effect on cognitive functions with slower reaction times and reduced psychomotor vigilance i.e., slower reaction times as a measure of reduced sustained attention (high altitude, 1,500–3,500 m); impaired learning, spatial and working memory (very high altitude, 3,500–5,500 m) and impaired memory retrieval (extreme altitude, >5,500 m)”


- “How do acute, subacute and repeated exposures to high altitude affect cognition?...During the acute high altitude exposure i.e. first day at ALMA Observatory (5050m), the cognitive functions were adversely affected by the altitude exposure. The most affected cognitive abilities were the ones involved in tasks that need focus and a high level of precision, such as sustained attention...Ultimately, these results will be helpful to devise schedules that will ensure safety, reduce health hazards, as well as optimize the performance of the ALMA Observatory workers...The concerned government bodies, associated organizations and industrial partners may also use these findings as evidence to change policies concerning the health and safety of high altitude workers.” https://www.cambridgecognition.com/blog/entry/how-do-exposures-to-high-altitude-affect-cognition
Altitude Diseases: Isolated High Altitude Psychosis

- “Isolated psychosis during exposure to very high and extreme altitude - characterisation of a new medical entity...CONCLUSIONS: Episodes of psychosis during exposure to high altitude are frequently reported, but have not been specifically examined or assigned to medical diagnoses. In addition to the risk of suffering from somatic mountain illnesses, climbers and workers at high altitude should be aware of the potential occurrence of psychotic episodes, the associated risks and respective coping strategies.”
- “Isolated psychosis drives mountaineers to madness, finds science...“In our study we found that there was a group of symptoms which are purely psychotic; that is to say, that although they are indeed linked to altitude, they cannot be ascribed to a high-altitude cerebral edema, nor to other organic factors such as fluid loss, infections or organic diseases,” Brugger, who is also the President of International Society for Mountain Medicine, explained.”
- “High-Altitude Psychosis Seen as Distinct from Altitude Sickness...After much scientific scrutiny, the researchers concluded the condition is a new medical entity: isolated high-altitude psychosis. Until now, doctors had attributed these acoustic, optical, and olfactory hallucinations to organic causes. This may be because they frequently occur with symptoms such as severe headaches, dizziness, and impaired balance — side effects of a high-altitude cerebral edema, or swelling due to injury or inflammation.”
- “‘Mountain Madness' Found to Be a Real Psychosis...The "madness" mountain climbers often experience isn't a type of altitude sickness, as once thought, but rather an actual psychotic disorder, a new study suggests.”
  https://consumer.healthday.com/fitness-information-14/climbing-health-news-244/mountain-madness-found-to-be-a-real-psychosis-729380.html
- “Mountain Madness. Why Climbers Hallucinate at High Altitudes...Headaches, dizziness, and muscle aches are expected, but some extreme climbers also suffer from hallucinations, going temporarily mad on the mountain, according to research from Cambridge University. And it’s not a side effect of altitude sickness...symptoms, like hearing voices, hallucinations, delusions, disorganized speech, impaired cognition, depression, and mania.”
  https://www.mensjournal.com/adventure/why-some-climbers-have-hallucinations-at-high-altitudes/
Altitude Diseases: Invisible Friend

- “After I started working extreme night shifts, I began to think that someone was in the telescope control room with me. I would look for the person many times and would never find them. I eventually stopped looking for the person and accepted that it was my oxygen starved mind playing tricks on me in a very abnormal environment.” Steven Magee CEng MIET - Q
- “Hallucinations are a known aspect of working at very high altitudes.” Steven Magee CEng MIET - Q
- “The Third Man Factor is an extraordinary account of how people at the very edge of death experience the sense of an unseen presence beside them who encourages them to make one final effort to survive. This incorporeal being offered them a feeling of hope, protection, and guidance, and left the person convinced he or she was not alone. There is a name for this phenomenon: It's called the Third Man Factor. If only a handful of people had ever encountered the Third Man, it might be dismissed as an unusual delusion shared by a few overstressed minds. But over the years, the experience has occurred again and again, to 9/11 survivors, mountaineers, divers, polar explorers, prisoners of war, sailors, shipwreck survivors, aviators, and astronauts. All have escaped traumatic events only to tell strikingly similar stories of having sensed the close presence of a helper or guardian. The force has been explained as everything from hallucination to divine intervention. Recent neurological research suggests something else.” The Third Man Factor: Surviving the Impossible by John Geiger http://a.co/hxOYB9E
- “Imaginary friends (also known as pretend friends or invisible friends) are a psychological and social phenomenon where a friendship or other interpersonal relationship takes place in the imagination rather than external physical reality.”
- “Why People Hear Voices When Climbing Mount Everest...At extreme altitudes, mountaineers often mention experiencing psychosis — that is, a mental disorder where a person becomes out of touch with reality. Symptoms of psychotic episodes include hallucinations and delusions…Alone in the Himalayas at an altitude of more than 5.1 miles (8.2 kilometers), Windsor hallucinated a man called Jimmy, who accompanied him all day long, spoke encouraging words to him and then vanished without a trace.” https://www.livescience.com/61220-altitude-climbing-can-cause-psychosis.html
- “Mountain climbers experience mysterious hallucinations that doctors are calling a new condition...Although these high-altitude visions remain mysterious, oxygen deprivation is certainly a more reassuring explanation than that given by Peter Habeler, one of the first two people to climb Everest without supplemental oxygen. "There is a saying that whoever is killed up on the mountain wanders forever after his death," Habeler wrote in his 1979 book "Everest: Impossible Victory," and guides the living mountaineers during their last meters to the summit.” https://www.businessinsider.com/high-altitude-climbers-psychosis-hallucinations-2018-1
- “For many years my best friend was an invisible presence that would go everywhere with me.” Steven Magee CEng MIET – Q
- “When a high altitude worker is experiencing hallucinations and visions, they are at serious risk of developing diseases.” Steven Magee CEng MIET – Q
Altitude Diseases: Delusional Disorders

- “Delusional Disorder was the first mental health diagnosis that I received after regularly receiving mental health treatment in the USA in my mid forties.” Steven Magee CEng MIET – Q
- “Delusional disorder is a generally rare mental illness in which the patient presents delusions, but with no accompanying prominent hallucinations, thought disorder, mood disorder, or significant flattening of affect.[1][2] Delusions are a specific symptom of psychosis. Delusions can be "bizarre" or "non-bizarre" in content;[2] non-bizarre delusions are fixed false beliefs that involve situations that occur in real life, such as being harmed or poisoned.[3] Apart from their delusion or delusions, people with delusional disorder may continue to socialize and function in a normal manner and their behavior does not necessarily generally seem odd.[4] However, the preoccupation with delusional ideas can be disruptive to their overall lives.[4] For the diagnosis to be made, auditory and visual hallucinations cannot be prominent, though olfactory or tactile hallucinations related to the content of the delusion may be present.[2] The delusions cannot be due to the effects of a drug, medication, or general medical condition, and delusional disorder cannot be diagnosed in an individual previously properly diagnosed with schizophrenia. A person with delusional disorder may be high functioning in daily life. Recent and comprehensive meta-analyses of scientific studies point to an association between a deterioration in aspects of IQ in psychotic patients, in particular perceptual reasoning.[5][6][7] According to German psychiatrist Emil Kraepelin, patients with delusional disorder remain coherent, sensible and reasonable.[8][dubious – discuss] The Diagnostic and Statistical Manual of Mental Disorders (DSM) defines six subtypes of the disorder characterized as erotomanic (believes that someone is in love with them), grandiose (believes that they are the greatest, strongest, fastest, richest, or most intelligent person ever), jealous (believes that the love partner is cheating on them), persecutory (delusions that the person or someone to whom the person is close is being malevolently treated in some way), somatic (believes that they have a disease or medical condition), and mixed, i.e., having features of more than one subtype.[2] Delusions also occur as symptoms of many other mental disorders, especially the other psychotic disorders. The DSM-IV, and psychologists agree that personal beliefs should be evaluated with great respect to cultural and religious differences, since some cultures have widely accepted beliefs that may be considered delusional in other cultures.[9]”


- “Delusional Disorder. Delusions are fixed beliefs that do not change, even when a person is presented with conflicting evidence. Delusions are considered "bizarre" if they are clearly implausible and peers within the same culture cannot understand them. An example of a bizarre delusion is when an individual believes that his or her organs have been replaced with someone else's without leaving any wounds or scars. An example of a nonbizarre delusion is the belief that one is under police surveillance, despite a lack of evidence. Delusional disorder refers to a condition in which an individual displays one or more delusions for one month or longer. Delusional disorder is distinct from schizophrenia and cannot be diagnosed if a person meets the criteria for schizophrenia. If a person has delusional disorder, functioning is generally not impaired and behavior is not obviously odd, with the exception of the delusion. Delusions may seem believable at face value, and patients may appear normal as long as an outsider does not touch upon their delusional themes. Also, these delusions are not due to a medical condition or..."

- “Delusional disorder is a type of serious mental illness in which a person cannot tell what is real from what is imagined…Although delusions might be a symptom of more common disorders, such as schizophrenia, delusional disorder itself is rather rare. Delusional disorder most often occurs in middle to late life...The presence of non-bizarre delusions is the most obvious symptom of this disorder. Other symptoms that might appear include: An irritable, angry, or low mood. Hallucinations (seeing, hearing, or feeling things that are not really there) that are related to the delusion (For example, a person who believes he or she has an odor problem may smell a bad odor.)”  https://my.clevelandclinic.org/health/diseases/9599-delusional-disorder
Altitude Diseases: Wrecked Brain Cells

- “Are the Mountains Killing Your Brain? Alarming new science shows that thin air can wreck brain cells—at lower altitudes than you'd think...."Atrophy of the frontal lobes," Fayed says, pointing to a black-and-white slice of brain on one MRI. The frontal cortex the region just behind the forehead that handles higher-level mental functions looks like a piece of dried fruit. This kind of damage can leave patients with an impaired ability to plan, focus, and make complex decisions. And it's permanent. "Cortical atrophy, subcortical lesion..." Fayed continues, pointing to the scans of eight amateur climbers whose MRIs were taken in 1998, just after a trip up Argentina's 22,834-foot Aconcagua. "This guy suffered the most serious damage," he says. He hands me a picture of a robust young climber standing on the mountain's snowy slopes, looking fit and determined. "When he came back, he couldn't remember his own phone number. His wife would send him to the store for a loaf of bread and he would forget why he was there and come home without it."..."High-altitude mountaineering kills brain cells, no doubt," says RMI guide Melissa Arnot."

- “When my brain functioning was at its worst, I was getting lost in my own neighborhood where I had lived for years.” Steven Magee CEng MIET

- “Roy Walford, 79; Eccentric UCLA Scientist Touted Food Restriction...He got an inadvertent chance to test his theories in humans when he became a member of the Biosphere 2 team...But levels of nitrous oxide -- produced by microorganisms in the soil and normally broken down by sunlight -- rose to dangerously high levels, and the crew suffered periods when the oxygen level in the structure was unusually low. Walford later speculated that both problems caused the death of brain cells.” [https://www.latimes.com/archives/la-xpm-2004-may-01-me-walford1-story.html](https://www.latimes.com/archives/la-xpm-2004-may-01-me-walford1-story.html)

- “The haunting true story of a man who spent two years in a self-contained 'Biosphere' and nearly fell apart...But the real damage was invisible. In the six months after leaving the Biosphere, Walford fell into a deep depression, drinking his way through a bottle of vodka every four days. He had injured his back while working in the compound, and he could barely walk, at first. Something seemed to have changed in his brain, as well: Just three years after leaving the Biosphere, he began experiencing episodes of “freezing,” where he would simply stop walking, and fall down. Soon he required a walker.” [https://www.businessinsider.com/man-spent-two-years-in-biosphere-2015-3](https://www.businessinsider.com/man-spent-two-years-in-biosphere-2015-3)

- “Roy Lee Walford, M. D. (June 29, 1924 - April 27, 2004) was a professor of pathology at University of California, Los Angeles School of Medicine, a leading advocate of calorie restriction for life extension and health improvement, and a crew member of Biosphere 2...At age 79, Roy Walford died of respiratory failure as a complication of amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig's disease...Wilford himself speculated that his disease may have been caused by the combination of chronic hypoxia and exposure to carbon monoxide and nitrous oxide in Biosphere 2.” [https://en.m.wikipedia.org/wiki/Roy_Walford](https://en.m.wikipedia.org/wiki/Roy_Walford)
Altitude Diseases: Conflict Control

- “Long-Term Exposure to High Altitude Affects Conflict Control in the Conflict-Resolving Stage...The neurocognitive basis of the effect of long-term high altitude exposure on conflict control is unclear. Event related potentials (ERPs) were recorded in a flanker task to investigate the influence of high altitude on conflict control in the high-altitude group (who had lived at high altitude for three years but were born at low altitude) and the low-altitude group (living in low altitude only). Although altitude effect was not significant at the behavioral level, ERPs showed cognitive conflict modulation. The interaction between group and trial type was significant: P3 amplitude was greater in the low-altitude group than in the high-altitude group in the incongruent trial. This result suggests that long-term exposure to high altitude affects conflict control in the conflict-resolving stage, and that attentional resources are decreased to resist the conflict control in the high-altitude group.” https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0145246
Altitude Diseases: Malignant Brain Tumors

- “Is high altitude an emergent occupational hazard for primary malignant brain tumors in young adults? A hypothesis...Introduction: Brain cancer accounts for approximately 1.4% of all cancers and 2.3% of all cancer-related deaths. Although relatively rare, the associated morbidity and mortality affecting young- and middle-aged individuals has a major bearing on the death-adjusted life years compared to other malignancies. Over the years, we have observed an increase in the incidence of primary malignant brain tumors (PMBTs) in young adults. This observational analysis is to study the prevalence and pattern of brain tumors in young population and find out any occupational correlation. Materials and Methods: The data were obtained from our tertiary care cancer institute's malignant diseases treatment center registry from January 2008 to January 2018. A total of 416 cases of PMBT were included in this study. Results: Our analysis suggested an overall male predominance with most PMBTs occurring at ages of 20–49 years. The glial tumors constituted 94.3% while other histology identified were gliosarcoma (1) gliomatosis cerebri (1), hemangiopericytoma (3), and pineal tumors (3). In our institute, PMBT constituted 1% of all cancers while 2/416 patients had secondary glioblastoma multiforme with 40% showing positivity for O-6-methylguanine-DNA-methyltransferase promoter methylation. Conclusions: Most patients belonged to a very young age group without any significant family history. A probable hypothesis could be excessive cosmic radiation exposure to persons staying at high altitude areas due to occupational exigencies for which in-depth case–control epidemiological studies are required to reach any conclusion.”

http://www.ijmpo.org/article.asp?issn=0971-5851;year=2019;volume=40;issue=3;spage=374;epage=380;aulast=Sharma
Altitude Diseases: Magee’s Descent Fatigue

- “Most high altitude workers experienced fatigue after descending to sea level at the end of the work day. No one appeared to know what it was and I now call it ‘Magee’s Descent Fatigue’.” Steven Magee CEng MIET – Q
- “When I would arrive home after a day working at high altitude, I would be extremely fatigued and would collapse in a chair until bedtime. I would wake up feeling hung over.” Steven Magee CEng MIET – Q
- “At the age of 50, Magee’s Descent Fatigue is now so severe that I no longer venture to high altitudes unless I have to.” Steven Magee CEng MIET – Q
- “My suspicion about what causes Magee’s Descent Fatigue in high altitude workers is related to reperfusion of hypoxic thickened blood.” Steven Magee CEng MIET – Q
- “Reperfusion injury, sometimes called ischemia-reperfusion injury (IRI) or reoxygenation injury, is the tissue damage caused when blood supply returns to tissue (re- + perfusion) after a period of ischemia or lack of oxygen (anoxia or hypoxia). The absence of oxygen and nutrients from blood during the ischemic period creates a condition in which the restoration of circulation results in inflammation and oxidative damage through the induction of oxidative stress rather than (or along with) restoration of normal function.”

Altitude Diseases: De-Acclimatization

• “Deacclimatization - how long does acclimatization typically last...Training acclimatization time needs to be longer as the altitude becomes higher. Training for 14 days at or above 6,500 feet (as at the U.S. Olympic Training Center in Colorado Springs) and 28 days at or above 8,000 feet are currently the best recommendations for athletes wishing to compete at similar elevations, while complete adaptation to the extreme altitude of 13,000 feet is possible after a continuous stay for 14 months (3). Obviously, climbers have a tiny fraction of this time open to them...One study cited by Armstrong indicates that the red blood cell volume of high-altitude natives (people who spend most of their lives above 7000 ft) decreases as quickly as ten days after spending time at sea level. Someone spending several hours to perhaps a day or two at altitude simply won’t have enough time for any long-lasting physiological changes. Those who choose to trek in Nepal, however, or participate in an expedition-type climb of a peak over 15,000 ft will have to spend a substantial amount of time adapting to the altitude in order to prevent altitude sickness. This is why climbers who gradually ascend their first peak in Alaska, Bolivia, Chile, or the Himalayas in order to get properly acclimatized can then speed up subsequent peaks, because the body’s ability to perform physical work at high altitude can persist for a few weeks (2). Through personal discussion with our African guide, cook, and porters on Mt. Kilimanjaro, and in talking with local Northwest guides and rangers who spend a lot of time on the mountains, we learned that they typically spend a week in the mountains above 10,000 ft and a week back home; their acclimatization and improved cardiovascular function may persist for several months after returning from altitude, and allows them to make subsequent trips quite easily without needing extra time to adapt.” http://www.bodyresults.com/e2deacc.asp
Altitude Diseases: High Altitude De-Adaptation Response (HADAR)

- “Relationship between acute high altitude response, cardiac function injury, and high altitude de-adaptation response after returning to lower altitude...The relationship between acute high altitude response (AHAR), cardiac function injury, and high altitude de-adaptation response (HADAR) was assessed. Cardiac function indicators were assessed for 96 men (18 - 35 years old) deployed into a high altitude (3700 - 4800 m) environment requiring intense physical activity. The subjects were divided into 3 groups based on AHAR at high altitude: severe AHAR (n = 24), mild to moderate AHAR (Group B, n = 47) and non-AHAR (Group C, 25); and based on HADAR: severe HADAR (Group E, n = 19), mild to moderate HADAR (Group F, n = 40) and non-HADAR (Group G, n = 37) after return to lower altitude (1,500 m). Cardiac function indicators were measured after 50 days at high altitude and at 12 h, 15 days, and 30 days after return to lower altitude. Controls were 50 healthy volunteers (Group D, n = 50) at 1500 m. Significant differences were observed in cardiac function indicators among groups A, B, C, and D. AHAR score was positively correlated with HADAR score (r = 0.863, P < 0.001). Significant differences were also observed in cardiac function indicators among groups D, E, F, and G, 12 h and 15 days after return to lower altitude. There were no significant differences in cardiac function indicators among the groups, 30 days after return to lower altitude, compared to group D. The results indicated that the severity of HADAR is associated with the severity of AHAR and cardiac injury, and prolonged recovery.”

- “Diagnostic criteria of high-altitude de-adaptation for high-altitude migrants returning to the plains: a multicenter, randomized controlled trial.”
https://www.researchgate.net/publication/279675805_Diagnostic_criteria_of_high-altitude_de-adaptation_for_high-altitude_migrants_returning_to_the_plains_a_multicenter_randomized_controlled_trial
Altitude Diseases: High-Altitude De-Acclimatization Syndrome

- “Regular Observation of De-Acclimatization and Randomized Controlled Research of Diagnostic Criteria of High Altitude De-Acclimatization Syndrome among Different Plateau Migrants Crowd after Their Return to the Plain...Objective: The objective of this study was to investigate the diagnostic methods of high altitude de-acclimatization syndrome and to formulate diagnostic criteria. Methods: This study was conducted using epidemiological surveys and a multi-center randomized controlled clinical trial. A total of 3011 subjects were studied, and the following indices were collected after their return to low altitude areas from the plateau: general health status, blood, urine and stool samples, myo-cardial enzyme levels, liver and kidney function, nerve function, sex hormone levels, microalbuminuria, electrocardiogram (ECG), echocardiography, pulmonary function, and hemorheological markers. These data were compared to those of randomized healthy subjects in the same age range who lived at the same altitude to determine the characteristics of high altitude de-acclimatization syndrome. Based on these characteristics, diagnostic criteria for high altitude de-acclimatization syndrome were formulated. Results: This study demonstrated that the incidence of high altitude de-acclimatization syndrome was 84.36%. Sixty percent of the cases were mild, 30% were medium, and 10% were severe. The incidence was higher among those who returned to a place of lower altitude, resided at a high altitude for a longer period of time, or engaged in heavy labor while at high altitude. Patients with high altitude de-acclimatization syndrome manifested hematological abnormalities and abnormal ventricular function, notably a right ventricular diastolic function, which recovered to baseline function after one to five years. Exposure to long-term hypoxia often caused obvious changes in cardiac morphology, i.e., left and right ventricular hypertrophy, particularly within the right ventricle. In addition, patients with high altitude de-acclimatization syndrome often presented with low blood pressure, low pulse pressure, and microalbuminuria. A few patients presented with occult blood in their feces. The diagnosis of high altitude de-acclimatization syndrome can be made if a patient who recently returns to the plain from the plateau complains of dizziness, weakness, sleepiness, chest tightness, edema, memory loss, and other symptoms and signs that do not alleviate under short-term rehabilitation or symptomatic treatment, and if organic diseases of the heart, lung, kidney, and other organs have been excluded. Conclusion: The diagnosis of high altitude de-acclimatization syndrome should be made after a comprehensive analysis of the patient’s clinical symptoms and signs.” [https://m.scirp.org/papers/51517]

- “Analysis of High-Altitude De-Acclimatization Syndrome after Exposure to High Altitudes: A Cluster-Randomized Controlled Trial...The syndrome of high-altitude de-acclimatization commonly takes place after long-term exposure to high altitudes upon return to low altitudes. The syndrome severely affects the returnee's quality of life. However, little attention has been paid to careful characterization of the syndrome and their underlying mechanisms. Male subjects from Chongqing (n=67, 180 m) and Kunming (n=70, 1800 m) visited a high-altitude area (3650 m) about 6 months and then returned to low-altitude. After they came back, all subjects were evaluated for high-altitude de-acclimatization syndrome on the 3rd, 50th, and 100th. Symptom scores, routine blood and blood gas tests, and myocardial zymograms assay were used for observation their syndrome. The results showed that the incidence and severity of symptoms had decreased markedly on the 50th and 100th days, compared with the 3rd day. The symptom scores and incidence of different symptoms were lower among subjects returning to
Kunming than among those returning to Chongqing. On the 3rd day, RBC, Hb, Hct, CK, CK-MB, and LDH values were significantly lower than values recorded at high altitudes, but they were higher than baseline values. On the 50th day, these values were not different from baseline values, but LDH levels did not return to baseline until the 100th day. These data show that, subjects who suffered high-altitude de-acclimatization syndrome, the recovery fully processes takes a long time (≥100th days). The appearance of the syndrome is found to be related to the changes in RBC, Hb, Hct, CK, CK-MB, and LDH levels, which should be caused by reoxygenation after hypoxia…Cui et al. demonstrated that 70.76% of individuals, who live at high altitudes for 10–30 years, present a series of clinical symptoms including fatigue, headache, and sleepiness [15]. Our previous study showed that 84.36% of individuals who had lived in Tibet for 10–20 years presented a series of clinical symptoms including fatigue, sleepiness, insomnia, unresponsiveness, memory loss, fidgetiness, headache, throat pain or discomfort, coughing, expectoration, chest tightness, flustering, increased appetite, decreased appetite, constipation, diarrhea, abdominal distention, abdominal pain, lumbago, arthralgia, and some abnormal physiological parameters of the cardiovascular, hematological, and respiratory systems upon returning to lower altitudes [16]. These symptoms were not observed in healthy individuals who had not visited high altitudes. Other studies have shown that several of these symptoms can last many years in some severe cases, and 1% of subjects experienced such severe symptoms that they had to return to high altitudes [17]. We refer to all of the above pathological features as a high-altitude de-acclimatization syndrome…1. Essential diagnostic criteria for high altitude de-acclimatization syndrome (1) Adult≤60 years old. (2) Recent return to lower altitude from a higher altitude. (3) Three or more of the following symptoms: fatigue, sleepiness, insomnia, unresponsiveness, memory loss, fidgety, headache, throat pain or discomfort, coughing, expectoration, chest tightness, flustering, increased appetite, decreased appetite, expectoration, diarrhea, abdominal distention, abdominal pain, lumbago, arthralgia. (4) No significant relief of symptoms after 3 days of simple medication administered after the return to lower altitudes. 2. Auxiliary diagnostic criteria for high altitude de-acclimatization syndrome (1) Blood routine: RBC, Hb, and Hct levels high above baseline. (2) Myocardial enzymes: CK-MB and LDH levels above those of individual's native to low altitudes. (3) Urine: Microalbuminuria above that of individual's native to low altitudes. (4) Heart function: Pulmonary arterial pressure slightly higher than that of individuals native to high altitudes accompanied by left or right ventricular systolic and diastolic dysfunction. Raised Tei index coupled with low values of left ventricular ejection fraction (LVEF), right ventricular ejection fraction (RVEF), left ventricular fractional shortening (LVFS), and right ventricular fractional shortening (RVFS). (5) Brain function: Dysfunction of immediate short-term memory. (6) Hepatic function: Total bilirubin, ALT, and AST levels higher than those of individual's native to low altitudes. Diagnosis of high altitude de-acclimatization included essential conditions and one Auxiliary condition. 3. Exclusion criteria (1) Symptoms directly attributable to primary diseases affecting the cardiovascular, respiratory, nervous, urinary, and hematological systems. (2) Cancer or leukemia. (3) Any history of highland heart disease or high-altitude polycythemia. (4) Recent history of flu, upper respiratory tract infection, infectious diarrhea, or similar symptoms.”

- “Association between Serum Interleukin-17A Level and High-Altitude Deacclimatization Syndrome...High-altitude deacclimatization syndrome (HADAS) is emerging as a severe public health issue that threatens the quality of life of individuals who return to lower altitude from high altitude. In this study, we measured serum levels of SOD, MDA, IL-17A, IL-10, TNF-α,
and HADAS score in HADAS subjects at baseline and 50th and 100th days and to evaluate the relationship between interleukins, including IL-17A, and HADAS. Our data showed that and the serum IL-17A levels and HADAS score decreased over time in the HADAS group, and serum IL-17A levels were significantly higher in the HADAS group at baseline and 50th day compared with controls (). Furthermore, baseline serum levels of MDA and TNF-α were significantly higher, while SOD and IL-10 levels were lower in HADAS subjects compared with controls (). It is interesting that serum levels of IL-17A were clearly interrelated with HADAS incidence and severity (). ROC curve analysis showed that combined serum IL-17A and IL-10 levels were a better predictor of HADAS incidence than serum levels of IL-17A or IL-10 alone. These data suggest that serum levels of IL-17A are a novel predictive index of HADAS.” https://www.hindawi.com/journals/mi/2016/1732352/
Altitude Diseases: Depression

- “I started showing depression symptoms shortly after my very high altitude coworker stated that they were experiencing gender issues.” Steven Magee CEng MIET - Q
- "Is Your Depression Linked to Low DHEA Levels? DHEA Has Potential to Relieve Depression...In my experience, low levels of DHEA are one of many important factors that may contribute to a depressed mood. Yet, routine testing for DHEA levels and DHEA supplementation is not considered a component of traditional medical or psychiatric practice... It is the most abundant hormone in the human body and a precursor to all of our sex hormones: estrogen, progesterone, testosterone, and the stress hormone cortisol." https://www.psychologytoday.com/us/blog/the-breakthrough-depression-solution/201107/is-your-depression-linked-low-dhea-levels
- “How high altitudes could raise risk of depression, suicide...A new systematic review, now published in the Harvard Review of Psychiatry, found that people living in high-altitude areas of the United States, such as intermountain states, have higher-than-average rates of suicide and depression...Major depressive disorder occurs when someone has at least 2 weeks of low mood, self-esteem, and energy across most situations.” https://www.medicalnewstoday.com/articles/321219.php
- "Research shows high altitude increases depression and suicide, especially for women...people who live at higher altitudes can become more depressed than people who live closer to sea level. The effect, they say, is especially noticeable in women...Kanekar has studied the negative effects of altitude for years. Her research has shown that men and women don’t feel the effects of typical antidepressants at higher elevations. Experiments also seem to indicate that women go through a chemical change in their brain when exposed to anything at or above “moderate” elevation, even for a relatively short period of time” https://fox13now.com/2019/04/01/research-shows-high-altitude-increases-depression-and-suicide-especially-for-women/
- “High Altitudes Increase Suicide, Depression Risks: Study...Researchers analyzed 12 studies, including population-based data on the relationship between altitude and suicide or depression. Most studies concluded that areas in higher altitudes had greater risks of suicide and depression...Kious and his colleagues suggest two pathways by which hypobaric hypoxia might increase the risks of suicide and depression: by altering the metabolism of the neurotransmitter serotonin and/or through its effects on brain bioenergetics...possible treatments to alleviate the effects of altitude on depression and suicide risk: supplemental 5-hydroxytryptophan (a serotonin precursor) to increase serotonin levels, or creatine to influence brain bioenergetics.” https://www.newsmax.com/Health/health-news/high-altitudes-depression-suicide/2018/03/12/id/848122/
- “Can Living at Altitude Lead to Depression?...high altitude — despite its risky virtues — can mess with your brain chemistry...Despite being ranked America’s happiest state with ski resorts, stargazing, and mountain trails galore, Utah also has the country’s highest suicide rates. One neuroscientist is calling it the “Utah Paradox” and thinks he has a hunch on why: high altitude — despite its risky virtues — can mess with your brain chemistry. Perry Renshaw’s research was recently featured in a Mic Article and we spoke to the man himself on why sadness might run so rampant at such great heights.” https://www.mensjournal.com/health-fitness/can-living-at-altitude-lead-to-depression-20141204/
Altitude Diseases: Acute Hypoxic Physiological Anxiety (AHPA)

- “High altitudes, anxiety, and panic attacks: Is there a relationship?...People exposed to high altitudes often experience somatic symptoms triggered by hypoxia, such as breathlessness, palpitations, dizziness, headache, and insomnia. Most of the symptoms are identical to those reported in panic attacks or severe anxiety. Potential causal links between adaptation to altitude and anxiety are apparent in all three leading models of panic, namely, hyperventilation (hypoxia leads to hypocapnia), suffocation false alarms (hypoxia counteracted to some extent by hypocapnia), and cognitive misinterpretations (symptoms from hypoxia and hypocapnia interpreted as dangerous). Furthermore, exposure to high altitudes produces respiratory disturbances during sleep in normals similar to those in panic disorder at low altitudes. In spite of these connections and their clinical importance, evidence for precipitation of panic attacks or more gradual increases in anxiety during altitude exposure is meager. We suggest some improvements that could be made in the design of future studies, possible tests of some of the theoretical causal links, and possible treatment applications, such as systematic exposure of panic patients to high altitude.” https://www.ncbi.nlm.nih.gov/pubmed/12219335

- “The Effect of Altitude on Cognitive Performance and Mood States...Observed behaviors and personal anecdotes suggest that the initial mood experienced at altitude is euphoria, followed by depression. With time, individuals may also become quarrelsome, irritable, anxious, and apathetic (Van Liere and Stickney, 1963). Unfortunately, although disturbances in emotional control have been noticed at altitude for decades, there are few quantitative studies assessing mood changes at altitude.” https://www.ncbi.nlm.nih.gov/books/NBK232882/

- “New-Onset Anxiety Disorders at High Altitude...We describe a series of patients with new-onset anxiety disorders at high altitude treated at the Himalayan Rescue Association (HRA) clinic in Pheriche, Nepal (4240 m) in the spring season of 2006...We describe 3 types of anxiety-related disorders: limited-symptom panic attacks induced by nocturnal periodic breathing, excessive health-related anxiety, and excessive emotionality.” https://www.wemjournal.org/article/S1080-6032(07)70261-2/fulltext

- “The relationship between anxiety and acute mountain sickness...Whilst the link between physical factors and risk of high altitude (HA)-related illness and acute mountain sickness (AMS) have been extensively explored, the influence of psychological factors has been less well examined. In this study we aimed to investigate the relationship between ‘anxiety and AMS risk during a progressive ascent to very HA...Trait anxiety at low altitude was an independent predictor of future severe AMS development at HA. State anxiety at HA was independently associated with AMS and its severity.” https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0197147

- “Syndrome of Acute Anxiety Among Marines After Recent Arrival at High Altitude...Management of mental health is critical for maintenance of readiness in austere military environments. Emerging evidence implicates hypoxia as an environmental trigger of anxiety spectrum symptomatology. One thousand thirty-six unacclimatized infantry Marines ascended from sea level to the Marine Corps Mountain Warfare Training Center (2,061–3,383 m) for a 30-day exercise. Within the first 6 days of training, 7 servicemen presented with severe, acute anxiety/panic with typical accompanying signs of sympathetic activation and no classic symptoms of acute mountain sickness (including headache). Four had a history of well-controlled psychiatric diagnoses. Invariably, cardiopulmonary and neurological evaluations
were unrevealing, and acute cardiopulmonary events were excluded within limits of expeditionary diagnostic capabilities. All patients responded clinically to oxygen, rest, and benzodiazepines, returning to baseline function the same day. The unexpected onset of 7 cases of acute anxiety symptomatology coincident with recent arrival at moderate-to-high altitudes represents a highly unusual incidence and temporal distribution, suggestive of hypobaric hypoxemia as the proximal cause. We propose acute hypoxic physiological anxiety (AHPA) as a unique member of the spectrum of altitude-associated neurological disorders. Recognition of AHPA is particularly relevant in a military population; warfighters with anxiety spectrum diagnoses may have a recognizable and possibly preventable vulnerability.”
Altitude Diseases: Suicide

- “While it would have been easier to jump off a cliff, developing the diagnosis and treatment of High Altitude Observatory Disease (HAOD) was a problem that needed to be solved.” Steven Magee CEng MIET - Q
- The Surprising Connection Between Altitude and Suicide...Previous studies have reported a significant association between suicide and altitude. One study showed a strong positive relationship between average state altitude and suicide rate. For example, in Utah, the average geographic altitude is about 6,000 feet and the rate of suicide is 70 percent higher than average...We found that for every increase of 100 meters in altitude, suicide rates increase by 0.4 per 100,000.” https://www.adventure-journal.com/2019/04/the-surprising-connection-between-altitude-and-suicide/
- "How high altitudes could raise risk of depression, suicide...A new systematic review, now published in the Harvard Review of Psychiatry, found that people living in high-altitude areas of the United States, such as intermountain states, have higher-than-average rates of suicide and depression...The review demonstrates that the highest rates of suicide “were clustered in the intermountain states” listed below: Arizona. Colorado. Idaho. Montana. Nevada. New Mexico. Utah. Wyoming. The researchers identified a dramatic increase in suicide rates among communities living at altitudes between 2,000 and 3,000 feet....The team suggests that chronic hypobaric hypoxia could have an adverse effect on the brain or perhaps alter how it processes serotonin, which is a neurotransmitter known to affect mood." https://www.medicalnewstoday.com/articles/321219#Highest-suicide-rates-in-intermountain-states
- "Is altitude causing suicide in the West? Researchers find that high elevations may affect our emotions in both good and bad ways...Western states are among the national leaders in alcohol abuse and depression rates, and rank low for mental health...Renshaw told her that he believes altitude messes with our bodies’ levels of dopamine and serotonin, chemicals that regulate our sense of happiness. Hypoxia, he says, causes serotonin to go down in our brains (which usually results in depression) and dopamine to increase (which usually creates a sense of euphoria, e.g. “runner’s high”)." https://www.hcn.org/articles/is-altitude-causing-suicide-in-the-west
- "Positive Association between Altitude and Suicide in 2584 U.S. Counties...Controlling for percent of age >50 yr, percent male, percent white, median household income, and population density of each county, the higher-altitude counties had significantly higher suicide rates than the lower-altitude counties. Similar findings were observed for both firearm-related suicides (59% of suicides) and nonfirearm-related suicides. We conclude that altitude may be a novel risk factor for suicide in the contiguous United States." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3114154/
- "My Crazy Brother. A personal look at the West's suicidal tendencies...Westerners lead the nation in suicide rates. No other measurement of mental illness distinguishes the West so clearly - not rates of depression and "serious psychological distress," not the shortages of money for treatment...He pulled the trigger in the springtime, the season of suicide..."The Arizona system is not particularly good," says Bob Hess, director of the National Alliance on Mental Illness' Arizona chapter. "But as a nation we're not good - basically everyone stinks together."" https://www.hcn.org/issues/367/17608?b_start:int=0#body
- "The Suicide Crisis. The number of suicides in America is growing, particularly in the West,
but the issue rarely garners attention from most policymakers...the Suicide Belt, a region stretching from Idaho down to Arizona and New Mexico where self-inflicted deaths are more prevalent...About half of suicides nationally are committed with firearms...women about three times more likely than men to attempt suicide." [https://www.governing.com/topics/health-human-services/gov-suicide-deaths-spike-in-rural-western-states.html#data]

- "There's a Suicide Epidemic in Utah — And One Neuroscientist Thinks He Knows Why...Utah has disproportionately high rates of suicide and associated mood disorders compared to the rest of the country. In fact, it's the No. 1 state for antidepressant use...Renshaw thinks he's identified a more likely cause for the Utah blues: altitude...For people who don't have any serotonin — perhaps because hypoxia decreased their already-low supply — SSRIs are probably no more effective than prescription-plan tic tacs." [https://www.mic.com/articles/104096/there-s-a-suicide-epidemic-in-utah-and-one-neuroscientist-thinks-he-knows-why]

- "The curious relationship between altitude and suicide...Suicide is one of the top 10 causes of death in the U.S. In the next 20 years, it's expected to cause more than 2 million deaths per year worldwide, ranking 14th in the world as a cause of death...One reasonable explanation could be the effects of hypoxia, or a deficiency in the amount of oxygen reaching the tissues. This can influence the body’s metabolism of serotonin, one of the neurotransmitters related to aggressive behavior and suicide. Several studies suggest that chronic hypoxia increases mood disturbances, especially in patients with emotional instability." [http://theconversation.com/the-curious-relationship-between-altitude-and-suicide-85716]

- "Is Suicide Linked to Living at High Altitude?...A research review discovers high-altitude areas have increased rates of suicide and depression. In the United States, intermountain states were found to have the highest suicide rate with investigators positing that blood oxygen levels due to low atmospheric pressure may play a factor...The highest suicide rates were clustered in the intermountain states: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming. (Alaska and Virginia also had high suicide rates.)" [https://psychcentral.com/news/2018/03/12/is-suicide-linked-to-living-at-high-altitude/133637.html]
Altitude Diseases: Failure To Acclimatize

- “What is the maximum altitude where humans can survive?...Between 62,000 and 63,500 feet (18,900 and 19,350 meters) blood begins to boil at body temperature. This altitude, referred to as the Armstrong limit, is generally considered to be the absolute limit compatible with life. At this point, humans cannot survive without pressurization measures.” https://biology.stackexchange.com/questions/42436/what-is-the-maximum-altitude-where-humans-can-survive
- “Effects of high altitude on humans...There is a limit to the level of adaptation; mountaineers refer to the altitudes above 8,000 metres (26,000 ft) as the death zone, where it is generally believed that no human body can acclimatize.” https://en.wikipedia.org/wiki/Effects_of_high_altitude_on_humans#Acclimatization_to_altitude
- “People don’t permanently live above 16,500 feet because the body does not adapt well...Some altitude researchers believe that there is long standing brain damage that occurs after staying above 16,500 feet for extended periods of time...some of those who went highest 50 years ago are now quite limited in altitude tolerance while others have limited exercise capacity.” Altitude Illness: Prevention & Treatment.
- “What is the highest altitude a human can survive? Altitude of Human Survivability, Maximum (Vertical Limit) Heights higher than 8000 meters are inhospitable for sustained human life. Research indicates that humans cannot live permanently above an elevation of 5500 meters (18,000 feet) without suffering a gradual physiological deterioration that eventually leads to death...Monique Anthony -- 2005” https://hypertextbook.com/facts/2005/MoniqueAnthony.shtml
- “The Limits Of The Human Body...High Altitude. Consciousness fades for most people at 15,000 feet. Although, highland dwellers that have adapted to high altitudes have larger lungs and more red blood cells which allows them to survive higher elevations.” https://blog.gunassociation.org/limits-human-body/
- “What Are the Limits of Human Survival?...We pass out when the pressure drops below 57 percent of atmospheric pressure — equivalent to that at an altitude of 15,000 feet (4,572 meters). Climbers can push higher because they gradually acclimate their bodies to the drop in oxygen, but no one survives long without an oxygen tank above 26,000 feet (7925 m).” https://www.yahoo.com/news/limits-human-survival-132143810.html
- “After a decade in high altitude professional astronomy (up to 13,797 feet) and daily mal-acclimatization, professional astronomy worker Steven Magee cannot acclimatize to any altitude.” Steven Magee CEng MIET - Q
Altitude Diseases: Long-Term Intermittent Work at High Altitude

- “Long-Term Intermittent Work at High Altitude: Right Heart Functional and Morphological Status and Associated Cardiometabolic Factors...Background: Living at high altitude or with chronic hypoxia implies functional and morphological changes in the right ventricle and pulmonary vasculature with a 10% prevalence of high-altitude pulmonary hypertension (HAPH). The implications of working intermittently (day shifts) at high altitude (hypobaric hypoxia) over the long term are still not well-defined. The aim of this study was to evaluate the right cardiac circuit status along with potentially contributory metabolic variables and distinctive responses after long exposure to the latter condition. Methods: A cross-sectional study of 120 healthy miners working at an altitude of 4,400–4,800 m for over 5 years in 7-day commuting shifts was designed. Echocardiography was performed on day 2 at sea level. Additionally, biomedical and biochemical variables, Lake Louise scores (LLSs), sleep disturbances and physiological variables were measured at altitude and at sea level. Results: The population was 41.8 ± 0.7 years old, with an average of 14 ± 0.5 (range 5–29) years spent at altitude. Most subjects still suffered from mild to moderate symptoms of acute mountain sickness (mild was an LLS of 3–5 points, including cephalgia; moderate was LLS of 6–10 points) (38.3%) at the end of day 1 of the shift. Echocardiography showed a 23% mean pulmonary artery pressure (mPAP) >25 mmHg, 9% HAPH (≥30 mmHg), 85% mild increase in right ventricle wall thickness (≥5 mm), 64% mild right ventricle dilation, low pulmonary vascular resistance (PVR) and fairly good ventricle performance. Asymmetric dimethylarginine (ADMA) (OR 8.84 (1.18–66.39); p < 0.05) and insulin (OR: 1.11 (1.02–1.20); p < 0.05) were associated with elevated mPAP and were defined as a cut-off. Interestingly, the correspondence analysis identified association patterns of several other variables (metabolic, labor, and biomedical) with higher mPAP. Conclusions: Working intermittently at high altitude involves a distinctive pattern. The most relevant and novel characteristics are a greater prevalence of elevated mPAP and HAPH than previously reported at chronic intermittent hypobaric hypoxia (CIHH), which is accompanied by subsequent morphological characteristics. These findings are associated with cardiometabolic factors (insulin and ADMA). However, the functional repercussions seem to be minor or negligible. This research contributes to our understanding and surveillance of this unique model of chronic intermittent high-altitude exposure.”

Altitude Diseases: Magee’s Delayed Altitude Complications

- “I am aware of at least 5 professional astronomy workers that suffered health crashes approximately 14 years after starting work at the 13,797 feet very high altitude summit of Mauna Kea. It killed two of them through fatal heart disease and cancer, one almost died from a stroke, and two relatively young workers developed tumors with one being cancerous requiring chemotherapy and radiation treatment. The fifth went on to develop mental illness and chronic fatigue. I call this process ‘Magee’s Delayed Altitude Complications’.” Steven Magee CEng MIET – Q

- “The initial signs of Magee’s Delayed Altitude Complications was a strange sickness that turned into a panic disorder followed a few years later with fatigue, confusion and forgetfulness.” Steven Magee CEng MIET – Q

- “Delayed complications from adverse environmental exposures is well known to the medical profession. It is documented for radiation, explosions, heavy metals, poisoning, electric shocks, head injuries, drugs, and we now appear to be adding high altitudes to the list.” Steven Magee CEng MIET – Q

- “This is the list of delayed altitude complications that Steven Magee experienced during and after working in professional astronomy:
  - Working in La Palma, Canary Islands, Spain, at Roque de los Muchachos Observatory 2,396 m (7,861 ft):
    - 1999- Year 1: Infertility.
  - Working in Hawaii, USA, at Mauna Kea Observatories (MKO) 4,205 m (13,796 ft):
    - 2001 - Year 3: Had nasty fall at very high altitude observatory onto metal grating, injuring both knees and foot, attended hospital emergency department. ‘Summit Brain’ daily when atop Mauna Kea and using medical oxygen and company supplied drugs to treat Acute Mountain Sickness (AMS) and High Altitude Cerebral Edema (HACE).
    - 2006 - Year 8: Had rare tumor removed from right knee. Showing extensive forgetfulness and confusion. Handling money was a problem.
  - Harassed out of position by management team. Now working in Tucson, Arizona, USA at Kitt Peak National Observatory 2,096 m (6,877 ft) and being exposed to powerful sonic booms from military aircraft, large amounts of lightning from storms, nitrogen gas, mercury,
showing chemicals, and electromagnetic fields from the electrical room that I was sitting next to.


- Now working with industrial and utility solar power systems.

- 2009 - Year 11: Started falling asleep at work, diagnosed as shift work disorder and put on prescription medications. Fired by two companies.

- 2010 - Year 12: Self treated radiation sickness (Hot skin, aches & pains throughout body) by hibernating for six months while unemployed.

- 2011 - Year 13: Developed heart arrhythmia’s, low vitamin D and low B12 diagnosed. Fired by last employer that I worked for.

- 2012 - Year 14: Sleeping during daytime due to chronic fatigue. Unemployed.


- 2014 - Year 16: Blood clot flushing with aspirin and alka-seltza cleared up the Electromagnetic Hypersensitivity (EHS). Self employed EMF consultant – noticing further degrading of memory function and chronic headaches that are affecting running the business.

- 2015 - Year 17: Complete collapse of mental health, applied for disability.

- 2016 - Year 18: Complete collapse of physical health. Chronically fatigued, falling asleep while driving, diagnosed with sleep apnea and placed onto CPAP machine.

- 2017 - Year 19: Sleep studies diagnose excessive daytime sleepiness and hypersomnia. CT X-Ray scan clears up the headaches. Awarded UK pension for ill health and blatantly denied USA disability benefits.

- 2018 - Year 20: Treated B12 & Vitamin D deficiencies by moving them into the high range with supplements. Supplementing with a wide variety of supplements. Discovered food intolerance’s and changed diet.

- 2019 - Year 21: Treatments for mercury poisoning (ALA), radiation sickness (DHEA) and high altitude induced depression (Creatine & 5HTP) were yielding positive results. Chronic fatigue changes from continuous to intermittent. Discovered that Multiple Chemical Sensitivity (MCS) to carbon dioxide was present and started maintaining the indoor environment to below 1,000 PPM. Bruxism discovered and started wearing a mouth guard and chin strap during sleep. Workers compensation for occupational disease was denied by Columbia University, Dartmouth College, and the W. M. Keck Observatory.

- 2020 - Year 22: Investigating treatments for "Mauna-Pause" (Mauna means mountain in Hawaii), which is endocrine disease environmentally induced into high altitude workers. Diagnosed with Nocturnal Angina and prescribed nitroglycerine. It had emerged through years of vitamin experimentation and blood tests that production of vitamin D is almost completely suppressed.
none existent, B12 production is low and hormones are low. Amnesiac disorders, absence seizures, cognitive decline and chronic fatigue is continuing. On a variety of prescription medications. Mental functioning severely degraded and a sleep study diagnosed positional sleep apnea. Now sleeping with an anti-back sleeping device. Prescribed BiPAP treatment for sleep apnea. Testing with the BiPAP machine showed that I was intolerant to inhalation pressures above 9 cmH2O. Testing with a 10,000 lux therapy light showed that Bright Light Adaptation Disease (BLAD) was present and it restored the daytime circadian rhythm to natural sunrise awakening. Treating a suspected ultraviolet radiation induced folate deficiency with a high dose folate supplement. Testing with red and infrared therapy light was showing improvements in the nighttime circadian rhythm. Nighttime infrared video recording of sleeping revealed a Sleep Movement Disorder was occurring every 20 minutes during the night and Pramipexole was prescribed to treat it.
Altitude Diseases: Aging

- “High altitude 'speeds up ageing'...Women who live at high altitudes are likely to age faster, research suggests. Scientists drew their conclusions after finding lower concentrations of hormones, which are important for maintaining health and youthfulness, in women living in the mountainous areas of Peru...They found concentrations of the hormones DHEA and DHEAS (dehydroepiandrosterone and dehydroepiandrosterone sulphate) rose more slowly during puberty in women living at high altitudes....They found DHEA levels in mountain-living women aged between 60 and 70 were only at about 40% of the levels found in the control group...It's known that women living at high altitude are more susceptible to disease, and tend to die earlier….when DHEA was fed to mice it increased their life expectancy by a third. The treated mice seemed younger and had a lower incidence of the typical diseases of ageing, including diabetes and cardiovascular complications. The hormone has also been shown to have a role in countering obesity and cancer...If you give synthetic DHEA to people who are deficient, their energy levels improve, their bones get a little thicker and their libido sometimes improves.” [http://news.bbc.co.uk/2/hi/health/1940046.stm]

- “Living at altitude: Exploring the effects on mountain town residents...people with existing respiratory conditions, such as chronic obstructive pulmonary disease, have a lower life expectancy at high elevations. The study concluded that the opposing effects on different populations probably offset each other, leaving no real tangible net effect on life expectancy overall. There also are health impacts specific to older adults as their bodies change and become less malleable over time. “We know there are significant issues affecting seniors that have to do with their cardiovascular system and lungs,” Honigman said. “We know that the lungs get less elastic, so they’re not as efficient, as we get older. That’s especially true for those individuals who are prone to lung diseases like emphysema or chronic bronchitis. The added inelasticity in the lung to compensate with these things makes it much more difficult to breathe.” Honigman said the work done by Dr. Warren Johnson, a cardiologist who pioneered research into the health of people who migrate to Summit County from lower elevations, showed that some seniors struggle to live at high altitude because of genetic predispositions. “There’s this subset of people with pulmonary hypertension, which is high blood pressure of blood vessels in the lungs,” Honigman said. “That causes lower oxygen levels, which leads to decreased exercise performance and fatigue. It makes people very upset; they spend millions of dollars on a house in Summit and then have to either leave or have to be put on oxygen.” Honigman said high pulmonary blood pressure can be eased with prescription drugs, specifically vasodilators that widen blood vessels and decrease pressure.” [https://www.vaildaily.com/news/colorado/living-at-altitude-exploring-the-effects-on-mountain-town-residents/]

- “Sea level adapted humans that are routinely exposed to high altitudes do not age well.” Steven Magee CEng MIET – Q

- “Even after a stroke disabled him, Mr Nelson started each day at the University of California, Santa Cruz, where he taught astronomy, with the night logs from Keck, checking for the unexpected.” [https://www.economist.com/news/obituary/21724363-astronomer-and-telescope-designer-was-73-obituary-jerry-nelson-died-june-10th]

- “Very High Altitude Mauna Kea Worker Steven Magee: Insomnia, Ideopathic Hypersomnia, Excessive Daytime Sleepiness, Amnestic Disorder, Seizures, Obstructive Sleep Apnea, Small
Airways Disease of the lungs, Hole in the heart, Heart Arrhythmia's, Erratic Low Blood Oxygen, High Cholesterol, Vitamin B12 Deficiency, Vitamin D Deficiency, Radiation Sickness Disorders, Electromagnetic Hyper-Sensitivity (EHS), Multiple Chemical Sensitivity (MCS), Mauna-Pause (Hormone Dysfunction), Bright Light Adaptation Disease (BLAD).” Steven Magee CEng MIET

- “Observed health conditions in various high altitude workers were not limited to: Digestive Disorders, Heart Issues, Chronic Headaches, Strokes, Fatigue, Sleepiness, Sleep Disorders, Amnestic Disorders, Irritability, Aggressive Behaviors, Confusion, Various Mental Health Issues, Radiation Sickness including Faraday Cage Sickness, Benign Tumors and Cancers that included Throat, Lymphoma, Prostrate, Breast and Colon cancer.” Steven Magee CEng MIET - Q

- “The top three symptoms that I observed in high altitude workers were: 1. Forgetfulness & Confusion; 2. Irritability; 3. Fatigue & Apathy.” Steven Magee CEng MIET - Q

- “The sickest high altitude workers that I encountered were at Kitt Peak National Observatory in Arizona, USA.” Steven Magee CEng MIET - Q

- “US Flight Crew Have Higher Cancer Rates Than General Population...Our study informs future research priorities regarding the health of this understudied group of workers, who have a wide range of job-related exposures to known and probable carcinogens including cosmic ionizing radiation, circadian rhythm disruption, and possible chemical contaminants in the aircraft cabin.” https://www.eurasiareview.com/26062018-us-flight-crew-have-higher-cancer-rates-than-general-population/

- “The estimated incidence of melanoma was found to be significantly increased among airline pilots...The 1,066 cancer cases reported among male pilots included prostate (76), colon (20), lymphoma (13), bladder (12), leukemia (9), testes (8), kidney (7), thyroid (7), lung (7), vocal chords (6), central nervous system (5), throat (3), sarcoma (3), squamous cell (3), rectum (2), mouth (2), and one reported case in each of the following categories: breast, vallecula, esophagus, urethra, eyelid, pancreas, armpit, nose, myeloma, cheek, and stomach...Non-cancer disease cases that male pilots reported are motor neuron disease (21), cataracts (261), diabetes (78), heart disease (260), high blood pressure (713), high cholesterol (1,725), liver disease (45), and meningitis (31).” https://public.alpa.org/portals/alpa/magazine/2001/March2001_HealthAmongPilots.htm

- “Both believed they had been poisoned by the toxic oil fumes that can contaminate cabin air and which regularly forces pilots to don oxygen masks in order to breathe...They say they are on the cusp of proving in a court of law the existence of “aerotoxic syndrome”, a chronic physical and neurological condition they predict will one day be seen as “the new asbestos”. Thousands of pilots are currently “unfit to fly”, one specialist doctor believes.” http://www.express.co.uk/news/uk/373594/Dead-BA-pilots-victims-of-toxic-cabin-fumes
Altitude Diseases: Adaptation

- “Cardiovascular Adaptation to High-Altitude Hypoxia...High-altitude exposure has been well recognized as a hypoxia exposure that significantly affects cardiovascular function. However, the pathophysiologic adaptation of cardiovascular system to high-altitude hypoxia (HAH) varies remarkably. It may depend on the exposed time and oxygen partial pressure in the altitude place. In short-term HAH, cardiovascular adaptation is mainly characterized by functional alteration, including cardiac functional adjustments, pulmonary vascular constriction, transient pulmonary hypertension, and changes in cerebral blood flow (CBF). These changes may be explained mainly by ventilatory acclimatization and variation of autonomic nervous activity. In long-term HAH, cardiovascular adaptation is mainly characterized by both functional and structural alterations. These changes include right ventricle (RV) hypertrophy, persistent pulmonary hypertension, lower CBF and reduced uteroplacental and fetal volumetric blood flows.” [https://www.intechopen.com/books/hypoxia-and-human-diseases/cardiovascular-adaptation-to-high-altitude-hypoxia](https://www.intechopen.com/books/hypoxia-and-human-diseases/cardiovascular-adaptation-to-high-altitude-hypoxia)
Altitude Diseases: Death

- "Effects of Living at Higher Altitudes on Mortality: A Narrative Review...Beside genetic and life-style characteristics environmental factors may profoundly influence mortality and life expectancy. The high altitude climate comprises a set of conditions bearing the potential of modifying morbidity and mortality of approximately 400 million people who are permanently residing at elevations above 1500 meters. However, epidemiological data on the effects of high altitude living on mortality from major diseases are inconsistent probably due to differences in ethnicity, behavioral factors and the complex interactions with environmental conditions. The available data indicate that residency at higher altitudes are associated with lower mortality from cardiovascular diseases, stroke and certain types of cancer. In contrast mortality from COPD and probably also from lower respiratory tract infections is rather elevated. It may be argued that moderate altitudes are more protective than high or even very high altitudes. Whereas living at higher elevations may frequently protect from development of diseases, it could adversely affect mortality when diseases progress. Corroborating and expanding these findings would be helpful for optimization of medical care and disease management in the aging residents of higher altitudes.”
- "Has there ever been a study on whether living at a high altitude long term has any effect on our health?...I know in China they compensate soldiers more for being stationed in Tibet (starting at 4000-5000m) because studies have shown lower lifespans resulting from such stations.”
  https://www.quora.com/Has-there-ever-been-a-study-on-whether-living-at-a-high-altitude-long-term-has-any-effect-on-our-health
- "Long term astronomical observatory worker #1: Fatal Heart Disease.” Steven Magee CEng MIET
- "Long term astronomical observatory worker #2: Fatal Heart Attack.” Steven Magee CEng MIET
- "Long term astronomical observatory worker #3: Fatal Colon Cancer.” Steven Magee CEng MIET
- "Long term astronomical observatory worker #4: Fatal Throat Cancer.” Steven Magee CEng MIET
- "Long term astronomical observatory worker #5: Suicide.” Steven Magee CEng MIET
- “Pilot's Die Sooner Than Others...The ALPA data also indicate death rates at younger ages, with an average age at death of 67, compared to 70 for the general population. The study reports that 69 percent of pilot deaths in the ALPA data occurred in the first nine years after retirement.”
  https://www.linkedin.com/pulse/20141206175102-4404516-pilot-s-die-sooner-than-others/
- “Retired Pilots Die Earlier Than Most, Study Says : Workplace: A global survey of fliers will look at why longevity figures for the pilots seem to be worse than for the rest of the population...60% of them would not be around when they were 65 years old.”
- “Mortality from Cancer and Other Causes among Airline Cabin Attendants in Europe: A Collaborative Cohort Study in Eight Countries...There is concern about the health effects of exposure to cosmic radiation during air travel. To study the potential health effects of this and occupational exposures, the authors investigated mortality patterns among more than 44,000
airline cabin crew members in Europe. A cohort study was performed in eight European countries, yielding approximately 655,000 person-years of follow-up. Observed numbers of deaths were compared with expected numbers based on national mortality rates. Among female cabin crew, overall mortality (standardized mortality ratio (SMR) = 0.80, 95% confidence interval (CI): 0.73, 0.88) and all-cancer mortality (SMR = 0.78, 95% CI: 0.66, 0.95) were slightly reduced, while breast cancer mortality was slightly but nonsignificantly increased (SMR = 1.11, 95% CI: 0.82, 1.48). In contrast, overall mortality (SMR = 1.09, 95% CI: 1.00, 1.18) and mortality from skin cancer (for malignant melanoma, SMR = 1.93, 95% CI: 0.70, 4.44) among male cabin crew were somewhat increased. The authors noted excess mortality from aircraft accidents and from acquired immunodeficiency syndrome in males. Among airline cabin crew in Europe, there was no increase in mortality that could be attributed to cosmic radiation or other occupational exposures to any substantial extent. The risk of skin cancer among male crew members requires further attention.”

“HOW MANY PEOPLE DIE ON AIRPLANES?..."During the 12 months we were looking at for that Lancet article," Donaldson said, "I think there were something like 340 or 360 deaths due to public transport aircraft accidents. Whereas by our estimation there'd certainly be more than 500 people die on public transport aircraft every year, far and away the majority of which are cardiac."”

“3 people have died at the ORM (Roque de los Muchachos Observatory. Spanish: Observatorio del Roque de los Muchachos, ORM). One (a Finn) driving off the road and falling into a ravine, one a German who didn't take safety precautions when working on one of the 'Magic' cosmic ray telescopes and fell off a platform in the dark. Finally an Irish astronomer who I knew well dying of a burst stomach ulcer which haemorrhaged. That was a known condition he had and was advised not to come to LP (La Palma), but he did so all the same.” Ellis John Mills

“Roque de los Muchachos Observatory (Spanish: Observatorio del Roque de los Muchachos, ORM) is an astronomical observatory located in the municipality of Garafía on the island of La Palma in the Canary Islands. The observatory site is operated by the Instituto de Astrofísica de Canarias, based on nearby Tenerife. ORM is part of the European Northern Observatory. The seeing statistics at ORM make it the second-best location for optical and infrared astronomy in the Northern Hemisphere, after Mauna Kea Observatory, Hawaii. The site also has some of the most extensive astronomical facilities in the Northern Hemisphere; its fleet of telescopes includes the 10.4 m Gran Telescopio Canarias, the world's largest single-aperture optical telescope as of July 2009,[1] the William Herschel Telescope (second largest in Europe), and the adaptive optics corrected Swedish 1-m Solar Telescope. The observatory was established in 1985, after 15 years of international work and cooperation of several countries with the Spanish island hosting many telescopes from Britain, The Netherlands, Spain, and other countries. The island provided better seeing conditions for the telescopes that had been moved to Herstmonceux by the Royal Greenwich Observatory, including the 98 inch aperture Isaac Newton Telescope (the largest reflector in Europe at that time). When it was moved to the island it was upgraded to a 100-inch (2.54 meter), and many even larger telescopes from various nations would be hosted there.”

“There is a lot of difference between working on LP (at 8000ft) and Mauna Kea (13,800ft)? I can well believe at that altitude the lack of oxygen is a big problem. We all all have different

436
metabolisms and probably many people find it difficult to work or go up to high altitude...there is a lot of difference between LP (at 8000ft) and Mauna Kea (at 13,800ft). I'd probably pass out due to lack of oxygen at that altitude” Ellis John Mills

- “Effects of high altitude on humans...Mountain medicine recognizes three altitude regions that reflect the lowered amount of oxygen in the atmosphere: High altitude = 1,500–3,500 metres (4,900–11,500 ft). Very high altitude = 3,500–5,500 metres (11,500–18,000 ft). Extreme altitude = above 5,500 metres (18,000 ft). Travel to each of these altitude regions can lead to medical problems, from the mild symptoms of acute mountain sickness to the potentially fatal high-altitude pulmonary edema (HAPE) and high-altitude cerebral edema (HACE). The higher the altitude, the greater the risk. Research also indicates elevated risk of permanent brain damage in people climbing to extreme altitudes. Expedition doctors commonly stock a supply of dexamethasone, or "dex," to treat these conditions on site. Humans have survived for two years at 5,950 m (19,520 ft, 475 millibars of atmospheric pressure), which is the highest recorded permanently tolerable altitude; the highest permanent settlement known, La Rinconada, is at 5,100 m (16,700 ft).[13] At extreme altitudes, above 7,500 m (24,600 ft, 383 millibars of atmospheric pressure), sleeping becomes very difficult, digesting food is near-impossible, and the risk of HAPE or HACE increases greatly.”

- “List of Mount Everest death statistics...One of the people claimed by Everest mountaineering was the U.S. astronaut Karl Gordon Henize. He was on a mission to study radiation but came down with a fatal case of HAPE in October 1993 and died at north base camp. At the time he was the oldest astronaut to have flown in space and also had a doctorate in astronomy.”

- “List of people who died climbing Mount Everest...Most deaths have been attributed to avalanches, injury from fall, serac collapse, exposure, frostbite, or health problems related to conditions on the mountain...Many deaths in high-altitude mountaineering have been caused by the effects of the death zone, either directly (loss of vital functions) or indirectly (unwise decisions made under stress or physical weakening leading to accidents). In the death zone, the human body cannot acclimatize, as it uses oxygen faster than it can be replenished. An extended stay in the zone without supplementary oxygen will result in deterioration of bodily functions, loss of consciousness and, ultimately, death.”

- “List of deaths on eight-thousanders...The eight-thousanders are the 14 mountains that rise more than 8,000 metres (26,247 ft) above sea level; they are all in the Himalayan and Karakoram mountain ranges.”

- “HAPE: The Number One Cause of Death at High Altitude...Ascending to high altitudes is common amongst outdoor enthusiasts. Too rapid of an ascent or inability to acclimate to higher altitudes leads to illnesses. The three most common of which are acute mountain sickness (AMS), high altitude cerebral edema (HACE) and high altitude pulmonary edema (HAPE). Of the three, HAPE is the most common cause of death related to high altitude.”

- “High-Altitude Illness Death Investigation...High altitude illness (HAI) is the current accepted clinical term for a group of disorders including acute mountain sickness (AMS), high-altitude cerebral edema (HACE), and high-altitude pulmonary edema (HAPE), which occur in travelers visiting high-altitude locations. High-altitude illness is due to hypobaric hypoxia, is not associated with age or physical conditioning, and mild forms are easily treated. High-altitude
cerebral edema and HAPE are medical emergencies that are fatal if not promptly treated and fortunately are uncommon. The cause of most high-altitude fatalities is not related to HAI and can be easily distinguished from HACE and HAPE; however, other causes of death may have symptoms and physical findings that overlap with HAI, making postmortem diagnosis challenging. Fatalities due to HAPE and HACE are diagnoses of exclusion. Medical examiners and coroners who work in jurisdictions with high-altitude locations should be aware of the risk factors, physiology, pathology, differential diagnosis, and classification of HAI to accurately recognize HAI as a cause of death. Medical examiners who do not work in jurisdictions with high-altitude locations may be asked to evaluate deaths that occur overseas associated with high-altitude trekking and mountaineering activities.”


- “Why altitude sickness kills people...Altitude sickness is one of the great dangers of climbing — and the most erratic. Its effects can range from a slight headache to losing the power of speech to slipping into a coma while you sleep...The headache is the result of brain swelling. In an attempt to get more oxygen to brain cells, the blood vessels dilate, swelling up. The capillaries in the lungs also develop problems, specifically leaking fluid into the lungs. As the sickness gets worse, more of the vascular system is taken out. Blood clots start forming inside the blood vessels. Tissues start hemorrhaging. Generally, though, it's the fluid in the brain or the fluid in the lungs that kills people.”


- “Can altitude sickness cause death?...People with pre-existing heart or lung problems are more prone to experience a serious form of altitude sickness than healthy people. Another risk factor for a potentially fatal case of altitude sickness is ascending to high altitudes too quickly. If you have symptoms of acute mountain sickness at lower altitudes, you have to wait until your body adjusts before continuing to ascend.”


- “Anoxæmic Changes in the Liver, with regard to the 'High-Altitude Death' of Airmen...IN recent papers Büchner1 and his disciples Pichotka2, Müller and Rotter3, as well as Hesse4, have described peculiar histological findings in livers of airmen who died under the effect of atmospheric conditions at a high altitude. The pictures under consideration consist in the formation of big, round or polyhedric vacuoles in liver cells nearest the acinus centres; these vacuoles do not contain either fat or glycogen; they appear as optically empty spaces, including here and there a crescent-like hem of slightly acidophil, homogeneous material, probably serous liquid.”

https://www.nature.com/articles/151558a0

- “Living at high altitude and risk of sudden infant death syndrome...This study identified altitude of residence as a significant risk predictor of SIDS, primarily in combination with the prone sleeping position. Respiratory disturbances, reduced oxygen saturation, and lower temperatures at high altitude might explain this association.”

https://adc.bmj.com/content/79/6/506

- “When Should I Worry About Altitude Sickness? I just read about how two climbers died on Aconcagua from altitude sickness. I have plans to go to Everest Base Camp this year. Altitude sickness isn’t a concern there, is it?...Yes it is a concern...about 20 percent of people who ascend above 8,000 feet will suffer from some form of altitude sickness, and 40 percent of those who go to 10,000 feet will. In the Himalaya, altitude sickness is the leading cause of death among climbers. Even sherpas fall victim to its fatal effects.”

https://www.outsideonline.com/1783446/when-should-i-worry-about-altitude-sickness
“Emphysema Mortality is Increased in Colorado Residents at High Altitude...Emphysema mortality is higher in Colorado than in the nation as a whole despite the younger age of Colorado's population. Colorado death records from 1959 to 1976 were examined to determine if emphysema mortality increases with altitude within the state and if altitude adversely affects survival from chronic lung disease. Because the proportion of persons older than 65 yr of age in Colorado decreases with altitude (r = −0.6, p < 0.01), emphysema mortality was age-standardized. The age-standardized rate increases with altitude among males (r = 0.9, p < 0.01; y = 0.003(x) + 42.1). Emphysema deaths at higher altitudes in Colorado (≥ 7,000 ft) occur at a younger age (68.1 ± 0.6 yr (mean ± SEM) versus 70.1 ± 0.6 yr at lower altitudes), after a shorter duration of illness, and more commonly from cor pulmonale than at lower altitudes (≤ 4,500 ft) where pneumonia is more common as the immediate cause of death. The mechanism by which high altitude residence interacts unfavorably with survival is not known but may stem from augmented pulmonary hypertension caused by the hypoxia of lung disease added to the hypoxia of high altitude.”

“Death at High Altitude in the Hypobaric Chamber...A small number of accidental and suicidal deaths have occurred in the hypobaric, or high altitude, chamber. A case of an unusual suicide in a hypobaric chamber is presented. The changes that resulted from decompression and hypoxia are discussed.”

“The Paradox of Doping in Mountain Climbing. In alpinism, supplemental oxygen is a matter of safety—but some say it’s doping...The only problem is that, for most, climbing without supplemental O2 dramatically increases the risk of death...While its causes are not fully understood, cerebral swelling, vasodilation, and alteration of the blood-brain barrier may all be involved. Effects of AMS can be felt as low as 8,000 feet. Untreated, the symptoms of AMS will progress, ultimately resulting in conditions like high altitude pulmonary edema, in which fluid accumulates in the lungs, or high altitude cerebral edema, in which the brain swells and pushes against the skull, causing a loss of coordination, coma, and eventually death.”

"Father of 2 sues Los Angeles hospital after wife dies during childbirth...She could fly planes and skydive and seemed invincible to her family, which is why her death is so much harder to understand. In the wake of it, her husband began research into maternal mortality and says the U.S. is in the midst of a “crisis.” Approximately 700 women in the U.S. die in childbirth every year. It is the only developed country with a rising death rate for pregnant or new mothers. For black women, like Kira Johnson, the risk of death is even higher. Globally, more mothers die in childbirth in America than in Iran, Turkey or Kazakhstan."
Altitude Diseases: Bovine High-Mountain Disease (BHMD)

- “Overview of Bovine High-Mountain Disease...Bovine high-mountain disease (BHMD) is characterized by a noncontagious swelling of edematous fluid in the ventral parasternal muscles (brisket region), the ventral aspect of the body including the abdomen, and the submandibular region in cattle raised in high-altitude regions (>5,000 ft [1,524 m]) in the western USA most commonly and substantially affecting Colorado, Wyoming, New Mexico, and Utah. It also affects cattle in mountainous ranges of the world, most commonly at elevations >6,500 ft (1,981 m) in western Canada and South America. BHMD affects cattle of all ages and breeds, but not necessarily equally.” [https://www.merckvetmanual.com/circulatory-system/bovine-high-mountain-disease/overview-of-bovine-high-mountain-disease](https://www.merckvetmanual.com/circulatory-system/bovine-high-mountain-disease/overview-of-bovine-high-mountain-disease)

- "Getting to the Heart of Brisket Disease...bovine pulmonary hypertension (BPH), also known as high-mountain disease or brisket disease...At high elevations, low oxygen levels lead to hypoxia and constriction of the pulmonary artery, resulting in high PAP. High PAP ultimately leads to right-sided congestive heart failure, clinical “brisket disease” and death, unless affected cattle are quickly moved to lower elevations. Cattle have small lung capacity relative to their body mass, making them more susceptible to this condition than most other mammals. Researchers suspect that high growth rate and heavy finished weights can lead to a similar disease process in genetically susceptible feedyard cattle at lower elevations." [https://www.drovers.com/article/getting-heart-brisket-disease](https://www.drovers.com/article/getting-heart-brisket-disease)

- "High-altitude pulmonary hypertension in cattle (brisket disease): Candidate genes and gene expression profiling of peripheral blood mononuclear cells...High-altitude pulmonary hypertension (HAPH) is a consequence of chronic alveolar hypoxia, leading to hypoxic vasoconstriction and remodeling of the pulmonary circulation. Brisket disease in cattle is a naturally occurring animal model of hypoxic pulmonary hypertension. Genetically susceptible cattle develop severe pulmonary hypertension and right heart failure at altitudes >7,000 ft. No information currently exists regarding the identity of the pathways and gene(s) responsible for HAPH or influencing severity. We hypothesized that initial insights into the pathogenesis of the disease could be discovered by a strategy of (1) sequencing of functional candidates revealed by single nucleotide polymorphism (SNP) analysis and (2) gene expression profiling of affected cattle compared with altitude-matched normal controls, with gene set enrichment analysis (GSEA) and Ingenuity pathway analysis (IPA). We isolated blood from a single herd of Black Angus cattle of both genders, aged 12-18 months, by jugular vein puncture. Mean pulmonary arterial pressures were 85.6±13 mmHg STD in the 10 affected and 35.3±1.2 mmHg STD in the 10 resistant cattle, P<0.001. From peripheral blood mononuclear cells, DNA was hybridized to an Affymetrix 10K Gene Chip SNP, and RNA was used to probe an Affymetrix Bovine genome array. SNP loci were remapped using the Btau 4.0 bovine genome assembly. mRNA data was analyzed by the Partek software package to identify sets of genes with an expression that was statistically different between the two groups. GSEA and IPA were conducted on the refined expression data to identify key cellular pathways and to generate networks and conduct functional analyses of the pathways and networks. Ten SNPs were identified by allelic association and four candidate genes were sequenced in the cohort. Neither endothelial nitric oxide synthetase, NADH dehydrogenase, TG-interacting factor-2 nor BMPR2 were different among affected and resistant cattle. A 60-gene mRNA signature was identified that differentiated affected from unaffected cattle. Forty-six genes were overexpressed in the
affected and 14 genes were downregulated in the affected cattle by at least 20%. GSEA and Ingenuity analysis identified respiratory diseases, inflammatory diseases and pathways as the top diseases and disorders (P<5.14×10-14), cell development and cell signaling as the top cellular functions (P<1.20×10-08), and IL6, TREM, PPAR, NFKb cell signaling (P<8.69×10-09) as the top canonical pathways associated with this gene signature. This study provides insights into differences in RNA expression in HAPH at a molecular level, and eliminates four functional gene candidates. Further studies are needed to validate and refine these preliminary findings and to determine the role of transcribed genes in the development of HAPH."

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3329076/
Altitude Diseases: Biological Limits

- “The spectrum of life reduces as altitude increases until 13,796 feet where there is hardly any biological life at all.” Steven Magee CEng MIET - Q
- “Altitude and house dust mites... The effects of altitude on house dust mites (one of the allergenic components of house dust) and the synthesis of anti-acari IgE antibodies were studied. Flotation extraction, counting, and identification of mites were performed each season for 1 yr on 218 mattress-dust samples taken from the Briançon region in the Alps, 900 to 3170 meters in altitude. Of the total dust samples, 41 were repeatedly positive and 177 repeatedly negative. The percentage of positive samples and the concentration of mites varied inversely with the altitude (40% positive with seven mites per 100 mg of dust at 900 to 1100 m, 14% and 4/100 mg at 1200 to 1350 m, 6% and 2/100 mg at 1400 to 1600 m, and 0% at higher altitudes). Species did not vary with altitude (Dermatophagoides pteronyssinus 17%, Euroglyphus maynei 51%). In contrast, on the plain we found 80% of 77 dust samples positive (88 mites/100 mg of dust, 65% D. pteronyssinus), with the peak in autumn. Total and specific IgE were measured initially and every 3 mo in 42 asthmatic children with positive skin tests to D. pteronyssinus and subjected to a 9-mo stay in Briançon (the highest city in Europe, 1365 m altitude). Geometric mean of initial total IgE (1047 U/ml) dropped to 40% (p≤0.001); specific IgE to D. pteronyssinus also fell. The value of climate change as a therapeutic modality in asthma is not supported by convincing data but may be attributed in some cases to removal of antigenic stimulation. The decrease in the number of mites and in IgE levels at higher altitudes supports this hypothesis.” https://www.jacionline.org/article/S0091-6749(82)80006-7/abstract

- "Diverse Responses to UV-B Radiation and Repair Mechanisms of Bacteria Isolated from High-Altitude Aquatic Environments... Acinetobacter johnsonii A2 isolated from the natural community of Laguna Azul (Andean Mountains at 4,560 m above sea level), Serratia marcescens MF42, Pseudomonas sp. strain MF8 isolated from the planktonic community, and Cytophaga sp. strain MF7 isolated from the benthic community from Laguna Pozuelos (Andean Puna at 3,600 m above sea level) were subjected to UV-B (3,931 J m−2) irradiation. In addition, a marine Pseudomonas putida strain, 2IDINH, and a second Acinetobacter johnsonii strain, ATCC 17909, were used as external controls. Resistance to UV-B and kinetic rates of light-dependent (UV-A [315 to 400 nm] and cool white light [400 to 700 nm]) and -independent reactivation following exposure were determined by measuring the survival (expressed as CFU) and accumulation of cyclobutane pyrimidine dimers (CPD). Significant differences in survival after UV-B irradiation were observed: Acinetobacter johnsonii A2, 48%; Acinetobacter johnsonii ATCC 17909, 20%; Pseudomonas sp. strain MF8, 40%; marine Pseudomonas putida strain 2IDINH, 12%; Cytophaga sp. strain MF7, 20%; and Serratia marcescens, 21%. Most bacteria exhibited little DNA damage (between 40 and 80 CPD/Mb), except for the benthic isolate Cytophaga sp. strain MF7 (400 CPD/Mb) and Acinetobacter johnsonii ATCC 17909 (160 CPD/Mb). The recovery strategies through dark and light repair were different in all strains. The most efficient in recovering were both Acinetobacter johnsonii A2 and Cytophaga sp. strain MF7; Serratia marcescens MF42 showed intermediate recovery, and in both Pseudomonas strains, recovery was essentially zero. The UV-B responses and recovery abilities of the different bacteria were consistent with the irradiation levels in their native environment." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1694205/
Altitude Diseases: Risk Factors For Injuries

- “I had a nasty fall onto a metal grating at very high altitude that required a visit to the hospital emergency department. They noted that they could still see the imprint of the metal grating on both knees hours after the injury occurred. Approximately four years later I had to have a slow growing PVNS tumor removed from the right knee.” Steven Magee CEng MIET

- “Pigmented Villonodular Synovitis...PVNS tends to act like a slow-growing local tumor. However, it does not metastasize like a true cancer. Treatment requires surgical removal of all of the tissue.”

- “Pigmented Villonodular Synovitis...Pigmented villonodular synovitis (PVNS) refers to a subtype of tenosynovial giant cell tumors that diffusely affect the soft tissue lining of joints and tendons. PVNS most commonly affects the knee, hip, and ankle joints and is insidious in onset, with symptoms often being present for years before diagnosis...Several authors have suggested a link between a prior joint injury and the development of PVNS...If left untreated, the complications of pigmented villonodular synovitis include moderate to severe joint deformity, degenerative articular changes, and osteoarthritis. If arthritic changes produce severe erosion of articular surfaces, the ensuing cortical bone destruction can lead to the need for arthrodesis or amputation.”

- “Pigmented villonodular synovitis...The exact cause of pigmented villonodular synovitis (PVNS) is unknown. Some doctors believe that it is similar to arthritis, arising from swelling (inflammation) of the joint tissue. Others believe it develops like a tumor, caused by cells growing and multiplying more quickly than usual. The association between a history of trauma and the development of PVNS is unclear. One study found that 56% of individuals with PVNS had a history of previous trauma, while other studies have found a much lower incidence. There have been studies suggesting that PVNS could be caused by specific genetic changes in the cells lining the joint.”

- “Joint Tumors...Tumors rarely affect joints unless a bone tumor or soft-tissue tumor is near a joint. However, two conditions—synovial chondromatosis and pigmented villonodular synovitis—occur in the lining (synovium) of joints. These tumors are noncancerous (benign) but can cause severe damage to the joint. Both conditions usually affect one joint, most often the knee or the hip, and can cause pain and a buildup of fluid. To diagnose these conditions, doctors do x-rays, computed tomography (CT), magnetic resonance imaging (MRI), or a combination. To confirm the diagnosis, doctors usually remove a tissue sample for examination under a microscope (biopsy). Treatment for both requires surgical removal of the abnormal synovium (called synovectomy)....Pigmented villonodular synovitis causes the lining of the joint to become swollen and grow. This growth harms the cartilage and bone around the joint. The lining also produces extra fluid that can cause pain and swelling. The process often causes bloody fluid to appear in the joint. It usually affects one joint. A total joint replacement may be needed if the condition returns after treatment. On rare occasions after several synovectomies, radiation therapy is sometimes given.”

- “About a year before I was diagnosed with PVNS, my right knee unexpectedly swelled up with blood after exercising, causing me to miss several weeks of work while waiting for the painful
swelling to subside. After tumor surgery a year later, PVNS did not recur in my right knee. My assumption for this is because I left the biologically toxic very high altitude environment where it had occurred several months later. With the benefit of hindsight, I consider myself fortunate that I left when I did.” Steven Magee CEng MIET

- “Ask a sports medicine doc: Recognizing bone tumors over other sports injuries...Pigmented Villonodular Synovitis (PVNS) is another benign but aggressive process that I see. Patients typically present with knee pain and swelling. There is typically no injury and the swelling does not respond to rest. Patients complain of locking and catching similar to what one would feel with a meniscal tear. With PVNS, there is overgrowth of the synovium or lining tissue of the knee. An MRI can help diagnose it, but arthroscopy is often needed to confirm the diagnosis and to help control it. Unfortunately, it is difficult to eradicate PVNS.”
  https://www.summitdaily.com/sports/ask-a-sports-medicine-doc-recognizing-bone-tumors-over-other-sports-injuries/

- “Why knee injuries often don’t heal...If you fall on the ski slopes or slip on a patch of ice, you’ll probably be better off if you break your leg than if you rip the cartilage in your knee. Unlike bones, your cartilage is never going to regrow or heal, according to a new study based in part on fallout from past nuclear explosions...“You need to take care of your joints while you are young,” he says. “Once you have damage to the cartilage, it’s not going to repair itself.””

- “Risk factors for injuries in a high-altitude ultramarathon...Runners primarily visited aid stations for musculoskeletal, gastrointestinal, and respiratory complaints.”
  https://bjsm.bmj.com/content/45/4/355.3
Altitude Diseases: Pre-existing Conditions

- “Effects of High Altitude on Pre-existing Conditions...People with pre-existing conditions should carefully evaluate risks. Depending upon where they are traveling, medical care may be 24-48 hours away, and this delay in treatment could increase risk of death in some conditions.” [http://www.rmceus.com/altitude/prevention.html](http://www.rmceus.com/altitude/prevention.html)
- “Preexisting Medical Conditions at Altitude” [http://www.altitudemedicine.org/altitude-and-pre-existing-conditions](http://www.altitudemedicine.org/altitude-and-pre-existing-conditions)
- “Utah's high altitude may have helped diagnose 8-year-old North Carolina boy's brain tumor, family says...At one point during the family’s trip to Utah, however, Perryn experienced an excruciating headache that landed him in a local hospital. At first, Perryn’s father, Jacob, and mother, Jaimee, thought the altitude change was exacerbating their son’s symptoms. But doctors in the Beehive State soon informed the family Perryn’s condition was not caused by the altitude change at all. Rather, the 8-year-old was suffering from Stage 4 glioblastoma multiforme. Perryn was then told a tumor found in his brain required immediate surgery, according to the news station, which noted the high altitude may have helped lead to the boy's diagnosis.” [https://www.foxnews.com/health/utahs-high-altitude-may-have-helped-diagnose-8-year-old-north-carolina-boys-brain-tumor-doctors-say](https://www.foxnews.com/health/utahs-high-altitude-may-have-helped-diagnose-8-year-old-north-carolina-boys-brain-tumor-doctors-say)
- “Suddenly symptomatic brain tumors at altitude...High-altitude cerebral edema can present with a wide variety of neurologic manifestations; these symptoms resolve with descent. The persistence of neurologic symptoms after descent suggests an intracranial lesion. Brain tumors suddenly becoming symptomatic at altitude have not been reported previously. We report three cases of previously unsuspected brain tumors that suddenly became symptomatic at high altitudes.” [https://www.annemergmed.com/article/S0196-0644(05)80948-5/pdf](https://www.annemergmed.com/article/S0196-0644(05)80948-5/pdf)
Altitude Diseases: Cancer

- “Cancer risk associated with living at high altitude in Ecuadorian population from 2005 to 2014...Living at high altitude was associated with a higher prevalence of cancer and also with a high mortality rate due to cancer. Risk of getting cancer was related to living at a higher altitude, as well as an increased risk of death by cancer: gastric (OR:1.204; p<0.001), colorectal (OR:1.421; p<0.001), hepatic/bile duct (OR:1.184; p<0.001), breast (OR:1.067; p=0.030), or lymphatic/hematopoietic neoplasms (OR:1.135; p<0.001).” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5958984/]
- “High Altitude and Cancer Mortality...However, some types of cancer may respond differently to HA. Indeed, several reports that analyzed site-specific cancer mortality suggested that mortality from lymphoma, breast (Youk et al., 2012), lung, tongue, mouth, and larynx (Amsel et al., 1982; Van Pelt, 2003) is reduced, whereas other cancers such as liver and cervix remain unaffected or are even increased [e.g., melanoma due to the higher background radiation (Boscoe and Schymura, 2006; Aceituno-Madera et al., 2011); placental choriocarcinoma (Reshetnikova et al., 1996)] (Table 1). In addition, carotid body tumor (paragangioma) incidence is increased at HA (Arias-Stella and Valcarcel, 1973; Astrom et al., 2003). Although hypoxia causes chief cell hyperplasia (Arias-Stella and Valcarcel, 1976), carotid body tumors have less malignant behavior than those tumors at low altitudes, and the ratio of female-to-male patients with these tumors increases from 2:1 at low altitude to 8.3:1 at HA (Rodriguez-Cuevas et al., 1998).” [https://www.liebertpub.com/doi/full/10.1089/ham.2017.0061#_i4]
- “Wet and cold weather linked to increased cancer rates. For the first time, a study finds an association between living in cold, wet regions and increased cancer prevalence. The conclusions are surprising and likely to spark debate...Long ago, scientists established that increased exposure to ultraviolet (UV) rays from the sun increases skin cancer risk. A new study, however, points the finger at precipitation and a cooler climate. Earlier research has shown that there is a surprising amount of disparity between cancer incidence and mortality rates in different regions of the United States. Specifically, the highest rates seem to cluster toward the East Coast.” [https://www.medicalnewstoday.com/articles/327210]
- “At Mauna Kea Observatories, we would wear cold weather clothing, as the observatories were often below freezing and there would be ice on the equipment.” Steven Magee CEng MIET - Q
- “Cold discomfort: Increasing cancer rates and adaptation of living in extreme environments...populations living in very low temperatures, like in Denmark and Norway, had among the highest incidences of cancer in the world. Now, in a new paper in the advanced online edition of the journal Molecular Biology and Evolution, he has advanced a new hypothesis: there is an evolutionary relationship that exists between adaptation at extreme environmental conditions—like cold and high altitude—and increased cancer risk in humans. "The findings of this study provide evidence that genetic variants found to be beneficial in extreme environments, can also predispose for cancer," said Voskarides. "Cell resistance at low temperatures and at high altitude probably increases the probability for malignancy. This effect hardly could be filtered out by natural selection since most cancers appear later on in age after most people have their children.”” [https://medicalxpress.com/news/2017-12-cold-discomfort-cancer-extreme-environments.html]
- “Why Cancer Rates Are Higher in Flight Attendants...Researchers found that women and men on U.S. cabin crews have higher rates of many types of cancer, compared with the general
population. This includes cancers of the breast, cervix, skin, thyroid and uterus, as well as gastrointestinal system cancers, which include colon, stomach, esophageal, liver and pancreatic cancers...One possible explanation for these increased rates is that flight attendants are exposed to a lot of known and potential carcinogens, or cancer-causing agents, within their work environment...One of those carcinogens is cosmic ionizing radiation, which is elevated at higher altitudes, Mordukhovich told Live Science. This type of radiation is particularly damaging to DNA and is a known cause of breast cancer and nonmelanoma skin cancer, she said.”

- “Colorado has the highest per-capita rate of skin cancer, thanks to sunshine and high elevation...However, Colorado — one of the sunniest states and also with the highest average elevation of any state — has the nation’s highest per-capita rate of skin cancer. Cancer remains the second-leading cause of death for Americans, behind heart disease, and the leading cause of death for Coloradans. In Colorado, 50 percent of men and 40 percent of women will have cancer in their lifetime, according to Cathy Bradley, deputy director of the CU Cancer Center. Lung cancer remains the deadliest cancer in Colorado and most states, but it is not the most prevalent cancer in this state. The most commonly diagnosed cancer for men is prostate, while the most common among women is breast cancer. Lung cancer is the second-most common cancer for both sexes. Melanoma, the worst kind of skin cancer, is the fifth-most diagnosed cancer for men in Colorado and the sixth for women.”

- “Mutational Analysis of Oncogenic AKT1 Gene Associated with Breast Cancer Risk in the High Altitude Ecuadorian Mestizo Population...Breast cancer is the leading cause of cancer-related death among women worldwide. AKT1 encodes the kinase B alpha protein. The rs121434592, rs12881616, rs11555432, rs11555431, rs2494732, and rs3803304 single nucleotide polymorphisms have been identified in the AKT1 kinase gene. Activated AKT1 phosphorylates downstream substrates regulating cell growth, metabolism, apoptosis, angiogenesis, and drug responses. It is essential to know how breast cancer risk is associated with histopathological and immunohistochemical characteristics and genotype polymorphisms in a high altitude Ecuadorian mestizo population. This is a retrospective case-control study. DNA was extracted from 185 healthy and 91 affected women who live 2,800 meters above sea level. Genotypes were determined by genomic sequencing. We found a possible association between the noncoding intronic variant rs3803304 and breast cancer risk development: GG (odds ratio [OR] = 5.2; 95% confidence interval [CI] = 1.3-20.9; P ≤ 0.05; Q > 0.05). Regarding pathologic characteristics, we found significant risk between estrogen receptor, progesterone receptor, and HER2 status and molecular subtypes (P ≤ 0.001; Q ≤ 0.05). On the other hand, we did not find risk between variants and histopathological characteristics. Despite the small sample size, we found that the intronic variant, AKT1 rs3803304, may act as a predictive biomarker in the risk of developing breast cancer in the high altitude Ecuadorian mestizo population.”

- “Cancer risk associated with living at high altitude in Ecuadorian population from 2005 to 2014...Background and aims. Cancer is a leading cause of death in Ecuador with high social and economic impact. This study aims to determinate the influence of living at a high altitude on the risk of developing or dying from cancer among the Ecuadorian population. Methods. This is an ecological and epidemiological analysis of cancer mortality and prevalence rates, based on national data from the Ecuadorian National Statistics and Census Institute, corresponding to the period between 2005 and 2014. This study includes the analysis of various
types of cancer: gastric, colorectal, hepatic/bile duct, breast, uterine/cervix, and lymphatic/hematopoietic, using rates of mortality and prevalence. Additionally, the association between the risk of getting or dying from cancer and living at high altitude was investigated. This comparison was made between the population living in Highlands, over 2000 meters above sea level, and low-lying regions. Results. Living at high altitude was associated with a higher prevalence of cancer and also with a high mortality rate due to cancer. Risk of getting cancer was related to living at a higher altitude, as well as an increased risk of death by cancer: gastric (OR:1.204; p<0.001), colorectal (OR:1.421; p<0.001), hepatic/bile duct (OR:1.184; p<0.001), breast (OR:1.067; p=0.030), or lymphatic/hematopoietic neoplasms (OR:1.135; p<0.001). Conclusions. Through an epidemiologic analysis, the association between developing or dying from cancer and living at high altitude was obtained. However, further research is needed to clarify these findings, something that could have a substantial impact on cancer prevention.”
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5958984/
Altitude Diseases: COVID-19

- “COVID-19 is remarkably similar to High Altitude Pulmonary Edema (HAPE).” Steven Magee CEng MIET - Q

- “‘Life-saving' ventilators are destroying coronavirus patients' lungs, doctor says...He has said that Covid-19 lung disease "is not a pneumonia” but appears to be “some kind of viral-induced disease most resembling high altitude sickness". He added: “It is as if tens of thousands of my fellow New Yorkers are on a plane at 30,000 feet and the cabin pressure is slowly being let out. “These patients are slowly being starved of oxygen... and while they look like patients absolutely on the brink of death, they do not look like patients dying of pneumonia.” The danger, he said, lies in the amount of pressure used to open the lungs, and he believes ventilators should be programmed "differently" for patients with coronavirus.”

- “Scientists Study Coronavirus Attack on Hemoglobin, Iron, & Test New Treatments with Old Standbys...In several studies, scientists have found high levels of ferritin in the blood of patients suffering with severe COVID-19...the RNA of the virus codes for a number of non-structural proteins which then hijack the red blood cells and attack the hemoglobin, removing the iron ions from the “heme groups” (HBB) within the hemoglobin and replacing themselves in their stead. This makes the hemoglobin less and less able to carry oxygen and carbon dioxide. The lung cells sustain “extremely intense poisoning and inflammation due to the inability to exchange carbon dioxide and oxygen frequently, which eventually results in ground-glass-like lung images,” the researchers write....“The patients in front of me of are unlike any I’ve ever seen,” he told Medscape in an interview. “They looked a lot more like they had altitude sickness than pneumonia.””

- “Emerging Theories That May Help Us Solve the COVID-19 Puzzle...The Connection Between COVID-19 and Altitude Sickness. Another interesting connection is the fact that COVID-19’s clinical presentation is quite similar to another respiratory illness – high altitude pulmonary edema, also known as altitude sickness. In both COVID-19 and high altitude pulmonary edema clinical findings include: A decreased ratio of arterial oxygen levels to inspired oxygen. Hypoxia (low oxygen levels) and tachypnea (abnormally rapid breathing). Low carbon dioxide levels. A ground glass appearance in the lung tissues. Elevated fibrinogen levels. Diffuse alveolar damage. In altitude sickness, the lungs are functioning fine – there are just inadequate levels of oxygen to process to properly meet the needs of the body. Clinical findings similar to altitude sickness would make sense if COVID-19 is in fact causing a dysfunction of red blood cells through production of massive oxidative stress rather than a direct problem with the lungs.”

- “Untangling Covid-19, Altitude Sickness, and Conspiracy Theory...One of the first things doctors do when people show up at the ER is check their oxygen saturation — the amount of oxygen being carried in the blood. In healthy people, saturation is normally above 95%. But some patients, writes Dr. Reuben Strayer, an emergency physician at Maimonides Medical Center in Brooklyn, New York, in an article published by Scientific American, present with “the kind of very low saturations that we associate with cyanosis and respiratory distress — but they
were comfortably speaking to us or texting on their phones.” This unusual phenomenon, he writes, is very “disorienting” because doctors often rely on this measurement to guide their work. Some physicians, he notes, suggest that the physiology of Covid-19 resembles that seen in people with altitude sickness. The prevailing characteristic of altitude sickness is low oxygen saturation, and similar symptoms can be observed when a diver returns to the surface too quickly.”

• “Doctors Puzzle Over COVID-19 Lung Problems...” A whole bunch of these patients really have low oxygen, but their lungs don’t look all that bad,”...Normally, when lungs become damaged, the vessels that carry blood through the lungs so it can be re-oxygenated constrict, or close down, so blood can be shunted away from the area that’s damaged to an area that’s still working properly. This protects the body from a drop in oxygen. Gattinoni thinks some COVID-19 patients can’t do this anymore. So blood is still flowing to damaged parts of the lungs. People still feel like they’re taking good breaths, but their blood oxygen is dropping all the same. This problem with the blood vessels is similar to what happens in a condition called high-altitude pulmonary edema, or HAPE, says Bull. HAPE patients recover when you bring them down from a high altitude and give them oxygen. They are sometimes also placed on ventilators and treated with medicines including diuretics to remove fluid that’s flooded their lungs. More research is needed to know if any of those strategies may help COVID-19 patients.”

• “COVID-19: hemoglobin, iron, and hypoxia beyond inflammation. A narrative review...” Concerning lung consequences, a systemic hypoxia state, with normal pulmonary tissue compliance, has been highlighted in up to 80% of intensive care unit (ICU) patients exhibiting respiratory distress, which led a few authors to question ARDS diagnosis. Furthermore, a certain similarity between the computed tomography (CT), laboratory, and clinical features of high altitude pulmonary edema (HAPE) and of COVID-19 pneumonia has been highlighted. HAPE is a non-infective, non-inflammatory interstitial pulmonary edema, caused by the low inhaled oxygen and Starling’s law disequilibrium, with pulmonary vasoconstriction and hypertension. 36 Interestingly, in COVID-19 patients paCO2 does not relevantly rise, if not at the latest, most critical stages.20 Furthermore, the PaO2/FiO2 ratio, which is usually high in ARDS, is conversely low in COVID-19 (HAPE-like) lung involvement, until critical respiratory insufficiency occurs.36 Basically, clinical/instrumental features of lung disease in COVID-19 seem to shift to typical ARDS features only when alveolocapillary membrane relevantly deteriorates and/or pulmonary circulation is impaired furthermore, possibly due to thromboembolic phenomena and ferroptosis.9,19,20,25,35,36 Likely, the combination of hypoxemic hypoxia with relatively normal lung compliance and normocapnia, could orientate the conventional pneumonia diagnostic/therapeutic approach differently.”

• “‘Silent hypoxia’ may be killing COVID-19 patients. But there's hope…” This is not a new phenomenon," said Dr. Marc Moss, the division head of Pulmonary Sciences and Critical Care Medicine at the University of Colorado Anschutz Medical Campus. There are other conditions in which patients are extremely low on oxygen but don't feel any sense of suffocation or lack of air, Moss told Live Science. For example, some congenital heart defects cause circulation to bypass the lungs, meaning the blood is poorly oxygenated...Normal blood-oxygen levels are around 97%, Moss said, and it becomes worrisome when the numbers drop below 90%.
levels below 90%, the brain may not get sufficient oxygen, and patients might start experiencing confusion, lethargy or other mental disruptions. As levels drop into the low 80s or below, the danger of damage to vital organs rises.”  


- “These patients did not report any sensation of breathing problems, even though their chest X-rays showed diffuse pneumonia and their oxygen was below normal. How could this be? We are just beginning to recognize that Covid pneumonia initially causes a form of oxygen deprivation we call “silent hypoxia” — “silent” because of its insidious, hard-to-detect nature...Normal oxygen saturation for most persons at sea level is 94 percent to 100 percent; Covid pneumonia patients I saw had oxygen saturations as low as 50 percent...A vast majority of Covid pneumonia patients I met had remarkably low oxygen saturations at triage — seemingly incompatible with life — but they were using their cellphones as we put them on monitors. Although breathing fast, they had relatively minimal apparent distress, despite dangerously low oxygen levels and terrible pneumonia on chest X-rays.”  


- “New study explains potential causes for "happy hypoxia" condition in patients with the COVID-19 virus...A new research study provides possible explanations for COVID-19 patients who present with extremely low, otherwise life-threatening levels of oxygen, but no signs of dyspnea (difficulty breathing). This new understanding of the condition, known as silent hypoxemia or "happy hypoxia," could prevent unnecessary intubation and ventilation in patients during the current and expected second wave of coronavirus….more than half of the patients had low levels of carbon dioxide, which may diminish the impact of an extremely low oxygen level.”  


- “Three reasons why COVID-19 can cause silent hypoxia..."Different people respond to this virus so differently," says Suki. For clinicians, he says it's critical to understand all the possible reasons why a patient's blood oxygen might be low, so that they can decide on the proper form of treatment, including medications that could help constrict blood vessels, bust blood clots, or correct a mismatched air-to-blood flow ratio.”  


- “Serum Iron Level as a Potential Predictor of Coronavirus Disease 2019 Severity and Mortality: A Retrospective Study...Background. Various types of pulmonary diseases are associated with iron deficiency. However, information on iron status in coronavirus disease 2019 (COVID-19) is scarce. Methods. This study included 50 hospitalized patients with confirmed COVID-19. The role of serum iron in predicting severity and mortality of COVID-19 was evaluated. Results. The most common symptoms of COVID-19 patients in this study were cough (82%), fever (64%), and chest distress (42%). Of the 50 patients, 45 (90%) patients had abnormally low serum iron levels (<7.8 μmol/L). The severity of COVID-19 was negatively correlated with serum iron levels before and after treatment and was positively correlated with C-reactive protein, serum amyloid A, D-dimer, lactate dehydrogenase, urea nitrogen, and myoglobin levels. Decreased serum iron level could predict the transition of COVID-19 from mild to severe and critical illness. Seven (53.8%) patients with a lower serum iron level after treatment in the critical group had died. There was a significant difference in posttreatment serum iron levels between COVID-19 survivors and nonsurvivors. Conclusions. Serum iron deficiency was detected in the patients with COVID-19. The severity and mortality of the disease was closely correlated with serum iron levels. Low serum iron concentration was an independent
risk factor for death in COVID-19 patients.”
https://academic.oup.com/ofid/article/7/7/ofaa250/5860447

- “Iron: Innocent bystander or vicious culprit in COVID-19 pathogenesis?...Hyper-ferritinemias observed in COVID-19 patients may be induced in response to inflammation. However, its role in COVID-19 disease progression has not been fully established. It has been reported that hyper-inflammation in association with altered iron homeostasis may play a key role in pathogenesis of disease including viral infections (Drakesmith and Prentice, 2008, Schmidt, 2020) (Figure 1). It may be postulated that hyper-ferritinemias is associated with a state of iron toxicity which may result from increased ferritin leakage from damaged tissue releasing free iron in the process. There is no established consensus to exclude this possibility. Therefore, it is crucial to investigate coexisting iron parameters in COVID-19 patients including transferrin saturation, plasma iron levels, non-transferrin bound iron (NTBI) as well as hepcidin. The association of hyper-ferritinemias with increased transferrin saturation may reflect a state of iron overload. In this case, we suggest that targeting the intracellular iron overload may be a strategy of vital importance needed to be taken into consideration in future controlled clinical trials.”
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7264936/

- “Anemia and iron metabolism in COVID-19: A systematic review and meta-analysis...Iron metabolism and anemia may play an important role in multiple organ dysfunction syndrome in Coronavirus disease 2019 (COVID-19). If confirmed, this has important implications for the more than 1.62 billion people estimated to have anemia globally. We conducted a systematic review and meta-analysis to evaluate biomarkers of anemia and iron metabolism (hemoglobin, ferritin, transferrin, soluble transferrin receptor, hepcidin, haptoglobin, unsaturated iron-binding capacity, erythropoietin, free erythrocyte proteoporphyrine, and prevalence of anemia) in patients diagnosed with COVID-19, and explore their prognostic value. Six bibliographic databases were searched up to May 5th 2020. We included 56 unique studies, with data from 14,044 COVID-19 patients (59 years median age). Pooled mean hemoglobin and ferritin levels in COVID-19 patients across all ages were 130.41 g/L (95% Confidence Interval (CI), 128.42; 132.39) and 673.91 ng/mL (95% CI, 420.98; 926.84), respectively. Hemoglobin levels decreased with advancing age and increasing percentage of comorbid and critically ill patients, while levels of ferritin increased with increasing male proportion and mean hemoglobin levels. Compared to moderate cases, severe cases had lower pooled mean hemoglobin [weighted mean difference (WMD), -4.21 (95% CI -6.63; -1.78)] and higher ferritin [WMD, -730.55 ng/mL (95% CI 413.24; 1047.85)]. A significant difference in mean ferritin level of 1027.23 ng/mL (95% CI 819.53; 1234.94) was found between survivors and non-survivors, but not in hemoglobin levels. No studies provided information on anemia or other biomarkers of interest. Future studies should explore the impact of iron metabolism and anemia and in the pathophysiology, prognosis, and treatment of COVID-19.”
https://www.medrxiv.org/content/10.1101/2020.06.04.20122267v1

- “Will low iron levels in blood can save from COVID-19?...maintaining a balanced iron level is optimum to battle against COVID....In ICU, anemic people have worst outcomes….The most fundamental factor of adaptation to hypoxia is an increase of the hemoglobin. COViD in its critical stages is linked to extreme hypoxia as if patients were taken suddenly to the summit of Mt. Everest. Without enough Hemoglobin and a high PaCO2 (due to pneumolysis), the 2 fundamental factors of the formula Tolerance to Hypoxia, death is imminent.”
https://www.researchgate.net/post/Will_low_iron_levels_in_blood_can_save_from_COVID-19

- “COVID-19 Publications, interviews & conferences...High Altitude Pulmonary and Pathology
Institute in La Paz, Bolivia 3500m. As far as we know, we were the first in the world to propose that the U-V at high altitude would be a protective disinfectant in the COVID Pandemic. Originally, in Dec 2017 on a paper on Longevity at high altitude (Se ref. 1, below). Then I wrote a newspaper article about it when the Pandemic started to arrive in Bolivia on April 5th, 2020 (3). My daughter Natalia Zubieta-DeUrioste, M.D., and I teamed up with another Bolivian Jorge Soliz Ph.D. and Christian Arias from Laval University who postulated that the lower amount of ACE2 receptors in the lungs at high altitude could also be a protective factor at high altitude. We participated in the U-V section. The other coauthors of that paper were several Bolivian Ph.D. students and an Australian Ph.D. (4). Likewise, we wrote of multiple diseases in COVID-19 early on May 5, 2020 (5) currently under peer review. Furthermore, I created the term “Pneumolysis” to describe what happens in COVID-19 and presented it for the first time in the INTERNATIONAL CONFERENCE ON CORONA VIRAL GENOME, in India (See the banner below). We feel proud to be able to contribute with our knowledge accumulated over 50 years of work at IPPA Just celebrated on July 9th, 2020, to this COVID Pandemic.”

- “People with Certain Medical Conditions...People of any age with the following conditions are at increased risk of severe illness from COVID-19: Cancer. Chronic kidney disease. COPD (chronic obstructive pulmonary disease). Immunocompromised state (weakened immune system) from solid organ transplant. Obesity (body mass index [BMI] of 30 or higher). Serious heart conditions, such as heart failure, coronary artery disease, or cardiomyopathies. Sickle cell disease. Type 2 diabetes mellitus...Based on what we know at this time, people with the following conditions might be at an increased risk for severe illness from COVID-19: Asthma (moderate-to-severe). Cerebrovascular disease (affects blood vessels and blood supply to the brain). Cystic fibrosis. Hypertension or high blood pressure. Immunocompromised state (weakened immune system) from blood or bone marrow transplant, immune deficiencies, HIV, use of corticosteroids, or use of other immune weakening medicines. Neurologic conditions, such as dementia. Liver disease. Pregnancy. Pulmonary fibrosis (having damaged or scarred lung tissues). Smoking. Thalassemia (a type of blood disorder). Type 1 diabetes mellitus”

- “It Took One Person, And One Errand, To Infect My Entire Family With COVID-19...88 is an ominous number for those of us in the medical field. With a pulse ox. of 92%, I would place a nasal cannula (low flow oxygen) on my patient. But at 88% I would choose a non-rebreather face mask (high flow oxygen) instead because if their oxygen level remained that low, they could sustain permanent organ damage...I got an oxygen reading of 83. Now I was scared.”

- “This is the latest very serious COVID-19 symptom...Stomach pain, loss of appetite, itchiness, or cramps? It might be coronavirus. New research shows gastrointestinal issues in COVID-19 patients studied, some with deadly consequences...17% of people they studied had bowel issues as a symptom of the virus...Over half of patients with COVID-19 that got ultrasounds showed signs of cholestasis or blockage of bile moving from the liver. Symptoms include intense itching, dark urine, and light-colored bowel movements. Loss of appetite is another symptom, even yellowing of the skin or eyes. Some patients with more serious cases had distended bowels and irreversible damage to the intestines. These symptoms of infection mean the virus ravaged the immune system in those major organs. Other symptoms showed organ shutdown in the bowels of some patients.”
serious-covid-19-symptom

- "The advantages of ultraviolet radiation in controlling the coronavirus at high-altitude...Ultra-violet radiation, a component of light that comes from the sun, is very strong at high altitudes in cities above 3,000 meters above sea level (especially) such as La Paz (3,100-4,100), El Alto (4000-4100), Oruro (3,800) and Potosí (4,000), in Bolivia. The ultraviolet radiation index (UVIndex) is considered to be at extreme levels in La Paz...Ultraviolet radiation is a protection factor against this virus, because it is lethal. One of the ways the disease is transmitted is because it sits on surfaces where it stays alive for several hours and possibly even days. But at high-altitude, solar radiation constitutes a sterilizer of all surfaces where the sun falls. That is why the streets in high-altitude cities benefit from this physical characteristic...in China there were no cases or they were very rare in the Tibet area...in India, where I am a "visiting professor”, likewise noted that there is lower incidence in high altitude areas in his country.”

- "Clinical features of imported cases of coronavirus disease 2019 in Tibetan patients in the Plateau area...Coronavirus disease 2019 (COVID-19), caused by SARS-CoV-2, has rapidly spread throughout China, but the clinical characteristics of Tibetan patients living in the Qinghai-Tibetan plateau are unknown. We aimed to investigate the epidemiological, clinical, laboratory and radiological characteristics of these patients. We included 67 Tibetan patients with confirmed SARS-CoV-2 infection. The patients were divided into two groups based on the presence of clinical symptoms at admission, with 31 and 36 patients in the symptomatic and asymptomatic groups, respectively. The epidemiological, clinical, laboratory and radiological characteristics were extracted and analysed. No patient had a history of exposure to COVID-19 patients from Wuhan or had travelled to Wuhan. The mean age of Tibetan patients was 39.3 years and 59% of the patients were male. Seven patients presented with fever on admission and lymphocytopenia was present in 20 patients. 47 patients had abnormal chest CTs at admission instead of stating that 20 were unchanged. Lactate dehydrogenase levels were increased in 31 patients. Seven patients progressed to severe COVID-19; however, after treatment, their condition was stable. No patients died. Of the 36 asymptomatic patients, the mean age was younger than the symptomatic group (34.4 vs 44.9 years, P=0.02). Lymphocyte count and prealbumin levels were higher in the asymptomatic group than the group with clinical symptoms (1.6 vs 1.3 and 241.8 vs 191.9, respectively; P<0.05). Imported cases of COVID-19 in Tibetan patients were generally mild in this high-altitude area. Absence of fever or radiologic abnormalities on initial presentation were common.”

- "Decreased incidence, virus transmission capacity, and severity of COVID-19 at altitude on the American continent...The coronavirus disease 2019 (COVID-19) outbreak in North, Central, and South America has become the epicenter of the current pandemic. We have suggested previously that the infection rate of this virus might be lower in people living at high altitude (over 2,500 m) compared to that in the lowlands. Based on data from official sources, we performed a new epidemiological analysis of the development of the pandemic in 23 countries on the American continent as of May 23, 2020. Our results confirm our previous finding, further showing that the incidence of COVID-19 on the American continent decreases significantly starting at 1,000 m above sea level (masl). Moreover, epidemiological modeling indicates that the virus transmission rate capacity is lower in the highlands (>1,000 masl) than in the lowlands (<1,000 masl). Finally, evaluating the differences in the recovery percentage of patients, the death-to-case ratio, and the theoretical fraction of undiagnosed cases, we found that the severity
of COVID-19 is also decreased above 1,000 m. We conclude that the impact of the COVID-19 decreases significantly with altitude.”

“Does the pathogenesis of SARS-CoV-2 virus decrease at high-altitude?...In the present study we analyze the epidemiological data of COVID-19 of Tibet and high-altitude regions of Bolivia and Ecuador, and compare to lowland data, to test the hypothesis that high-altitude inhabitants (+2,500m above sea-level) are less susceptible to develop severe adverse effects in acute SARS-CoV-2 virus infection. Analysis of available epidemiological data suggest that physiological acclimatization/adaptation that counterbalance the hypoxic environment in high-altitude may protect from severe impact of acute SARS-CoV-2 virus infection. Potential underlying mechanisms such as: (i) a compromised half-life of the virus caused by the highaltitude environment, and (ii) a hypoxia mediated down regulation of angiotensin-converting enzyme 2 (ACE2), which is the main binding target of SARS-CoV-2 virus in the pulmonary epithelium are discussed.”

“COVID-19: Multiple Diseases Simulating Extreme High-Altitude Exposure? Oxygen Transport Physiology and Scarce Need of Ventilators; Andean Condor’s-Eye-View...The critical hypoxia in COVID-19 patients during this pandemic, has taken away many lives all around the globe. The mechanism has been poorly understood and initially, word got around that it was a SARS (Severe Acute Respiratory Syndrome) pneumonia. The atypical images in lung computerized axial tomography (CAT) scans were alarming. This immediately alerted everyone including poor countries to purchase lacking sophisticated ventilator equipment. However, in some countries, even 88% of the patients on ventilators lost their lives. New observations and pathological findings are gradually clarifying the disease. What seems evident is that it is not only one disease but several, with different responses in different countries and different altitudes. The critical hypoxia and «gasping» present in some patients are not totally understood. It was mentioned that it could be like a High-Altitude Pulmonary Edema (HAPE). Hereby, as high-altitude medicine and hypoxia physiology specialists, we compare the pathophysiology with that of high-altitude exposure in order to understand the mechanisms involved. Some differences in lung radiological images along with transmission and viral attack mechanisms are discussed. The oxygen transport triad used at high-altitude can be applied on this pathology in order to propose even the use of erythropoietin (EPO) early in the treatment. The immune system is the most important long-term survival tool, so we suggest a short-term strategy: the use of special Earth open-circuit astronaut-resembling suits with effective outside air filtering re-breathing mechanisms in order to return to work and daily activities, without contamination risk. Thereby, the curve can be flattened without quarantine and the economy could recover.”

“Coping with hypoxemia: Could erythropoietin (EPO) be an adjuvant treatment of COVID-19?...A very recent epidemiological study provides preliminary evidence that living in habitats located at 2500 m above sea level (masl) might protect from the development of severe respiratory symptoms following infection with the novel SARS-CoV-2 virus. This epidemiological finding raises the question of whether physiological mechanisms underlying the acclimatization to high altitude identifies therapeutic targets for the effective treatment of severe acute respiratory syndrome pivotal to the reduction of global mortality during the
COVID-19 pandemic. This article compares the symptoms of acute mountain sickness (AMS) with those of SARS-CoV-2 infection and explores overlapping patho-physiological mechanisms of the respiratory system including impaired oxygen transport, pulmonary gas exchange and brainstem circuits controlling respiration. In this context, we also discuss the potential impact of SARS-CoV-2 infection on oxygen sensing in the carotid body. Finally, since erythropoietin (EPO) is an effective prophylactic treatment for AMS, this article reviews the potential benefits of implementing FDA-approved erythropoietin-based (EPO) drug therapies to counteract a variety of acute respiratory and non-respiratory (e.g. excessive inflammation of vascular beds) symptoms of SARS-CoV-2 infection.”


- “The Shocking Coronavirus Symptoms That Could Last for Years...The understanding of COVID-19 is still in its infancy, but scientists think its lasting effects could be similar to another respiratory virus, SARS (severe acute respiratory syndrome). Although only 800 people died in a 2003 outbreak in Asia, one study found that survivors suffered a range of health issues, including lung infections, high blood cholesterol levels and a seemingly lowered immune system, more than a decade after their initial infection. “These data demonstrated that the recovered SARS patients had a poor quality of life 12 years following recovery, and were susceptible to inflammation, tumors, and glucose and lipid metabolic disorders,” wrote the authors of that 2017 study.  The prospect that COVID-19 could cause lasting damage led the doctor who treated British Prime Minister Boris Johnson to recently call the illness “this generation’s polio.” That will create serious challenges for the medical field.” https://ig60.com/2020/05/17/the-shocking-coronavirus-symptoms-that-could-last-for-years/

- “Brain fog, fatigue, breathlessness. Rehab centers set up across Europe to treat long-term effects of coronavirus...research now indicates that coronavirus is a multi-system disease that can damage not only the lungs, but the kidneys, liver, heart, brain and nervous system, skin and gastrointestinal tract...Pescarolo said he had trouble concentrating and was still very concerned about his cognitive powers, "especially short-term memory, I don't remember simple things."...Like Pescarolo, O'Hara has noticed her mind seems less sharp. "I have brain fog, I can't function. I have a PhD in physics and I can't put two thoughts together," she said..."My breathing has got better. I had really bad brain fog, my memory was really bad, I couldn't concentrate, I was really emotional and really, really tired and fatigued, I couldn't do anything," she said. "Even now, on week 17, I am still not able to work, can only manage two hours of activity and I have to lie down...they are often struggling with fatigue, chronic breathlessness, palpitations and fast heart rate, poor sleep, headaches, poor concentration”” https://www.cnn.com/2020/07/19/health/long-covid-italy-uk-gbr-intl/index.html

- “Early details of brain damage in COVID-19 patients...Looking at six patients using a specialized magnetic resonance technique, researchers found that COVID-19 patients with neurological symptoms show some of the same metabolic disturbances in the brain as other patients who have suffered oxygen deprivation from other causes, but there are also notable differences...COVID-19 patients' brains showed N-acetyl-aspartate (NAA) reduction, choline elevation and myo-inositol elevation, similar to what is seen with these metabolites in other patients with white matter abnormalities (leukoencephalopathy) after hypoxia without COVID. One of the patients with COVID-19 who showed the most severe white matter damage (necrosis and cavitation) had particularly pronounced lactate elevation on MRS, which is another sign of brain damage from oxygen deprivation.” https://www.sciencedaily.com/releases/2020/11/201118141707.htm
“The many strange long-term symptoms of Covid-19, explained. Long Covid “is a phenomenon that is really quite real and quite extensive,” Anthony Fauci said earlier this month...Six months later, Brown is still very ill. She has been hospitalized for blood clots and has lingering heart problems, nerve pain, and extreme fatigue. “Even making breakfast is now out of the question,” she says. Most troublingly, she’s still experiencing severe brain fog, which makes it hard for her to return to work...The Centers for Disease Control and Prevention (CDC) recently created a list of some of the persistent symptoms patients are experiencing, which include chest pain, brain fog, fatigue, and hair loss — with patients reporting many others as well...Interviews with dozens of patients like Brown and Campbell provide a closer look at long Covid’s devastating impact — and the clues the latest research offers into what might be causing all these symptoms, including erectile dysfunction, hormonal imbalances, hallucinations, and dementia-like effects that can severely impact daily life...“A lot of people with long Covid notice that their symptoms get worse just before their period happens,” when estrogen levels are lowest, says Louise Newson, a general practitioner and menopause specialist. She says an additional sign hormones may be involved are long-Covid symptoms like “brain fog, fatigue, dizziness, joint pain — these are also symptoms of menopause.”...patients with long Covid from her menopause clinic have improved with the right dose and type of hormone replacement therapy. “They all had low oestradiol and low testosterone results before treatment,” she says...A study in Germany found that the majority of men admitted to the hospital with Covid-19 had low testosterone levels and high inflammatory markers...One recent study of 201 long-Covid patients in the UK found that even in a young, low-risk population, 66 percent had impairments to one or more organs four months after their initial symptoms...New research suggests that around half of asymptomatic Covid-19 infections can also cause damage to the lungs...Some long-Covid patients are reporting symptoms and inflammation similar to mast cell activation syndrome (MCAS), a chronic, multisystem condition that causes allergic responses, GI problems, and neurological issues....Frances Simpson, a psychology lecturer at Coventry University in the UK, says she and her 5- and 9-year old were infected with Covid-19 in March and have had long-Covid symptoms since, including new allergic reactions. “When you read about possible mast cell activation syndrome,” she says, “we can tick all of the symptoms off between us” — things like headaches, rashes, and extreme fatigue. Moreover, some of the drugs that have been shown to help with severe Covid-19 cases, like famotidine and aspirin, inhibit mast cell activation...One peer-reviewed paper found that a surprising 40 percent of patients with Covid-19 showed some kind of neurologic manifestation, and more than 30 percent had impaired cognition. These symptoms — including brain fog, extreme fatigue, difficulty with short-term memory, intense headaches, and tingling or numbness — are common in long-Covid patients.”


“The long term health complications from COVID-19 are remarkably similar to what is being seen in long term high altitude workers.” Steven Magee CEng MIET - Q
Altitude Diseases: Las Vegas Threshold

- “High and Low. Does elevation trigger depression?...Some call it the Las Vegas threshold. It’s the sensation, when you drive out of Vegas down I-15 toward the Pacific, of becoming happier, lighter. Dr. Perry Renshaw attributes this phenomenon to how high you got in Vegas. But not like that. Vegas sits at 2,000 feet above sea level, and Renshaw, who studies the effects of altitude on emotional well-being, thinks that’s the exact elevation where a person’s mood starts to shift.” [https://story.californiasunday.com/high-and-low](https://story.californiasunday.com/high-and-low)
Altitude Diseases: Suicide Belt

- “High and Low. Does elevation trigger depression?...It’s long been established that the states that span the Intermountain West, from Montana to New Mexico, have the greatest suicide rates in the country. According to the Centers for Disease Control and Prevention, someone who lives in Wyoming is five times more likely to take his own life than someone who lives in Washington, D.C. Researchers who study depression call the region the Suicide Belt.”
  https://story.californiasunday.com/high-and-low
Altitude Diseases: Utah Paradox

- “High and Low. Does elevation trigger depression?...Everyone processes serotonin and dopamine in his own way. If someone is prone to low levels of serotonin, as is about a quarter of the U.S. population, elevation will likely make things harder, but if someone has normal serotonin levels and produces a lot of dopamine, he might actually feel better at elevation. “We call it the Utah paradox,” Renshaw says. “It’s the happiest and saddest place on earth.”"
  
- "Can Living at Altitude Lead to Depression?...Despite being ranked America’s happiest state with ski resorts, stargazing, and mountain trails galore, Utah also has the country’s highest suicide rates. One neuroscientist is calling it the “Utah Paradox” and thinks he has a hunch on why: high altitude— despite its risky virtues — can mess with your brain chemistry."
  
- "There's a Suicide Epidemic in Utah — And One Neuroscientist Thinks He Knows Why...But there's another side to Utah that isn't shown in surveys. Despite ranking as America's happiest state, Utah has disproportionately high rates of suicide and associated mood disorders compared to the rest of the country. In fact, it's the No. 1 state for antidepressant use. These polarized feelings of despondency and delight underlie a confusing phenomenon that Perry Renshaw, a neuroscientist at the University of Utah investigating the strange juxtaposition, calls the "Utah paradox. Utah residents and experts are aware of the paradox, often attributing gun use, low population density and the area's heavy Mormon influence as potential factors. But Renshaw thinks he's identified a more likely cause for the Utah blues: altitude."
  
- "Utah’s Depression Paradox...“Utah is interesting because we have a high number of antidepressant users and suicides, but we have a lower number of people doing counseling and alternative treatments,” she said. “People want help so they go to their doctor and get prescribed an antidepressant, and that’s all they do and they don’t feel better. Then, if the one doctor or the one medication doesn’t help them, they just give up.””
  
- "Why is Utah America's most depressed state?...“One of the perverse things about Utah is that we not only lead the nation in suicide and depression, but we’re also one of the happiest states in the land,” said Renshaw. “[It’s] something we’ve taken to calling the ‘Utah Paradox.’” From Salt Lake City, more than 4,200 feet above sea level, Renshaw began a quest to unravel the paradox. And there was one theory that he wanted to test: That altitude can dramatically affect the chemistry of the brain....The swim test, developed 30 years ago by a French psychologist because rats don't show emotion, has a simple premise: Depressed rats immersed in water give up swimming after a few minutes, and are rescued by the researchers, while the happy rats keep treading water for at least five minutes. In this study, almost all the rats that spent extended time in higher altitudes gave up...“The further you go up in altitude, starting about 2,000 feet, the more depression-like behavior you have.”...Of course, Salt Lake City can't be razed to sea level. The Suicide Belt is stuck with its topography. But Renshaw hopes knowledge of the connection might be comforting to someone battling depression who lives in, or recently moved to, a high-
altitude area. To overcome the condition, you don't have to move mountains; perhaps you just have to move you." [http://america.aljazeera.com/watch/shows/america-tonight/articles/2015/1/29/why-is-utah-americas-most-depressed-state.html](http://america.aljazeera.com/watch/shows/america-tonight/articles/2015/1/29/why-is-utah-americas-most-depressed-state.html)

- "My KiDS HAVE to wear CPAP MASKS to BED! *No Exceptions!*"
  [https://www.facebook.com/watch/?v=1604625426393479](https://www.facebook.com/watch/?v=1604625426393479)
Altitude Diseases: Roque de los Muchachos Observatory (2,396 m or 7,861 ft)

- “Roque de los Muchachos Observatory (Spanish: Observatorio del Roque de los Muchachos, ORM) is an astronomical observatory located in the municipality of Garafía on the island of La Palma in the Canary Islands. The observatory site is operated by the Instituto de Astrofísica de Canarias, based on nearby Tenerife. ORM is part of the European Northern Observatory. The seeing statistics at ORM make it the second-best location for optical and infrared astronomy in the Northern Hemisphere, after Mauna Kea Observatory, Hawaii. The site also has some of the most extensive astronomical facilities in the Northern Hemisphere; its fleet of telescopes includes the 10.4 m Gran Telescopio Canarias, the world's largest single-aperture optical telescope as of July 2009,[1] the William Herschel Telescope (second largest in Europe), and the adaptive optics corrected Swedish 1-m Solar Telescope. The observatory was established in 1985, after 15 years of international work and cooperation of several countries with the Spanish island hosting many telescopes from Britain, The Netherlands, Spain, and other countries. The island provided better seeing conditions for the telescopes that had been moved to Herstmonceux by the Royal Greenwich Observatory, including the 98 inch aperture Isaac Newton Telescope (the largest reflector in Europe at that time). When it was moved to the island it was upgraded to a 100-inch (2.54 meter), and many even larger telescopes from various nations would be hosted there.”

https://en.wikipedia.org/wiki/Roque_de_los_Muchachos_Observatory

- Steven Magee is aware of the following health issues in workers:
  - Electronics Engineers:
    - Worker 1: Irritability and aggressive behaviors.
    - Worker 2: Student working with worker 1 was routinely breathing nitrogen gas and later unexpectedly fainted and collapsed to the ground, went to hospital.
    - Worker 3: Irritable bowel syndrome and fecal urgency.
    - Worker 4: Infertility followed by irritability and panic disorder, family were noticing personality changes.
    - Worker 5: Died of throat cancer. (Was routinely breathing nitrogen gas.)
    - Worker 6: Lethargic.
    - Worker 7: Arrogant.
    - Worker 8: Arrogant.
    - All the above routinely breathed nitrogen gas.
  - Software Engineers:
    - Worker 9: Changed gender from male to female.
    - Worker 10: Changed gender from male to female. (Same job as worker 9)
    - Worker 11: Chronic Fatigue.
    - Worker 12: Forgetfulness and confusion.
    - Some of the above routinely breathed nitrogen gas.
  - Extreme Night Shift Workers:
    - Worker 13: Personality issues.
    - Worker 14: Personality issues, was shown the door for writing in the dust on the telescope mirror with a finger.
    - All the above routinely breathed nitrogen gas.
Worker Deaths:
- “3 people have died at the ORM (Roque de los Muchachos Observatory. Spanish: Observatorio del Roque de los Muchachos, ORM). One (a Finn) driving off the road and falling into a ravine, one a German who didn't take safety precautions when working on one of the 'Magic' cosmic ray telescopes and fell off a platform in the dark. Finally an Irish astronomer who I knew well dying of a burst stomach ulcer which haemorrhaged. That was a known condition he had and was advised not to come to LP (La Palma), but he did so all the same.” Ellis John Mills
- Some of these workers had offices in a building that had a cell phone transmitter on its roof.
- “Cell Tower Health Effects” [https://mdsafetech.org/cell-tower-health-effects/](https://mdsafetech.org/cell-tower-health-effects/)
- Most workers were complaining about ‘Descent Fatigue’ when returning to sea level.
- There may be more workers with health issues that Steven Magee was not aware of.
- Given that there were only about 20 people working at the summit, this list represents approximately half the workers that Steven Magee would come into contact with.
Altitude Diseases: Mauna Kea Observatories (4,205 m or 13,796 ft)

- “The Mauna Kea Observatories (MKO) are a number of independent astronomical research facilities and large telescope observatories that are located at the summit of Mauna Kea on the Big Island of Hawai‘i, United States. The facilities are located in a 525-acre (212 ha) special land use zone known as the "Astronomy Precinct", which is located within the 11,228-acre (4,544 ha) Mauna Kea Science Reserve.[1] The Astronomy Precinct was established in 1967 and is located on land protected by the Historical Preservation Act for its significance to Hawaiian culture. The presence and continued construction of telescopes is highly controversial due to Mauna Kea's centrality in native Hawaiian religion and culture, as well as for a variety of environmental reasons. The location is near ideal because of its dark skies from lack of light pollution, good astronomical seeing, low humidity, high elevation of 4,205 meters (13,796 ft), position above most of the water vapor in the atmosphere, clean air, good weather and low latitude location.” [2]

- Steven Magee was aware of the following health issues in summit workers:
  - Electronics engineers:
    - Worker 1: Behavioral issues.
    - Worker 2: Forgetfulness.
    - Worker 3: Unusual personality issues bordering mental illness.
    - Worker 4: Lethargic.
    - Worker 5: Lethargic.
    - Worker 6: Acute mountain sickness (AMS), ‘Summit Brain’ daily, developed anxiety.
    - All the above routinely breathed nitrogen, helium and oxygen gas and solvent vapors.
  - Mechanical Engineers:
    - Worker 7: Died of colon cancer.
    - Worker 8: Argumentative. (‘Voluntarily’ resigned during management meeting.)
    - Worker 9: Argumentative.
    - Worker 10: Argumentative.
    - Worker 11: Argumentative.
    - Worker 12: Unreliable.
    - All the above routinely breathed solvent vapors.
  - Administration:
    - Worker 13: Died of heart disease. (Had privately complained to me that the administration were were engaging in workplace harassment.)
    - Worker 14: Harassing staff for their ‘Voluntary’ resignations.
  - Software Engineers:
    - Worker 15: Lethargic, unable to progress project work.
  - Extreme Night Shift Workers (up to 18 hour shifts and several days long, sleeping at 9,200 feet):
    - Worker 16: Personality issues, irritable, unkempt, bordering mental illness.
    - Worker 17: Personality issues, irritable, chronically fatigued, sleeping on the job, argumentative.
    - Worker 18: Tired, sleeping on the job.
    - Worker 19: Changed gender from female attracted to males to being lesbian attracted to females.
Worker 20: Lesbian. (No idea if the gender issue occurred or was magnified in astronomy – suspected issue.).

Worker 21: Became chronically fatigued, irritable, problems with handling money, problems with computer filing systems and paperwork, amnesia issues, increasing use of oxygen to get through the night shift, drinking a lot of coffee during the night and increasing reliance on sleeping tablets for daytime sleep, hallucinations, visions, invisible friend, was taking several days between night shifts to recover from acute mountain sickness (AMS). Had rare tumor removed from knee.

Worker 22: Irritable and aggressive, and privately engaging in staff harassment techniques to obtain their ‘Voluntary’ resignation.

Worker 23: Showing severe memory issues bordering dementia.

Worker 24: Chemotherapy followed by radiation treatment for breast cancer, relatively young worker.

Astronomers - Optics:

Worker 25: Irritable, aggressive and mistreating their staff.

Visitors

Visitor 26: Unexpectedly fainted and collapsed while touring the telescopes. Administered oxygen followed by descent. ‘Healthiest’ member of tour group.

Visitor 27: "Mental exam ordered for alleged telescope attacker" [link]

Deaths:

"...incidents claimed the lives of four workers during the construction of the telescope" [link]

Mechanical technician committed suicide some years after working atop Mauna Kea.

Most workers were complaining about ‘Descent Fatigue’ when returning to sea level.

Most workers would develop ‘Summit Brain’.

Most workers were breathing intermittent oxygen approximately one to four times per day for approximately 5 to 15 minutes per time to treat their acute mountain sickness (AMS). Shared oxygen mask use that was a cross infection hazard. Lining up for oxygen administration was common.

There may be more workers with health issues that Steven Magee was not aware of.

Given that there were only about 30 people working at the summit, this list represents more than half the workers that Steven Magee would come into contact with.

“Irritability would show up in extreme night shift workers that were nearing the end of their several days of night shifts. It was severe at times in some people. It was also prevalent in the mornings after being awake and working for up to 18 hours. On the day shift, irritability was prevalent in the mechanical team, some of them were taken into management meetings because of it and at least one came out of those meetings having ‘voluntarily’ resigned. What we are talking about is environmental induced illness, which is a number of factors, not just Acute Mountain Sickness, but ‘Summit Brain’, Central Sleep Apnea, long term systemic damage to the body, drug use, breathing a variety of gasses, mercury exposure, solvent exposure, radiation sickness, industrial LASER exposure, Faraday cage sickness, Interference Radiation Sickness, Satellite Radiation Sickness, Radio Wave Sickness, and so on. The longer you have these exposures, the more biological damage that accumulates.”

Steven Magee CEng MIET
Altitude Diseases: Kitt Peak National Observatory (2,096 m or 6,877 ft)

- “The Kitt Peak National Observatory (KPNO) is a United States astronomical observatory located on Kitt Peak of the Quinlan Mountains in the Arizona-Sonoran Desert on the Tohono O'odham Nation, 88 kilometers (55 mi) west-southwest of Tucson, Arizona. With over twenty optical and two radio telescopes, it is one of the largest gatherings of astronomical instruments in the northern hemisphere.[1] Kitt Peak National Observatory was founded in 1958.[2] It was home to what was the largest solar telescope in the world, and many large astronomical telescopes of the late 20th century in the United States.[2] The observatory was administered by the National Optical Astronomy Observatory (NOAO) from the early 1980s until 2019, after which it was overseen by the National Optical-Infrared Astronomy Research Laboratory.[3]”

Steven Magee was aware of the following health issues in summit workers:
- Worker 1: Behavioral issues, forgetfulness and confusion, lethargic.
- Worker 2: Behavioral issues, forgetfulness and confusion, lethargic.
- Worker 3: Behavioral issues, forgetfulness and confusion, lethargic.
- Worker 4: Behavioral issues, forgetfulness and confusion, lethargic, strong desire to fall asleep at work, gastrointestinal issues, lung issues, urinary tract issues, hot and itchy skin, skin crawling sensations, mercury poisoning, radiation poisoning, inability to exercise, easily fatigued, chronic insomnia, relationship problems, irritability, multiple visits to doctors for progressively failing physical and mental health, contract not renewed.
- Worker 5: Behavioral issues, was fired.
- All the above were routinely breathing nitrogen gas, chemical vapors, and solvent vapors. All had exposures to high levels of stray voltage, electromagnetic fields, powerful pulsed radio wave fields from the antenna park, powerful sonic booms from military aircraft, Faraday cages, close lightning strikes, and long commutes to high altitude. All were handling mercury systems without any OSHA recognized mercury training courses or protective equipment such as mercury rated respirators and gloves.

Deaths:
- "astronomer...crushed to death between a door and a 150-ton revolving telescope dome"

All workers that Steven Magee supervised were displaying a variety of problems that had been reported to the management team.

Steven Magee’s employer, Dartmouth College, had already killed a worker through occupational mercury poisoning.

The management team would not allow Occupational Safety and Health Administration (OSHA) to visit Kitt Peak National Observatory.
Altitude Diseases: Chile (3,000 m to 5,000 m or 10,000 ft to 16,000 ft)

- “Astronomy in Chile...Chile can be considered astronomy's world capital. In 2011,[2] Chile was home to 42% of the world's astronomical infrastructure consisting mostly of telescopes. In 2015 it expected to contain around 70% of the global infrastructure by 2020.[3] In the Atacama desert region of northern Chile, the skies are exceptionally clear and dry for more than 300 days a year. These conditions have attracted the world's scientific community to develop in the Atacama desert the most ambitious astronomical projects in the history of mankind.[4][5]. Chile's diverse and active astronomical community includes Chilean and international professionals and others, such as astronomers, engineers, students, teachers and amateurs. The first documented testimony of an astronomical measurement done in Chile is the observation of a lunar eclipse by the soldier Pedro Cuadrado Chavino (June 1582).[6] He used a classic Greek method to obtain the latitude of the city of Valdivia based on the eclipse's measurements. In 1849, during the government of Manuel Bulnes, a scientific mission from the U.S. navy led by James Melville Gilliss arrived in Chile for observing Venus and Mars to calculate the Earth-Sun distance. The Gilliss mission established the first astronomical observatory in the Cerro Santa Lucia (Santiago). In 1852, the facilities were transferred to Chile and the National Astronomical Observatory was created.[7] During the second half of the 20th century, observatories from the U.S. and Europe were installed in different locations at the north of the country:[8] La Silla, Cerro Tololo, Las Campanas and later Cerro Paranal, Cerro Pachon and Chajnantor.”

- Steven Magee has not worked in Chile but has met astronomy summit staff that have and they said it was making them sick. Some left Chile because of the sickness.

- Chile Observatories:
  - Cerro Tololo Inter-American Observatory: NOAO telescopes, SMART consortium, GONG, PROMPT, ALPACA.
  - Cerro Pachon Observatory: Gemini Observatory, SOAR Telescope.
  - Llano de Chajnantor Observatory: Cosmic Background Imager (CBI), Atacama Pathfinder Experiment (APEX), Q/U Imaging Experiment QUIET,
  - Pampa La Bola and Purico Complex: Atacama Submillimeter Telescope Experiment (ASTE), NANTEN2 Observatory
  - Paranal Observatory: Very Large Telescope (VLT), Visible & Infrared Survey Telescope for Astronomy (VISTA Telescope).
  - Atacama Large Millimeter Array ALMA official site
  - La Silla Observatory: ESO telescopes,
  - Las Campanas Observatory: Carnegie telescopes, Magellan telescopes, Birmingham Solar Oscillations Network
  - Cerro El Roble Observatory
  - Manuel Foster Observatory
  - TIGO (Transportable Integrated Geodetic Observatory)

- Future facilities:
  - Giant Magellan Telescope (GMT) to be located at Las Campanas Observatory.
  - European Extremely Large Telescope (ELT) to be located in Cerro Armazones.
  - Large Synoptic Survey Telescope (LSST) to be located in Cerro Pachón Observatory (El Peñón).
• “Travel to Chajnantor — APEX and ALMA...High Altitude Health Issues. There are inherent risks in traveling at high altitude. The information below is designed for general information, and is not a substitute for specific training or experience and does not constitute medical advice. If you have any questions or concerns please consult to your doctor. When visiting the APEX/ALMA observatory site, you should be prepared to recognize and respond to the symptoms of altitude illness caused by the lower level of oxygen available at high elevations. The human body can adjust to changes in altitude, by the process called acclimatization. Symptoms of Altitude Illness: Headache. Insomnia. Irritability. Dizziness. Muscle aches. Fatigue. Loss of appetite. Nausea or vomiting. Swelling of the face, hands and feet. Danger signs include severe headache, extreme fatigue or breathlessness (especially while resting), and any neurological problems such as stumbling, confusion, poor judgment or changes in consciousness. It is crucial to descend until symptoms begin to diminish if these signs are present. Consult your health care provider or travel medicine specialist for specific recommendations about prevention and treatment. If you are interested in reading more:
http://en.wikipedia.org/wiki/Altitude_sickness
https://www.eso.org/public/usa/about-eso/travel/chajnantor/

• “Travel to Chajnantor — APEX and ALMA...Special Health and Safety advisory. A visit to ALMA or APEX at the Array Operations Site (AOS) at 5000 metres altitude at the Chajnantor Plateau, has some significant safety, security and health constraints. For this reason: Access to Array Operations Site (AOS) is granted only to staff and authorized visits, under the conditions stated below. Upon arrival at the ALMA Operations Support Facility (OSF), the visitor will be given a safety talk explaining the rules and procedures that have to be duly respected. The ALMA Safety Manual is the authoritative text and must be consulted for full details. Media visitors or others visiting as part of a job assignment may wish to consult with their supervisor or Human Resources department. The High Altitude Medical Examination (HAME) is a medical examination that certifies that the individual is fit to perform work at 5000 metres. The relevant extract to show to the occupational physician is on p. 93 of the ALMA Safety Manual. A certificate is valid during 1 year from the date of release, unless a specific lesser term is indicated by the evaluating doctor. In order to be granted access to ALMA AOS, all AOS visitors are required to: Have slept at least one night in San Pedro de Atacama or Calama for acclimatization before they can go up to the AOS. Undergo a paramedic medical check-up (blood pressure, blood oxygen level, altitude sickness symptoms, diabetes) by the OSF paramedic. Following the “OSF Clinic Exam Protocol” described on p. 94 of the ALMA Safety Manual, those who do not pass the test will not be allowed to continue to the AOS. The medical check-up is also repeated at AOS. Must meet the requirements given in the ALMA Safety Manual p. 91-93 in the version of 14 Feb. 2012. In particular: External Visitors (defined as any person not in a contractual or working relationship with any of the executives or JAO, e.g. journalists) staying at AOS less than 2 hours: need to sign a waiver form before every visit. External Visitors (defined as above) staying at AOS more than 2 hours: need to present an High Altitude Medical Examination, HAME. All Contractors (defined as any person in a contractual or working relationship with any of the ALMA executives or JAO, including so-called “freelancers”) need to present either: A statement from their Human Resources department which asserts that the person in question is covered by their work accident insurance to work at
5000 metres, or An High Altitude Medical Examination (HAME). In the special case of freelancers without work accident insurance, you may sign a waiver form although it is recommended that you also consult your physician. Members of staff of the ALMA executives or JAO: please consult your Human Resources department for full details, but a High Altitude Medical Examination (HAME) is required.”

https://www.eso.org/public/usa/about-eso/travel/chajnantor/

- “ALMA Safety Manual”

- “ALMA STATEMENT AND WAIVER OF RESPONSIBILITY FOR VISITORS...Having requested and obtained, from the Director of ALMA-JAO, due authorization to enter the ALMA Project site, I hereby make the following statement and undertake the following obligations: 1. I have been informed that the ALMA Project, its Operations Support Facility (OSF) and other installations are located at an altitude of approximately 3.000 to 5.000 mt above sea level and I agree to undertake any eventual risk on my health and assets thereof. 2. I also state that I am aware that visiting the ALMA Project may pose risks or hazards to my health. These risks might result from the nature of the area itself, its location, or from human error or negligence of persons who have scheduled or organized the activities or programmes carried out on site. I also state I have read the medical information issued by ALMA, concerning health hazards derived from a visit to a high altitude site. 3. That as a result of these potential hazards I, as an authorized visitor, am aware I may suffer body injuries or serious illnesses, leading even to death. 4. I state I have been informed about the convenience of undergoing a medical test, by a physician, prior to my visit to the ALMA Project, in order to ensure that I do not suffer from any health impairment that might render my stay, under high altitude conditions, hazardous. 5. I therefore declare I do not suffer from any physical or health impairment that prevents me from visiting high altitude sites, particularly at the altitude where the ALMA facilities are located. 6. I agree that it is my responsibility to read and abide with all safety and protection regulations and instructions given orally, or in writing, by the ALMA personnel. 7. Therefore, I accept to abide with all rules, regulations and all other instructions concerning Safety and Protection, mentioned in the above paragraph. Moreover, I accept full responsibility for any result or effects derived from my eventual noncompliance to the norms, regulations and instructions. 8. In the event of any accident or emergency that might cause injury or any type of illness, I authorize the ALMA personnel or the person to whom ALMA has delegated this authority, to seek and take all emergency measures. 9. Through this document I resign to take any action, claim, complaint or law suit of any nature whatsoever (except when resulting from deceitful behavior or gross negligence of ALMA officials, staff, executives and other personnel) resulting in harm or loss to myself or my assets, as a direct consequence of my visit to the ALMA Project. 10. I hereby accept to repair and /or leave undamaged the ALMA Project, its offices, directors, executives, staff, contractors, cessionaries and personnel in general, for any harm, injury (including death) or loss, resulting directly or as a consequence of my conduct or activities within the ALMA facilities. 11. I state I have been informed and agree, that both myself and any assets under my control (including vehicles) may be searched, at any moment, by the ALMA staff. 12. I state I have read with attention, and am aware of all statements, obligations and waivers of responsibility included in this document and know the legal consequences that may result thereof. I agree and sign this document through my own free will and in a responsible manner. This document will be valid for a year, as from the date of
Environmental Radiation LLC - https://www.environmentalradiation.com


- “A 10,000-Foot View from the ALMA Observatory in Atacama...San Pedro, and most of the Atacama Desert, is located at around 8,000 feet above sea level. The ALMA control center sits above the town at around 10,000 feet. Most impressively, the radio telescopes that make the observations are located on a plateau at 16,000 feet high. For comparison, Mount Whitney, the highest mountain in the continental U.S., is 14,505 feet above sea level. Spending time at high altitudes can have an impact on the cardiovascular and respiratory systems. The increased ultraviolet exposure is significant, and ALMA visitors (even just to the control center) are cautioned against spending prolonged periods in the sun and are advised to wear sunscreen and protective clothing. The extremely arid Atacama Desert also challenges the body’s ability to maintain proper hydration, so water is frequently provided to visitors...Telescope visitors must also spend a minimum of one night getting used to the high elevation (acclimatizing) in Calama (the town where the nearest airport is) or San Pedro to prepare the body for this challenging environment. They are also given supplemental oxygen to help prevent any altitude-related issues and to allow them to perform physical tasks that might otherwise be too difficult.” https://ispyphysiology.com/2016/09/01/a-10000-foot-view-from-the-alma-observatory-in-atacama/

- “Altitude issues?...The main highway from northern Chile to Argentina, Route 27, is the highest main road in the world. At its highest point, it reaches 15,843 feet (4,829 meters). And this is only half the story! For more than 70 miles, the highway stays above an altitude of 14,750 feet! By contrast, Lhasa, Tibet lies at a mere 11,450 feet. My wife got bad altitude sickness. I was able to drive by taking four Aspirin. If you plan to go over the Altiplano (and, since you're so close, you absolutely should) see whether oxygen is available. It's no fun, after you've driven halfway across the Altiplano, to find yourself feeling sick while knowing you have to drive all the way back again. …We have been lucky and apart from slight headache haven't had problems but do know people who have had problems above 4000m...One thing we did notice was that small cuts took longer to heal and our bodies were slower to throw off infection (I'm thinking stomach bugs) at altitude.” https://www.tripadvisor.com/ShowTopic-g303681-i11183-k3751219-Altitude_issues-San_Pedro_de_Atacama_Antofagasta_Region.html

- “This telescope is so extreme, the weak of heart need not apply...PBS NewsHour’s Rebecca Jacobson traveled to Chile to learn how scientists plan to take a picture of a black hole for the first time...The most important thing I learned from working at 16,500 feet above sea level is this: High altitude makes you stupid....Scientists working at ALMA call this a “summit moment,” where the lack of oxygen starts to affect your ability to think and communicate clearly. Every scientist we spoke with had a story: One bilingual scientist lost the ability to translate words; another tightened a screw for a full five minutes only to realize he was unscrewing it; others complained of feeling dizzy, lightheaded and taking unintelligible notes. Some say the altitude gives them a voracious appetite. Others drop weight from the nausea. The altitude also screws up your vision, which explained why my eyes had trouble focusing...Acute mountain sickness can make the body shift oxygen away from its limbs to its most vital organs, said Ivan Lopez, ALMA’s health and safety manager. Ascending to 16,000 feet with high blood pressure or a high heart rate could result in a stroke, he told us. More seriously, high altitude can cause pulmonary edema. Fluid fills your lungs, and you suffocate.” https://www.pbs.org/newshour/science/reporters-notebook

- “Chile's high oasis of huge telescopes...Staff astronomer Jonathan Smoker had warned me earlier about the effects of working in the Atacama desert, the most parched place on the planet.
“If you stay here for long your skin dries out,” he said. “Sometimes it’s so bad that my hands bleed.” Water vapour in the atmosphere blocks certain wavelengths of light. So the extreme dryness is one reason why Chile is a magnet for astronomers.”
https://www.newscientist.com/article/mg21228344-900-chiles-high-oasis-of-huge-telescopes/
Altitude Diseases: Tropical Diseases

- “Professional astronomical facilities are generally located in or near to the tropics.” Steven Magee CEng MIET – Q
- “High altitude professional astronomy took me to the Canary Islands, Hawaii, Arizona and Mexico.” Steven Magee CEng MIET – Q
- “Tropical diseases are diseases that are prevalent in or unique to tropical and subtropical regions.[1] The diseases are less prevalent in temperate climates, due in part to the occurrence of a cold season, which controls the insect population by forcing hibernation. However, many were present in northern Europe and northern America in the 17th and 18th centuries before modern understanding of disease causation. The initial impetus for tropical medicine was to protect the health of colonial settlers, notably in India under the British Raj.[2] Insects such as mosquitoes and flies are by far the most common disease carrier, or vector. These insects may carry a parasite, bacterium or virus that is infectious to humans and animals. Most often disease is transmitted by an insect "bite", which causes transmission of the infectious agent through subcutaneous blood exchange. Vaccines are not available for most of the diseases listed here, and many do not have cures. Human exploration of tropical rainforests, deforestation, rising immigration and increased international air travel and other tourism to tropical regions has led to an increased incidence of such diseases to non-tropical countries.”

https://en.wikipedia.org/wiki/Tropical_disease

- “Tropical diseases...Tropical diseases encompass all diseases that occur solely, or principally, in the tropics. In practice, the term is often taken to refer to infectious diseases that thrive in hot, humid conditions, such as malaria, leishmaniasis, schistosomiasis, onchocerciasis, lymphatic filariasis, Chagas disease, African trypanosomiasis, and dengue.”

https://www.who.int/topics/tropical_diseases/en/

- “Tropical Diseases. Some of the organisms that cause tropical diseases are bacteria and viruses, terms that may be familiar to most people since these types of organisms cause illness common in the U.S. Less well known are those more complex organisms commonly referred to as parasites. All of these types of agents may be referred to generically as pathogens -- meaning any organisms that cause disease. In the temperate climate zones, many familiar viral and bacterial diseases are spread directly from person to person, by airborne routes of transmission or by sexual contact. In the tropics, respiratory diseases (such as measles, respiratory syncytial virus, tuberculosis) and sexually transmitted diseases are also of great importance. In addition, many diseases are spread by contaminated water and food sources, since clean water and sanitary conditions are often a luxury in developing countries. Alternatively, some tropical disease agents are transmitted by an intermediate carrier or vector. The insect or other invertebrate vector picks up the pathogen from an infected person or animal and transmits it to others in the process of feeding. Often, tropical disease agents must undergo important developmental changes within the vector before they complete their life cycle and once again become infective for man.”

https://www.astmh.org/education-resources/tropical-medicine-q-a/major-tropical-diseases

- “Which diseases are considered neglected tropical diseases?”

https://www.cdc.gov/globalhealth/ntd/diseases/index.html

- “Alphabetical Index of Parasitic Diseases”

https://www.cdc.gov/parasites/az/index.html

- “Parasitic disease, also known as parasitosis, is an infectious disease caused or transmitted by a
parasite. Many parasites do not cause diseases as it may eventually lead to death of both organism and host. Parasites infecting human beings are called human parasites. Parasitic diseases can affect practically all living organisms, including plants and mammals. The study of parasitic diseases is called parasitology. Some parasites like Toxoplasma gondii and Plasmodium spp. can cause disease directly, but other organisms can cause disease by the toxins that they produce. Symptoms of parasites may not always be obvious. However, such symptoms may mimic anemia or a hormone deficiency. Some of the symptoms caused by several worm infestations can include itching affecting the anus or the vaginal area, abdominal pain, weight loss, increased appetite, bowel obstructions, diarrhea, and vomiting eventually leading to dehydration, sleeping problems, worms present in the vomit or stools, anemia, aching muscles or joints, general malaise, allergies, fatigue, and nervousness. Symptoms may also be confused with pneumonia or food poisoning. The effects caused by parasitic diseases range from mild discomfort to death. The nematode parasites Necator americanus and Ancylostoma duodenale cause human hookworm infection, which leads to anaemia, protein malnutrition and, in severely malnourished people, shortness of breath and weakness. This infection affects approximately 740 million people in the developing countries, including children and adults, of the tropics specifically in poor rural areas located in sub-Saharan Africa, Latin America, Southeast Asia and China. Chronic hookworm in children leads to impaired physical and intellectual development, school performance and attendance are reduced. Pregnant women affected by a hookworm infection can also develop anemia, which results in negative outcomes both for the mother and the infant. Some of them are: low birth weight, impaired milk production, as well as increased risk of death for the mother and the baby.  

- “Human parasites include various protozoa and worms that may infect humans that cause parasitic diseases. Human parasites are divided into endoparasites, which cause infection inside the body, and ectoparasites, which cause infection superficially within the skin. The cysts and eggs of endoparasites may be found in feces, which aids in the detection of the parasite in the human host while also providing the means for the parasitic species to exit the current host and enter other hosts. Although there are a number of ways in which humans can contract parasitic infections, observing basic hygiene and cleanliness tips can reduce its probability. The most accurate diagnosis is by qPcr DNA antigen assay, not generally available by primary care physicians in the USA: most labs offer research only service.”  
- “Parasitic Infections...Parasites are organisms that live in (or on) another organism, called the host. The parasitic can be microscopic or large enough to see with the naked eye, and they survive by feeding from the host. They can also spread parasitic infections, which can lead to sepsis. Sometimes incorrectly called blood poisoning, sepsis is the body’s often deadly response to infection. Sepsis kills and disables millions and requires early suspicion and rapid treatment for survival. Sepsis is and septic shock can result from an infection anywhere in the body, such as pneumonia, influenza, or urinary tract infections. Worldwide, one-third of people who develop sepsis die. Many who do survive are left with life-changing effects, such as post-traumatic stress disorder (PTSD), chronic pain and fatigue, organ dysfunction (organs don’t work properly), and/or amputations.”  
- “Transmission of Parasitic Diseases...Numerous parasites can be transmitted by food including many protozoa and helminths. In the United States, the most common foodborne parasites are protozoa such as Cryptosporidium spp., Giardia intestinalis, Cyclospora cayetanensis, and
Toxoplasma gondii; roundworms such as Trichinella spp. and Anisakis spp.; and tapeworms such as Diphyllobothrium spp. and Taenia spp. Many of these organisms can also be transmitted by water, soil, or person-to-person contact. Occasionally in the U.S., but often in developing countries, a wide variety of helminthic roundworms, tapeworms, and flukes are transmitted in foods such as undercooked fish, crabs, and mollusks; undercooked meat; raw aquatic plants, such as watercress; and raw vegetables that have been contaminated by human or animal feces. Some foods are contaminated by food service workers who practice poor hygiene or who work in unsanitary facilities. Symptoms of foodborne parasitic infections vary greatly depending on the type of parasite. Protozoa such as Cryptosporidium spp., Giardia intestinalis, and Cyclospora cayetanensis most commonly cause diarrhea and other gastrointestinal symptoms. Helminthic infections can cause abdominal pain, diarrhea, muscle pain, cough, skin lesions, malnutrition, weight loss, neurological and many other symptoms depending on the particular organism and burden of infection. Treatment is available for most of the foodborne parasitic organisms.

• “High Bacteria Count Reported At Hilo’s “Ice Pond”...The public is advised of a water quality exceedance of enterococci at Exit of Ice Pond, Hawai‘i. Levels of 178 per 100 mL have been detected during routine beach monitoring. The Department of Health Clean Water Branch provides beach monitoring and notification through its beach program. The advisory for this beach is posted because testing for enterococci indicate that potentially harmful microorganisms such as bacteria, viruses, protozoa, or parasites may be present in the water. Swimming at beaches with pollution in the water may make you ill. Children, the elderly, and people with weakened immune systems are the most likely populations to develop illnesses or infections after coming into contact with polluted water, usually while swimming.”

• “Irritable Bowel Syndrome (IBS) — or Intestinal Parasites?...I think IBS is being used by doctors as a catch-all diagnosis for a complicated host of symptoms that need to be explored in depth before the root cause (such as yeast, parasites or food sensitivities) can be identified and treated. Because of my own experience with GI distress, I now test for intestinal parasites in every woman who comes into the clinic with a diagnosis of IBS or similar symptoms. You may be surprised to learn that 40% of these women prove to have intestinal parasites — even though many have never left the United States....In the mid 1980s I went to Mexico and ended up with what is known as “Montezuma’s Revenge.” I returned to the U.S. and realized I had all the symptoms that my patients had been complaining about. So I did a stool test which was sent to the hospital. I was surprised when the test indicated nothing abnormal...Being the persistent person that I am, I did not stop there, but began to explore within the alternative medical community what options were available. I found a chiropractor who recommended a lab in Arizona. Sure enough, this stool test came back indicating intestinal parasites. She then effectively treated me and also recommended staying away from particular foods to which I had become sensitive. My symptoms disappeared.”

• “Health Hazards Posed by Rodents...It's not uncommon, especially during the winter months, to have an unpleasant encounter with a rodent who has made its way into a home uninvited. What many people do not realize, however, is that these pests can be much more than a nuisance. Rodents such as rats and mice are associated with a number of health risks. In fact, rats and mice are known to spread more than 35 diseases. These diseases can be spread to humans directly through handling of live or dead rodents, contact with rodent feces, urine, or saliva, as
well as rodent bites. Diseases carried by rodents can also be spread to humans indirectly through fleas, ticks, or mites that have fed on an infected rodent...Below is a summary of some of the most common diseases associated with rodents: Hantavirus, lymphocytic choriomeningitis, tularemia and plague.”

- “Diseases directly transmitted by rodents” [https://www.cdc.gov/rodents/diseases/direct.html](https://www.cdc.gov/rodents/diseases/direct.html)
- “Protozoan Parasites of Rodents and Their Zoonotic Significance in Boyer-Ahmad District, Southwestern Iran...Wild rodents are reservoirs of various zoonotic diseases, such as toxoplasmosis, babesiosis, and leishmaniasis. The current study aimed to assess the protozoan infection of rodents in Boyer-Ahmad district, southwestern Iran. Materials and Methods. A total of 52 rodents were collected from different parts of Boyer-Ahmad district, in Kohgiluyeh and Boyer-Ahmad province, using Sherman live traps. Each rodent was anesthetized with ether, according to the ethics of working with animals, and was dissected. Samples were taken from various tissues and stool samples were collected from the contents of the colon and small intestines. Moreover, 2 to 5 mL of blood was taken from each of the rodents and the sera were examined for anti-Leishmania antibodies, by ELISA, or anti-T. gondii antibodies, by modified agglutination test (MAT). DNA was extracted from brain tissue samples of each rodent and PCR was used to identify the DNA of T. gondii. Results. Of the 52 stool samples of rodents studied by parasitological methods, intestinal protozoa infection was seen in 28 cases (53.8%). From 52 rodents, 19 (36.5%) were infected with Trichomonas, 10 (19.2%) with Giardia muris, and 11 (21.2%) with Entamoeba spp. Also, 10 cases (19.2%) were infected with Blastocystis, 3 (5.8%) were infected with Chilomastix, 7 (13.5%) were infected with Endolimax, 1 (1.9%) was infected with Retortamonas, 3 (5.77%) were infected with T. gondii, and 6 (11.54%) were infected with Trypanosoma lewisi. Antibodies to T. gondii were detected in the sera of 5 (9.61%) cases. Results of the molecular study showed T. gondii infection in 3 (5.77%) of the rodents. Findings of this study showed that rodents in Kohgiluyeh and Boyer-Ahmad province, southwestern Iran, are infected with several blood and intestinal parasites; some of them might be potential risks to residents and domestic animals in the region.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4779541/#sec1title](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4779541/#sec1title)
- “Kitt Peak National Observatory was infested with rodents. There were so many that traps were in daily use there.” Steven Magee CEng MIET – Q
- “Blastocystis hominis...Blastocystis hominis is a microscopic organism that sometimes is found in the stools of people who have ingested contaminated food or water. It can be found in healthy people who aren't having digestive symptoms, and it's also sometimes found in the stools of people who have diarrhea, abdominal pain or other gastrointestinal problems.” [https://www.nchmd.org/education/mayo-health-library/details/CON-20155618](https://www.nchmd.org/education/mayo-health-library/details/CON-20155618)
- “The first stool sample after leaving Kitt Peak National Observatory detected Blastocystis Hominis in January 2009.” Steven Magee CEng MIET
- “Parasitic Infections in Children...Several parasitic diseases occur occasionally in the United States and more frequently in developing countries, but their prevalence has not been well studied. They include strongyloidiasis, caused by a worm infection that is of particular danger for children with an impaired immune system. It is acquired when larvae (immature worms) in soil contaminated with infected human feces come into contact with and penetrate the skin. They also include visceral toxocariasis, spread when children ingest soil contaminated with dog or cat feces containing the eggs of cat or dog roundworms, and cutaneous larva migrans, transmitted when children walk barefoot on soil contaminated with cat or dog hookworm larvae.
that penetrate their skin.” https://www.cdc.gov/parasites/children.html

- “Parasites and 7 Other Reasons You Aren’t Sleeping...When was the last time you got a good night’s sleep? If you’re working back through your memory, and can’t remember, or maybe even forget what you were doing halfway through, that’s a good sign that you’re chronically sleep deprived. It’s a very common problem these days with nearly one quarter of Americans saying they experience insomnia on a regular basis...Chronic insomnia that lasts months or even years has dire consequences. Studies show that sleep loss over time contributes to an increased risk of developing practically every major chronic illness, including diabetes, heart disease and Alzheimer’s. Inadequate sleep also leaves you with a higher likelihood of becoming obese and developing cancer....Parasites: This is a bit of a squeamish one — nasty creatures living in your gut or blood stream could actually be keeping you awake at night. Experts point out that many parasites are most active at inopportune hours such as 3 or 4 a.m. Functional medicine practitioners can diagnose and treat parasitic infections without doing damage to your fragile friendly gut bacteria.” https://www.thealternativedaily.com/reasons-for-insomnia/

- “Parasites and Sleep..."80% of my clients have parasites, and getting rid of them is crucial for sleep" - Christine Hansen...Sleep Disorders And Parasites. Parasites in the intestinal tract are a trigger for insomnia. Their presence undermines the nervous system, which regulates sleep patterns, causing sleep issues. Their presence also set your immune system into motion, generating in spike in cortisol which is your wake up hormone. Not very handy to have at 3am Research indicates parasites may also generate high levels of ammonia in the brain. The brain then lacks an essential enzyme ornithe curbamyl-transferase, which transforms ammonia into urea in the liver and kidneys. Ornithine, an ammonia reducer, can induce sleep in sleep-deprived persons. After eliminating a parasitic infestation, sleep quality is usually greatly improved. Grinding your teeth in your sleep is another sign of a possible parasite infestation. Teeth grinding, also called bruxism, may occur while you sleep due to anxiety and restlessness caused by the toxins and waste released by the parasites into their host’s body.” https://sleeplikeaboss.com/parasites-and-sleep/

- “The parasite that disrupts sleep...Trypanosoma brucei infection disrupts the sleep-wake cycle, leading to daytime sleepiness and insomnia at night. Scientists now know how the parasites do this....Transmitted by the tse-tse fly, the Trypanosoma brucei parasite causes African trypanosomiasis, or sleeping sickness, a disease characterized by disturbed sleep patterns that is fatal without treatment...The researchers also detected the short circadian period in fibroblasts cultivated in the presence of parasites in a petri dish, indicating that the parasite may secrete a substance that controls the biological clock.” https://www.biotechniques.com/microbiology/the-parasite-that-disrupts-sleep/

- “Cystoisosporiasis FAQs...Cystoisospora can be found worldwide. It is most common in tropical and subtropical areas....People become infected by swallowing mature parasites, for example, by ingesting contaminated food or water. Infected people shed the immature form of the parasite in their feces. The parasite usually needs about 1 or 2 days in the environment (outside of people) to mature enough to infect someone else. In some settings, the parasite might mature in less than a day...The most common symptom is watery diarrhea. Other symptoms can include abdominal pain, cramps, loss of appetite, nausea, vomiting, and fever. If untreated, people with weak immune systems, such as people with AIDS, may be at higher risk for severe or prolonged illness...Cystoisospora is too small to be seen without a microscope. The infection is diagnosed by examining stool (fecal) specimens under a microscope. More than one specimen may need to be examined to find the parasite...The infection is treated with
prescription antibiotics. The usual treatment is with trimethoprim-sulfamethoxazole, which is also known as Bactrim*, Septra*, or Cotrim*. People who have diarrhea should also rest and drink plenty of fluids.” [https://www.cdc.gov/parasites/cystoisospora/faqs.html]

- “Antiparasitics are a class of medications which are indicated for the treatment of parasitic diseases, such as those caused by helminths,[1] amoeba,[2] ectoparasites, parasitic fungi,[3] and protozoa,[1] among others. Antiparasitics target the parasitic agents of the infections by destroying them or inhibiting their growth;[4] they are usually effective against a limited number of parasites within a particular class. Antiparasitics are one of the antimicrobial drugs which include antibiotics that target bacteria, and antifungals that target fungi. They may be administered orally, intravenously or topically.[4] Broad-Spectrum antiparasitics, analogous to broad-spectrum antibiotics for bacteria, are antiparasitic drugs with efficacy in treating a wide range of parasitic infections caused by parasites from different classes.” [https://en.m.wikipedia.org/wiki/Antiparasitic]

- “You Probably Have a Parasite—Here’s What to Do About It...We often think of parasites as something to worry about only when we travel, so the Center for Disease Control statistic that more than 60 million Americans are infected with parasites—and most don’t even know it—is jarring, considering both the ick factor and the energy-depleting health consequences. Dr. Linda Lancaster, a Santa Fe-based naturopathic physician and homeopath, says parasites are at the root of many types of illnesses and suspects that infection rates are likely much higher than CDC data suggests. Below, she outlines what you need to know about parasitic infections, and gives us a peek into the unique treatment that she’s famous for: Patient-specific cleanses that use goat milk and herbs to eliminate parasites, which allows patients to skip out on harsh drug regimens...Fatigue, exhaustion, and brain fog are also common symptoms of parasites. Many times, I’ve put people on a parasite program, and they’ve come out feeling energized—because they’ve been bogged down by a parasite sapping their energy for years. That fatigue and lack of get-up-and-go can also lead to depression, anger, and neurological issues.” [https://goop.com/wellness/detox/you-probably-have-a-parasite-heres-what-to-do-about-it/]


- “Global change, parasite transmission and disease control: lessons from ecology...Parasitic infections are ubiquitous in wildlife, livestock and human populations, and healthy ecosystems are often parasite rich. Yet, their negative impacts can be extreme. Understanding how both anticipated and cryptic changes in a system might affect parasite transmission at an individual, local and global level is critical for sustainable control in humans and livestock. Here we highlight and synthesize evidence regarding potential effects of ‘system changes’ (both climatic and anthropogenic) on parasite transmission from wild host–parasite systems. Such information could inform more efficient and sustainable parasite control programmes in domestic animals or humans. Many examples from diverse terrestrial and aquatic natural systems show how abiotic and biotic factors affected by system changes can interact additively, multiplicatively or antagonistically to influence parasite transmission, including through altered habitat structure, biodiversity, host demographics and evolution. Despite this, few studies of managed systems explicitly consider these higher-order interactions, or the subsequent effects of parasite evolution, which can conceal or exaggerate measured impacts of control actions. We call for a more integrated approach to investigating transmission dynamics, which recognizes these
complexities and makes use of new technologies for data capture and monitoring, and to support robust predictions of altered parasite dynamics in a rapidly changing world. This article is part of the themed issue ‘Opening the black box: re-examining the ecology and evolution of parasite transmission’. “https://royalsocietypublishing.org/doi/10.1098/rstb.2016.0088

- “Home Remedies and Herbs for Parasitic Disease...Some parasitic diseases are more common in underdeveloped areas of the world. However, there are parasites that can be contracted in North America. Some common parasitic diseases include: Trichomoniasis. Giardiasis. Cryptosporidiosis. Toxoplasmosis....Parasitic diseases can be contracted in many different ways. Some of the ways people contract parasites include: Food. Water. Bug bite. Sexual contact...Diatomaceous Earth is the most effective natural product for Parasitic Disease. Take 1 tablespoon full of diatomaceous earth daily for up to 1 week. You can mix it in with a smoothie or another beverage of your choice.” https://www.curesdecoded.com/conditions/parasitic-disease/186

- “Tropical medicine is an interdisciplinary branch of medicine that deals with health issues that occur uniquely, are more widespread, or are more difficult to control in tropical and subtropical regions.[1] Physicians in this field diagnose and treat a variety of diseases and ailments. Most infections they deal with are endemic to the tropics. A few of the most well-known include malaria, HIV/AIDS, and tuberculosis. They must be knowledgeable in the 18 lesser known neglected tropical diseases, which include Chagas disease, rabies, and dengue. Poor living conditions in underdeveloped tropical countries have led to a rising number of non-communicable diseases. These diseases include cancer and cardiovascular disease, which, in the past, have been more of a worry in developed countries. Physicians trained in tropical medicine must also be prepared to diagnose and treat these diseases.[1] Training for physicians wishing to specialize in tropical medicine varies widely over the different countries. They must study epidemiology, virology, parasitology, and statistics, as well as the training required of an ordinary MD. Research on tropical diseases and how to treat them comes from both field research and research centers, including those of the military.[2] Sir Patrick Manson is recognized as the father of tropical medicine. He founded the London School of Hygiene & Tropical Medicine in 1899.[3] He is credited with discovering the vector by which elephantiasis was being passed to humans. He learned it was a microscopic nematode worm called filaria sanguinis hominis. He continued to study this worm and its life cycle and determined the worms underwent metamorphosis within female culex fatigans mosquitoes. Thus he discovered mosquitoes as a vector for elephantiasis. After this discovery he collaborated with Ronald Ross to examine the transmission of malaria via mosquito vector. His work with discovering vectors as modes of transmission was critical in the founding of tropical medicine and our current understanding of many tropical diseases.” https://en.wikipedia.org/wiki/Tropical_medicine

- “The Liverpool School of Tropical Medicine (LSTM) is a higher education institution with degree awarding powers[1] and registered charity[2] located in Liverpool, United Kingdom. Established in 1898, it was the first institution in the world dedicated to research and teaching in tropical medicine. The school has a research portfolio of over £220 million, assisted by funding from organisations such as the Bill & Melinda Gates Foundation, Wellcome Trust and Department for International Development (DFID).” https://en.wikipedia.org/wiki/Liverpool_School_of_Tropical_Medicine
Altitude Diseases: Visitors

- “A visiting student in La Palma was working with an astronomical detector engineer and routinely breathing nitrogen gas. He later unexpectedly fainted, collapsed to the ground and went to hospital.” Steven Magee CEng MIET - Q
- “I took my parents and past girlfriend up to the very high altitude summit of Mauna Kea to visit the W. M. Keck Observatory. The plan was to spend a few hours at the summit, but after half an hour they all became sickly and we had to leave.” Steven Magee CEng MIET - Q
- “I saw a guy faint at the W. M. Keck Observatory, he stepped out from the tour group and said to me "I'm feeling sick" and then his eyes rolled back and his knees gave way! The group caught him on his way to the ground and he got free emergency medical oxygen for half an hour before being evacuated off the summit by his tour group!!! His friends stated that he was considered the healthiest person in the group while he was gasping for breaths of life on the summit of Mauna Kea! Never saw him again.” Steven Magee CEng MIET – Q
- “I gave a tour to a large group of young students and their teacher at the W. M. Keck Observatory atop Mauna Kea. No one had oxygen administration equipment on. A few hours later I got a phone call stating that one of them had forgotten their backpack. ‘Summit Brain’ I thought. I located the backpack and was able to return it to them, as they were staying at the beach near to where I lived. I always wondered what their long term health outcomes were after experiencing ‘Summit Brain’. ” Steven Magee CEng MIET – Q
- “I have taken many people up to the very high altitude summit of Mauna Kea to visit the W. M. Keck Observatory. It is not something I would do today due to my extensive knowledge of High Altitude Observatory Diseases.” Steven Magee CEng MIET - Q
- “I made the mistake of taking a past girlfriend up to Kitt Peak National Observatory to fill the instrument cryostat with liquid nitrogen. It was one of the largest cryostats at the facility and took a long time to fill. The entire time there was a huge plume of cold nitrogen gas coming out of it, visible for several feet. After we were finished, she started complaining of feeling sick to the point that she thought she was going to vomit. It lasted for several hours. A couple of years later she started showing signs and symptoms of fatigue and depression. I always felt guilty that I exposed her to the nitrogen gas, as I had no idea how toxic it was because I had never been sent on an OSHA approved cryogenic liquid training course.” Steven Magee CEng MIET
Altitude Diseases: Other High Altitude Activities

- Pilots, Air Cabin Crew & Frequent Fliers
  - “Ask an Airline Pilot: Why Do I Feel So Worn Out After a Flight?”

- Skydivers
  - “What Actually Happens To Your Body When You Sky Dive 13,000 Feet...During your descent from a height of 13,000 feet, you’ll also experience rapid changes in atmospheric pressure, which can have a huge impact on your ears and your sinuses. In a review in Current Sports Medicine Reports, researchers investigating the impact of extreme pressure changes inherent in activities like scuba diving and skydiving found that the pressure in the sinus and ears decreases during the flight up, forcing air in through a “reverse sneeze.” But during free fall, pressure increases, squeezing air out of the ear and sinus. These sudden changes in pressure can give you ear and sinus pain as well as vertigo, headache, and nausea.”
    https://www.inverse.com/article/35684-skydiving-impact-on-your-body
  - “The dangers of skydiving...skydivers typically can make up to 10 jumps a day, which increases the odds of an accident...Skydiving injuries often involve dislocations of limbs, and bone fractures during high impact landings, on both land and water. Parachute or lifejacket malfunctions can also hugely increase injury risk. Spinal cord injuries, paralysis and traumatic brain injuries have also been recorded.”
  - “High or Hypoxic?...Just ten minutes above 12,000 feet is all it takes before the onset of hypoxia is a serious probability...some metabolic disorders and infections can cause problems with red blood cells, so anybody experiencing problems at altitude, or unexplained tiredness at other times should seek professional advice, explain their concerns and ask for appropriate tests. And of course, perfect blood won’t carry enough oxygen if you have a defect with, say, a heart valve, or a reduced pumping capacity.”
    http://www.skydivemag.com/article/20130816-high-or-hypoxic?fwd=1
  - “What are the effects of skydiving on the body?...the effects on the body are mainly long-term as in being hungover and having a really bad headache or just not wanting to do anything the next day”
    http://www.answers.com/Q/What_are_the_effects_of_skydiving_on_the_body
  - “Skydiving accident kills visitor, instructor...Hawaii’s tight-knit skydiving community is mourning the death of a veteran instructor and his young student on Sunday. Tandem parachute instructor Greg Hunter, 44, and 18-year-old Margaret Jean Thomas of Papillion, Neb. were killed after falling 9,000 feet into a back yard on the North Shore. A longtime skydiver, Hunter was also a commercial diver, boat captain, and scuba instructor.”
  - “I did a tandem free fall skydive from 10,000 feet with Greg Hunter the day before he was killed. After the jump he informed me that the parachute had tangled after deployment and he had to untangle it. He said it had been tangling frequently.”
    Steven Magee CEng MIET - Q
  - “There really should be a legal requirement for skydiving customers to be fully informed...”

480
about the age and failure history of the parachute that they are using prior to the jump.”

Steven Magee CEng MIET - Q

“it is important that skydivers and BASE jumpers realize that they may be accumulating hypoxic brain damage and should not be repacking parachutes due to the errors it may cause.” Steven Magee CEng MIET - Q

“Falling. Can you parachute twenty-five miles and survive?...Above ten thousand feet, pilots without air tanks begin to suffer hypoxia: their brains get so little oxygen that they start to speak gibberish and make foolish errors.”

https://www.newyorker.com/magazine/2007/08/13/falling-4

"Authorities Raise Death Toll To 11 In Hawaii Skydiving Plane Crash..."In my 40 years as a firefighter here in Hawaii, this is the most tragic aircraft incident that we had,..."Oahu Parachute Center's website advertises jumps from either 10,000 feet or 14,000 feet using a King Air 90, "the fastest skydiving plane in Hawaii.""


• BASE Jumpers

“Why Are So Many BASE Jumpers Dying?...In researching 2016’s dramatic rise in BASE jumping deaths, I was almost unable to keep up with the pace with which people were dying.”


• Skiers

“Is Skiing Harmful To Health?”


• Mountain Climbers

“Are the Mountains Killing Your Brain? Alarming new science shows that thin air can wreck brain cells—at lower altitudes than you'd think…\n\nENLARGED VIRCHOW-ROBIN (VR) SPACES. Widening of spaces surrounding blood vessels in the brain. They are caused by brain swelling or atrophy and are associated with age-related cognitive decline, dementia, and various brain diseases.\n\nCORTICAL ATROPHY. Loss of neurons in the cerebral cortex—the surface layer of the brain, which carries out conscious thought, physical perception, and higher-level control of body movements.\n\nSUBCORTICAL LESION. Damage to the white matter beneath the cerebral cortex. In a climber's brain, the damage is often caused by small strokes—clots that form in the thickened blood, starving the surrounding tissue of oxygen. White matter is the network that transfers signals between parts of the brain, so damage causes widespread and irreversible problems.”

https://www.outsideonline.com/1884846/are-mountains-killing-your-brain

“Climbers Face Lasting Effects if Brain Swells”

https://www.medpagetoday.com/meetingcoverage/rsna/36195

“High altitude sickness can lead to long-term brain damage...German researchers have used MRI to get a closer look at the potentially devastating neurological impact of high altitude sickness. In research presented at last week's RSNA congress in Chicago, they showed that mountain climbers can have traces of bleeding in the brain years after the initial incident.”


“Mountain Climbing Can Actually Cause Psychosis, And We Don't Know Why. It's not the same as altitude sickness…HP Lovecraft may be a polarising figure nowadays, but he was right about one thing: there's madness in them thar mountains. And now researchers have determined a new medical entity, discrete from altitude sickness, that causes it. They're
calling it high-altitude psychosis, and it occurs at altitudes of over 7,000 metres (23,000 feet) - often manifesting as extreme hallucinations. There have been many documented cases of mountaineers experiencing psychotic episodes at extreme altitudes.”
https://www.sciencealert.com/mountain-climbing-madness-high-altitude-psychosis

- **Hikers**
  - “Hazards of mountain climbing and hiking...Abstract. At elevations above 1500 m, even a healthy person undergoes acclimatization. To avoid problems such as acute mountain sickness (AMS), high altitude cerebral edema (HACE) or high altitude pulmonary edema (HAPE), the speed of ascent and the daily sleeping elevation are of primary importance. Mild symptoms and peripheral swelling are usually harmless. However, when the severity of altitude sickness progresses, rapid therapy and immediate transport to lower elevations can be life-saving under certain conditions. A sojourn in the mountains requires effective preparation and prophylaxis against oxygen deficiency, increased UV radiation, as well as against the possibility of hypothermia and frostbite.”
  

- **Military**
  - “Military applications of hypoxic training for high-altitude operations...Rapid deployment of unacclimatized soldiers to high mountainous environments causes debilitating effects on operational capabilities (physical work performance), and force health (altitude sickness).”
  
  - “Army studies high-altitude health effects...At 4,000 ft. above sea level you first start seeing a lack of physical performance. 8,000 ft. is usually the altitude at which cognitive performance is affected. And we've found that 10,000 ft. is the threshold where judgment starts to become impaired”
  
  https://www.army.mil/article/32487/army_studies_high_altitude_health_effects
  - “USARIEM is an internationally recognized center of excellence for Warfighter health and performance. Our research studies are conducted by scientists from our four research divisions, working in concert with one another, as well as other world-class scientists from government, industry and academia.”
  
  http://www.usariem.army.mil/index.cfm/research
Altitude Diseases: Chronic Mountain Sickness (CMS) - Monge's disease

- “Chronic mountain sickness (CMS or Monge's disease) is a disease in which the proportion of blood volume that is occupied by red blood cells increases (polycythaemia) and there is an abnormally low level of oxygen in the blood (hypoxaemia). CMS typically develops after extended time living at high altitude (over 2,500 metres (8,200 ft)). It is most common amongst native populations of high altitude nations.[1] The most frequent symptoms of CMS are headache, dizziness, tinnitus, breathlessness, palpitations, sleep disturbance, fatigue, loss of appetite, confusion, cyanosis, and dilation of veins.[2]. CMS was first described in 1925 by Carlos Monge Medrano, a Peruvian doctor who specialised in diseases of high altitude.[3] While acute mountain sickness is experienced shortly after ascent to high altitude, chronic mountain sickness may develop only after many years of living at high altitude. In medicine, high altitude is defined as over 2,500 metres (8,200 ft), but most cases of CMS occur at over 3,000 metres (9,800 ft). It has recently been correlated with increased expression of the genes ANP32D and SENP1.[4][5]” [https://en.m.wikipedia.org/wiki/Chronic_mountain_sickness

- “Neurological Complications of High Altitude...Chronic mountain sickness (CMS) is found in all populations that have lived at altitude for many years. With the exception of Han Chinese immigrants in Tibet, it is not a disease of lowlanders. It was first recognized in 1925 in Peru by Carlos Monge and is also known as Monge's disease. Its incidence increases with altitude and age. It is characterized by excessive erythrocytosis with hematocrits exceeding 80% (CMS), which predominates in the Andes, and in some cases high-altitude pulmonary hypertension, which is more common in Asia. It improves with descent to lower altitudes.” [https://www.sciencedirect.com/topics/medicine-and-dentistry/altitude-disease

- “Age as a cause of chronic mountain sickness (Monge's disease)...Chronic mountain sickness (CMS) or Monge's disease is a clinical entity observed among residents at altitude characterized by polycythaemia increased above the physiological level due to altitude adaptation. From correlation studies of haematocrit with ventilation rate of healthy and diseased native high altitude residents (4,540 m) it was found that CMS is a clinical manifestation of aging. The higher the altitude the sooner the symptoms of excessive polycythaemia will become evident.” [https://link.springer.com/article/10.1007/BF01463864

- “Chronic Mountain Sickness: Clinical Aspects, Etiology, Management, and Treatment...Millions of people worldwide live at a high altitude, and a significant number are at risk of developing Chronic Mountain Sickness (CMS), a progressive incapacitating syndrome caused by lifelong exposure to hypoxia. CMS is characterized by severe symptomatic excessive erythrocytosis (EE; Hb ≥19 g/dL for women and Hb ≥21 g/dL for men) and accentuated hypoxemia, which are frequently associated with pulmonary hypertension. In advanced cases, the condition may evolve to cor pulmonale and congestive heart failure.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4913504/

- “New Insights into the Genetic Basis of Monge's Disease and Adaptation to High-Altitude...Human high-altitude (HA) adaptation or mal-adaptation is explored to understand the physiology, pathophysiology, and molecular mechanisms that underlie long-term exposure to hypoxia. Here, we report the results of an analysis of the largest whole-genome-sequencing of Chronic Mountain Sickness (CMS) and nonCMS individuals, identified candidate genes and functionally validated these candidates in a genetic model system (Drosophila). We used PreCIOSS algorithm that uses Haplotype Allele Frequency score to separate haplotypes.
carrying the favored allele from the noncarriers and accordingly, prioritize genes associated with the CMS or nonCMS phenotype. Haplotypes in eleven candidate regions, with SNPs mostly in nonexonic regions, were significantly different between CMS and nonCMS subjects. Closer examination of individual genes in these regions revealed the involvement of previously identified candidates (e.g., SENP1) and also unreported ones SGK3, COPS5, PRDM1, and IFT122 in CMS. Remarkably, in addition to genes like SENP1, SGK3, and COPS5 which are HIF-dependent, our study reveals for the first time HIF-independent gene PRDM1, indicating an involvement of wider, nonHIF pathways in HA adaptation. Finally, we observed that down-regulating orthologs of these genes in Drosophila significantly enhanced their hypoxia tolerance. Taken together, the PreCIOSS algorithm, applied on a large number of genomes, identifies the involvement of both new and previously reported genes in selection sweeps, highlighting the involvement of multiple hypoxia response systems. Since the overwhelming majority of SNPs are in nonexonic (and possibly regulatory) regions, we speculate that adaptation to HA necessitates greater genetic flexibility allowing for transcript variability in response to graded levels of hypoxia.”

- “A case of “chronic mountain sickness” in the United States. Clinical, physiologic and electrocardiographic observations...1. A case of chronic mountain sickness is described in a resident of the Colorado Rocky Mountains. Clinical, electrocardiographic and cardiopulmonary physiologic studies are presented. Signs, symptoms and electrocardiographic abnormalities disappeared when the patient moved to sea level. However, evidence of persistent intrinsic, mild pulmonary disease could still be identified after he had resided at sea level for more than two years. 2. It is proposed that some cases of chronic mountain sickness may result from disturbances in respiratory gas exchange and altered ventilation-perfusion ratios on the basis of intrinsic pulmonary disease, too mild to cause signs or symptoms at sea level.”
- “After a decade in high altitude astronomy, I appear to have a variation of Monge’s disease, as I always feel better at sea level than at altitude in Tucson, Arizona, USA.”
Altitude Diseases: Magee’s Disease

- “There appears to be a form of chronic mountain sickness that comes from years of repeated frequent malacclimitization to very high altitudes by the sea level adapted human living at sea level. It eventually shows up as sleep apnea, bruxism, erratic low blood oxygenation, fatigue, forgetfulness, confusion, gastrointestinal issues, nutritional deficiencies, hormone problems, radiation sickness and failure to acclimatize to any altitude. Left untreated it progresses onto include nerve pains throughout the body, food intolerance, heart arrhythmia’s, headaches, irritability, depression, disease and premature death. I call it ‘Magee's Disease’.” Steven Magee CEng MIET - Q
- “Magee’s Disease was discovered by Chartered Electrical Engineer Steven Magee as he used his biomedical training to work through an array of strange health conditions that showed up during and after his time in very high altitude astronomy atop the biologically toxic summit of Mauna Kea, Hawaii, USA.” Steven Magee CEng MIET - Q
- “Magee’s Disease is a chronic lifelong condition that may lead to permanent disability. It presents as permanent altitude sickness, regardless of the altitude that the person is at. There is no known cure, only treatment options. Avoidance of high altitudes by the sea level adapted human may prevent the development of the condition in healthy people.” Steven Magee CEng MIET - Q
- Symptoms of Magee’s disease:
  - Infertility issues.
  - Fatigue.
  - Malaise.
  - Sleepiness.
  - Insomnia.
  - Headaches.
  - Forgetfulness (Amnesiac Disorders).
  - Confusion.
  - May be disorganized with paperwork.
  - May be untidy and disorganized.
  - May be unkempt.
  - Irritability.
  - Aggressiveness.
  - Tumors.
  - Aching bones.
  - Plantar Fasciitis.
  - Yellowing teeth.
  - Lower blood oxygen levels than the healthy local population.
  - Erratic day and night blood oxygen levels.
  - Significant weight gain.
  - Poisoning may be causing urinary tract infection (UTI) like symptoms from urinating the poison out as the kidneys filter it from the blood.
  - May be getting poor performance warnings at work (If working).
  - May have had numerous jobs in quick succession after having a stable career.
  - May have been harassed out of jobs.
May have had contracts not renewed.
May have been subjected to conflict in the workplace.
May be exhausted.
May be randomly falling asleep during the daytime.
May be falling asleep while driving.
May have sleep disorders.
May have sleep movement disorders.
May have dizziness.
May have eye problems, such as halos and starbursts in their night time vision.
May have had past visions or hallucinations.
May feel like there is a presence in the room with them.
May have gastrointestinal problems.
May have loose stools.
May have depression.
May have aches and pains throughout the body.
May feel like their skin is itchy, hot or sunburned.
May be taking daily baths to calm down their hot and painful skin sensations.
May have skin crawling sensations or random nerve tingling.
May be experiencing random muscle twitches.
May have sensitive teeth.
May be coughing up phlegm.
May have history of shared oxygen mask use with dozens of people.
May have history of breathing industrial gasses, such as nitrogen, helium, oxygen, carbon dioxide, and so on.
May have history of breathing solvent vapors and chemical exposures.
May have history of working with heavy metals, such as lead, mercury, and so on.
May have history of unusual radiation exposures, such as industrial high powered LASERS, high background radiation levels, ultraviolet radiation, infrared radiation, exposure to specific wavelengths of light (comparison spectrum lamps), electrical rooms, electromagnetic interference (EMI), computers, radio frequency transmitters, Faraday cages, and so on.
May have a history of working in bright light environments. (LASER’s, high UV, reflective environments, and so on)
May have light deficiency issues. (night shift work, windowless environments, dim environments, cubicle working, and so on)
May have triggering of the human mating cycle from abnormal environmental exposures.
May be developing gender issues (Gender Dysphoria).
May have had a number of definite health crashes (Delayed Altitude Complications).
May have damaged offspring.

Diagnosis of Magee’s Disease:
24 hours of blood oxygen readings taken at different altitudes: 0’, 2,000’, 4,000’, 6,000’, 8,000’, 10,000’.
Sleep studies performed at different altitudes: 0’, 2,000’, 4,000’, 6,000’, 8,000’, 10,000’.
Do not perform any high altitude tests above 10,000 feet on sea level adapted humans due to the long term damage it may cause.
Multiple Sleep Latency Test (MSLT).
- Holter monitor for seven days.
- Mental State Examination.
- Mini-Mental State Examination (MMSE).
- Complete blood tests including all electrolytes, vitamins, metals and minerals.
- Test for anemia including blood smear (Pernicious and Megaloblastic Anemia).
- Test for thickened blood.
- Test for correct Melatonin levels during sleep.
- Test for correct Dehydroepiandrosterone (DHEA) levels.
- Test all sex hormones.
- Test for Addison's disease, also called adrenal insufficiency.
- Test for heavy metals.
- Test for mercury poisoning.
- Endoscopy.
- Colonoscopy.
- Test for Multiple Chemical Sensitivity (MCS).
- Test for sensitization to a variety of abnormal air environments:
  - Test for sensitization to low pressure environments.
  - Test for sensitization to carbon dioxide gas.
  - Test for sensitization to nitrogen gas.
  - Test for sensitization to helium gas.
  - Test for sensitization to oxygen gas.
  - Test for sensitization to all solvents exposed to.
- Treatment of Magee’s Disease:
  - **Radiation Detoxification:**
    - Hibernation for six months avoiding sunlight.
    - Gradual reintroduction to sunlight over several weeks.
  - **Treatment of Radiation Sickness:**
    - May need to take vitamins A and E, and selenomethionine.
  - **Treatment of brain damage:**
    - Large dose of X-ray radiation to the brain if needed from a CT scanner.
    - Brain supplements if needed (CoQ10, Selenium, Ginko Biloba, Vinceptine, amino acids, and so on).
  - **Treatment of sleep disorders:**
    - Annual sleep studies with Positive Airway Pressure (APAP, CPAP, BiPap) and melatonin if needed.
    - May have pressure sensitivity and may only tolerate the lowest pressure of respiratory therapy.
    - Advise to sleep with the window slightly open (install window locks for security) and a sound machine for ambient noise.
    - Daytime stimulants if falling asleep during daytime.
    - May have positional sleep apnea and need to wear a sleep position device during sleep.
    - May have sleep movement disorders and need to take medication for it.
  - **Treatment of sleep disorder complications:**
these issues.

- **Treatment of Daytime Circadian Rhythm Disorder:**
  - May need to do bright light therapy to restore the waking time to sunrise.

- **Treatment of Nighttime Circadian Rhythm Disorder:**
  - May need to do red and infrared light therapy to reduce nighttime awakenings and disturbed sleep patterns.
  - May need to treat Sleep Movement Disorders.

- **Treatment of Bruxism:**
  - Oral appliance and chin strap worn during the night.

- **Treatment of skin damage:**
  - May need to take vitamins C, D and E.
  - Full inspection of the skin for growths.
  - May have hormonal skin tags that need to be removed.
  - May have fungal infections from a depressed immune system that need treatment with anti-fungals and removal of fungal nails.
  - Advise to swim regularly in a chlorinated pool to assist in treating fungal infections.

- **Treatment of lung damage:**
  - High resolution imaging of lungs.
  - Inhalers and/or oxygen if needed.
  - Administration of Pneumococcal Polysaccharide Vaccine (PPSV23).
  - May have Small Airways Disease, Asthma and Allergies.

- **Treatment of heart damage:**
  - May have Nocturnal Angina and may need to take a vasodilator, such as nitro-glycerin.
  - Echo-cardiogram of heart with bubble study looking for holes.
  - Seven day Holter test looking for heart rhythm issues.
  - Prescription heart medication if needed.

- **Treatment of gastrointestinal damage:**
  - Restricted diet free of gluten, fructose, lactose and corn.
  - Endoscopy and colonoscopy and removal of gastrointestinal growths if needed.
  - May need to take digestive enzymes with each meal.
  - May have Bruxism that is introducing air into the gastrointestinal tract causing intestinal pains, loose stools and excessive gas.
  - Identify and treat food sensitivities.

- **Treatment of hormone dysfunction:**
  - Hormone supplementation as needed.
  - May need to be placed onto DHEA, testosterone, estrogen and dopamine support.
  - Keep testosterone, estrogen and DHEA in the middle of the test range.

- **Treatment of malnutrition and cholesterol problems:**
  - Restoration of depleted minerals, metals, electrolytes and vitamins using appropriate supplements.
  - Plant protein and amino acids based anti-radiation and anti-cholesterol diet.
  - Keep B12, D, folate and iron in the middle of the range.

- **Treatment of blood disorders:**
  - Anemia from low oxygen, radiation exposures and systemic organ damage may be present.
  - May need to treat for Pernicious Anemia due to industrial gas & solvent exposures in a
low pressure and low oxygen environment.

- May have Megaloblastic Anemia from ultraviolet radiation induced folate deficiency.
- May have Aplastic Anemia caused by exposure to certain chemicals, drugs, radiation, infection, immune disease.
- May need to place on blood thinners if blood is thickened.
- May have undetectable blood clots (micro-clots) throughout body and need to do a blood clot flush using blood thinners for several months.
- Ensure that supplements B12, D, Folate and Iron are correctly administered, as they interact with each other.

○ **Treatment of air pressure damage:**
  - May have Cassion’s Disease, Monge’s Disease and/or Barotrauma damage from frequently changing from high to low pressure environments and vice-versa.
  - May have sensitivity to pressure changes that can bring on fatigue, confusion, forgetfulness and sleepiness.
  - May need to avoid air travel and driving through high altitude areas.

○ **Treatment of toxicity:**
  - Chelation therapy based on known toxins exposed to.
  - Patient may have a variation of Aerotoxic Syndrome.
  - Mercury, lead and vaporized gold, silver and aluminum are common exposures to metals and they may need to do a heavy metals detoxification.
  - Ask for a complete list of chemicals that the worker has been exposed to and see if their symptoms match well with chemical poisoning.

○ **Treatment of organ damage:**
  - May need to do liver and kidney cleanses.
  - May have extensive oxygen starvation organ damage that needs to be identified and treated.
  - Keep blood oxygen above 92% day and night.

○ **Treatment of gas sensitivities:**
  - Workers are commonly exposed to carbon dioxide, helium, nitrogen and oxygen gasses and a variety of solvents. Ask for a list of all gas and solvent exposures and see if their symptoms match well with the known adverse effects.
  - Advise patient to spend as much time outside as they can and when indoors to be in a well ventilated low carbon dioxide environment. They should sleep in their bedroom with the window slightly open (install window locks for security) and have a carbon dioxide meter to monitor their air quality. Indoor carbon dioxide levels to be maintained below 1,000 ppm.
  - Patient should have a carbon dioxide meter in their workplace, if working.
  - May have Multiple Chemical Sensitivity (MCS).

○ **Treatment of Tropical Diseases:**
  - May have tropical and subtropical diseases, such as parasitic infections. Ask for a list of tropical locations that they have been to and identify tropical diseases that the patient may have developed.
  - Identify tropical infections with stool and blood tests and treat.
  - Administer parasite cleanse regardless of test results.

○ **Treatment of Ultraviolet (UV) Damage:**
  - May need to take DHEA (Dehydroepiandrosterone) and Folate (Vitamin B9).
○ **Treatment of Bright Light Adaptation Disease (BLAD):**
  - May need to use 10,000 lux bright light therapy during the daytime to treat Seasonal Affective Disorder (SAD).
  - May need to spend their day outdoors in the shade or indoors next to a shady window.
  - Advise to go outside, sit next to a bright window, or use a full spectrum 10,000 lux light therapy box when fatigued instead of going to bed, as sleeping may make the fatigue worse.

○ **Treatment of Bicarbonate Depletion:**
  - Restore the bicarbonate levels with bicarbonate supplements.

○ **Treatment of Fat & Salt Depletion:**
  - May need to drink Tibetan Butter Tea daily.

○ **Treatment of Anxiety & Depression:**
  - May need to take Creatine and 5-HTP to boost serotonin and dopamine levels in the brain.

○ **Treatment of chronic fatigue:**
  - May have to take a large dose of caffeine in the morning and exercise in the afternoon.
  - May need to take D-Ribose.
  - May need to use full spectrum 10,000 lux light therapy in conjunction with red and infrared light therapy.

○ **Treatment of damaged offspring:**
  - Identify problems in high altitude exposed parents that may have transferred to their children and treat appropriately.

○ **Diagnosis:**
  - Diagnose permanent and disabling chronic occupational altitude sickness.

○ **Doctors Advice:**
  - Advise patient to live at sea level in a bright home.
  - Advise patient to apply for early pension disbursements for ill health.
  - Advise patient to apply for disability payments.
  - Advise patient to apply for workers compensation for occupational disease.

  - “When diagnosing sickened high altitude workers, you must remember that altitude diseases are just part of the equation and the various toxic occupational exposures must be factored in.”
  - Steven Magee CEng MIET - Q

  - “Steven Magee’s body behaves as if it is permanently above 10,000 feet and causes chronic daily altitude sickness, even though he lives in Tucson, Arizona, USA.”
  - Steven Magee CEng MIET - Q

  - “Part of Magee’s disease comes from the long term damage that oxygen starvation, industrial gas and unnatural radiation exposures cause to the brain, heart, lungs, skin, organs, blood, hormones, gastrointestinal tract and immune system.”
  - Steven Magee CEng MIET – Q

  - “Magee’s Disease is also known as High Altitude Observatory Disease (HAOD) or Mauna Kea Sickness (MKS) and is a form of High Altitude Disease (HAD).”
  - Steven Magee CEng MIET - Q

  - “Magee’s disease is a high altitude commuting disease.”
  - Steven Magee CEng MIET – Q

  - “The greatest scientific achievement of the Mauna Kea Observatories (MKO) in Hawaii is the medical diagnosis and treatment of High Altitude Observatory Disease (HAOD) in their sickened summit workers.”
  - Steven Magee CEng MIET – Q

  - “Progress in the science of High Altitude Disease (HAD) has been lost due to the professional
astronomy cover-up of their sickened observatory workers.” Steven Magee CEng MIET – Q

- “Magee’s Disease treatments may be applicable to the oxygen starvation and blood clotting damage that occurs in intensive care and COVID-19 patients.” Steven Magee CEng MIET

- “Professional astronomers have successfully evaded researching Mauna Kea Sickness (MKS) in their summit workers and their offspring, and it is unacceptable for this to continue.” Steven Magee CEng MIET – Q

- “I was fortunate when we decided to conceive a child that I had extensively detoxified from high altitude work and solar radiation exposures.” Steven Magee CEng MIET - Q

- “As a child I always wanted to be like Steve Austin, the six million dollar man. I got my wish when professional astronomy destroyed my health and sent me down the path of having to rebuild my body in the USA.” Steven Magee CEng MIET - Q

“I released the diagnosis and treatment of Magee’s Disease (MD) to the internet for free because it was the right thing to do.”

Steven Magee CEng MIET
Altitude Diseases: High Altitude Disease Disability Codes

- “2019 ICD-10-CM Diagnosis Code T70 Effects of air pressure and water pressure”
  https://www.icd10data.com/ICD10CM/Codes/S00-T88/T66-T78/T70-/T70
- “2019 ICD-10-CM Diagnosis Code T70.20 Unspecified effects of high altitude”
  https://www.icd10data.com/ICD10CM/Codes/S00-T88/T66-T78/T70-/T70.20
- “2018 ICD-10-CM Diagnosis Code T70.29 Other effects of high altitude...Applicable To Alpine sickness...Anoxia due to high altitude...Barotrauma NOS...Hypobaropathy...Mountain sickness...Clinical Information. A general term applied to any clinical syndrome caused by difference between the surrounding atmospheric pressure and the total gas pressure in the various tissues, fluids and cavities of the body. A morbid condition of anoxia caused by the reduced available oxygen at high altitudes. Barotrauma means injury to your body because of changes in barometric (air) or water pressure. One common type happens to your ear. A change in altitude may cause your ears to hurt. This can happen if you are flying in an airplane, driving in the mountains, or scuba diving. Divers can also get decompression sickness, which affects the whole body. common symptoms of ear barotrauma include pain, a feeling that your ears are stuffed, hearing loss, dizziness, treatments for ear barotrauma include chewing gum and yawning to relieve the pressure. Medications such as decongestants may also help. Injury following pressure changes; includes injury to the eustachian tube, ear drum, lung and stomach.”
  http://www.icd10data.com/ICD10CM/Codes/S00-T88/T66-T78/T70-/T70.29
- “2019 ICD-10-CM Diagnosis Code G47 Sleep disorders”
  https://www.icd10data.com/ICD10CM/Codes/G00-G99/G40-G47/G47-/G47
- “2018 ICD-10-CM Diagnosis Code G47.32 High altitude periodic breathing...Approximate Synonyms; Central sleep apnea due to high altitude; Central sleep apnea, high-altitude periodic breath. Clinical Information. A disorder characterized by recurrent apneas during sleep despite persistent respiratory efforts. It is due to upper airway obstruction. The respiratory pauses may induce hypercapnia or hypoxia. Cardiac arrhythmias and elevation of systemic and pulmonary arterial pressures may occur. Frequent partial arousals occur throughout sleep, resulting in relative sleep deprivation and daytime tiredness. Associated conditions include obesity; acromegaly; myxedema; micrognathia; myotonic dystrophy; adenotonsilar dystrophy; and neuromuscular diseases. (from Adams et al., Principles of Neurology, 6th ed, p395)”
  http://www.icd10data.com/ICD10CM/Codes/G00-G99/G40-G47/G47-/G47.32
- “2011 ICD-9-CM Diagnosis Code 993.2 Other and unspecified effects of high altitude...Approximate Synonyms: Acute mountain sickness, Aerodontalgia, Altitude edema, Andes disease, Anoxia due to high altitude, Barotrauma of ascent, Barotrauma of descent, Chronic mountain sickness, Diving barotrauma, Ebullism, Effects of high altitude, Erythrocytosis due to low atmospheric pressure, High altitude cerebral edema, High altitude pulmonary edema, High altitude pulmonary hypertension, High altitude retinopathy, Local pressure effects, Subacute mountain sickness, Suit squeeze. Applies To: Alpine sickness, Andes disease, Anoxia due to high altitude, Hypobaropathy, Mountain sickness”
- “2019 ICD-10-CM Diagnosis Code W94 Exposure to high and low air pressure and changes in air pressure”
- “Non-specific code 993 Effects of air pressure. Specific code 993.0 Barotrauma otitic...Specific code 993.1 Barotrauma sinus....Specific code 993.2 Other and unspecified effects of high...”
altitude....Specific code 993.3 Caisson disease...Specific code 993.4 Effects of air pressure caused by explosion....Specific code 993.8 Other specified effects of air pressure...Specific code 993.9 Unspecified effect of air pressure.”

- "Toxic effect of other gases, fumes and vapors T59"
  https://www.icd10data.com/ICD10CM/Codes/S00-T88/T51-T65/T59-
- "2019 ICD-10-CM Diagnosis Code D75 Other and unspecified diseases of blood and blood-forming organs"
  https://www.icd10data.com/ICD10CM/Codes/D50-D89/D70-D77/D75-/D75
- "2019 ICD-10-CM Diagnosis Code D75.1 Secondary polycythemia"
  https://www.icd10data.com/ICD10CM/Codes/D50-D89/D70-D77/D75-/D75.1
- "2019 ICD-10-CM Diagnosis Code L58 Radiodermatitis"
  https://www.icd10data.com/ICD10CM/Codes/L00-L99/L55-L59/L58-/L58
- "ICD-10-CM Diagnosis Code K52.0 [convert to ICD-9-CM] Gastroenteritis and colitis due to radiation"
  https://www.icd10data.com/ICD10CM/Codes/K00-K95/K50-K52/K52-/K52.0
- "2019 ICD-10-CM Diagnosis Code L57 Skin changes due to chronic exposure to nonionizing radiation"
  https://www.icd10data.com/ICD10CM/Codes/L00-L99/L55-L59/L57-/L57
- "2019 ICD-10-CM Diagnosis Code T66 Radiation sickness, unspecified"
  https://www.icd10data.com/ICD10CM/Codes/S00-T88/T66-T78/T66-/T66
- “2019 ICD-10-CM Diagnosis Code W90.2 Exposure to laser radiation”
  https://www.icd10data.com/ICD10CM/Codes/V00-Y99/W85-W99/W90-/W90.2
- “ICD-10-CM Diagnosis Code W90.0 Exposure to radiofrequency”
  https://www.icd10data.com/ICD10CM/Codes/V00-Y99/W85-W99/W90-/W90.0
- “ICD-10-CM Diagnosis Code W90.1 Exposure to infrared radiation”
  https://www.icd10data.com/ICD10CM/Codes/V00-Y99/W85-W99/W90-/W90.1
- “2019 ICD-10-CM Diagnosis Code W90.8XXA Exposure to other nonionizing radiation, initial encounter”
  https://www.icd10data.com/ICD10CM/Codes/V00-Y99/W85-W99/W90-/W90.8XXA
Altitude Diseases: Devices For Detecting Health Issues

- Facelake CMS-50E Recording Fingertip Pulse Oximeter. [https://www.facelake.com/cms50e.html](https://www.facelake.com/cms50e.html)
- "Introducing WatchPAT™ ONE from Lunella. Undiagnosed Sleep Apnea can shorten your lifespan and dramatically increase your risk of a heart attack, stroke and a whole host of other diseases. Are you at risk?" [https://www.lunella.com/](https://www.lunella.com/)
- "Alice NightOne. Designed to provide it all – ease, confidence, and reliability. The Alice NightOne home sleep testing (HST) device is designed to help patients get their study done right the first night." [https://www.usa.philips.com/healthcare/product/HC1109289/alice-nightone-home-sleep-testing-device](https://www.usa.philips.com/healthcare/product/HC1109289/alice-nightone-home-sleep-testing-device)
Treatment Of Abnormally High Radiation Exposure

- "Outdoor sunlight avoidance for several months is recommended after receiving abnormally high radiation exposures." Steven Magee CEng MIET - Q
- "Hormone May Prevent Dirty Bomb Deaths. Neumune Could Also Reduce Casualties in Nuclear Attack...A close relative of the performance-boosting supplement DHEA may be able to combat radiation from a "dirty bomb," Researchers say." https://www.webmd.com/balance/news/20041005/hormone-may-prevent-dirty-bomb-deaths#1
- "Androstenediol, or 5-androstenediol (abbreviated as A5 or Δ5-diol), also known as androst-5-ene-3β,17β-diol, is an endogenous weak androgen and estrogen steroid hormone and intermediate in the biosynthesis of testosterone from dehydroepiandrosterone (DHEA). It is closely related to androstenedione (androst-4-ene-3,17-dione)...Androstenediol has been investigated for use as a radiation countermeasure. Its value as a radiation countermeasure is based mainly on its stimulation of production of white blood cells and platelets.[6] Its potential use as a radiation countermeasure was developed by the Armed Forces Radiobiology Research Institute (AFRRI) and subsequently studied by AFRRI and Hollis-Eden Pharmaceuticals under the proposed brand name Neumune for the treatment of acute radiation syndrome.[6][7]. The clinical trials with rhesus monkeys were successful. According to the Hollis-Eden report, only 12.5% of the 40 Neumune-treated animals died versus 32.5% in the placebo group."
- "Preliminary clinical findings on NEUMUNE as a potential treatment for acute radiation syndrome...5-androstenediol (5-AED) has been advanced as a possible countermeasure for treating the haematological component of acute radiation syndrome (ARS). It has been used in animal models to stimulate both innate and adaptive immunity and treat infection and radiation-induced immune suppression...NEUMUNE significantly increased circulating neutrophils (p < 0.001) and platelets (p < 0.001) in the peripheral blood of adult and elderly subjects. A dose-response relationship was identified. Findings suggest that parenteral administration of 5-AED in aqueous suspension may be a safe and effective means to stimulate innate immunity and alleviate neutropenia and thrombocytopenia associated with ARS."
- "Hyaluronic acid is radioprotective in the intestine through a TLR4 and COX-2-mediated mechanism...The intestinal epithelium is sensitive to radiation injury. Damage to the intestinal epithelium is dose limiting in radiation therapy of abdominal cancers. There is a need for agents that can be given before radiation therapy to protect the intestinal epithelium...HA or other TLR4 agonists may be practical agents for protecting the intestinal epithelium during radiation therapy of abdominal malignancies."
- "Development of a panel of seven efficacious radiation countermeasure candidates against acute radiation syndrome (ARS). These agents have low toxicity and practical routes of administration. They are ready for advanced development by other DOD agencies when resources become available. All are at Technology Readiness Level (TRL) 3 or above. This is the level for which AFRRI is funded (DOD S&T activities 6.2 and 6.3). One candidate (genistein or BIO-300) is at TRL 5, and another (5-AED) is at TRL 6. Five of these countermeasure candidates were conceived at AFRRI, and research and development initiated at
AFRRI. These are 5-AED, tocols, genistein (BIO 300), ciprofloxacin (CIPRO), and ghrelin. Two were researched at early stages in collaboration with companies: Ex-Rad® and CDX-301. Three have FDA Investigational New Drug (IND) status for ARS: 5-AED, genistein (BIO 300), and Ex-Rad®. Six have human safety trials: 5-AED, genistein (BIO 300), Ex-Rad®, CDX-301, CIPRO, and Ghrelin. The seventh (tocols) has very low toxicity in non-GLP studies (administered in a manner suitable for an ARS countermeasure). All enhance survival in irradiated animals in robust studies repeated multiple times. Four of these countermeasure candidates are dual use, i.e., approved or being developed for mainstream medical indications: CIPRO: antibiotic. Ghrelin: cachexia, hemodialysis, seizures, gastroparesis. CDX-301: hematopoietic stem cell transplantation. BIO 300: lung cancer, prostate cancer" 

- "400 Abstracts with Radioprotective Research" https://www.greenmedinfo.com/pharmacological-action/radioprotective
- "Neutralizing Nuclear Radioactivity" https://www.freshandalive.com/radiation-links.html
- "Recommended foods and supplements to help protect your health and Counter the Effects of Radiation...Diet and your body’s susceptibility to radiation are closely entwined. Radiation and pollutants destroy vitamins A, C, E, K, several B vitamins, essential fatty acids, calcium and neuro-hormones. If your body lacks calcium, potassium and other nutrients, it will more readily absorb the radioactive elements that are similar in structure to these nutrients. Your best bet is to eat natural, fresh, organic (as much as possible) unprocessed foods, avoiding white sugar, red meat, refined wheat, caffeine and homogenized milk."
  https://www.safespaceprotection.com/healthy-tips/the-anti-radiation-diet/
- "Natural Ways to Protect Against Radiation...Introduce more chlorophyll-rich foods into your diet, such as seaweed, kelp, blue-green algae, spirulina, and chlorella. These plants contain rich minerals, including iodine, that bind up the receptors site in your thyroid so that any radioactive iodine that you end up being exposed to will be unable to harm your thyroid. These foods also contain potent antioxidants, like selenium, that prevent destructive free radical activity and cancerous growth, as well as chelating agents that bind to toxins and eliminate them from your body. Eat antioxidant-rich foods of every color, especially cherries, blueberries, pomegranates, yams, and sweet potatoes. The variety of antioxidants found in these foods help your body to mop up free radicals and toxins. Drink six to eight 8-ounce glasses of filtered water every day to flush and hydrate your system. Consider taking vitamin C, E, and D to assist antioxidant actions within your body. Also, alpha lipoic acid is a nutrient that protects cells from radiation damage. Herbs like dandelion, peppermint, and chrysanthemum help the body detoxify. Undergoing a medically supervised detox program like the Tao of Wellness Detox Retreat can support your body’s cleansing function." https://www.huffpost.com/entry/radiation-protection-_b_840246
People Most Exposed To Ionizing Radiation

- Astronauts.
- Airline crew.
- Industrial radiography.
- Medical radiology and nuclear medicine.
- Uranium mining.
- Nuclear power plant and nuclear fuel reprocessing plant workers.
- Research laboratories (government, university and private).
- High altitude workers.
- Nuclear medicine patients
- Radiation therapy patients
- Patients exposed to X-rays.
Treatment Of Ultraviolet (UV) Damage

- “In 2019 I noticed a positive response after supplementing with 50 mg of DHEA daily. I have a history of high ultraviolet (UV) exposure from living in Hawaii, working at very high altitudes, and managing reflective industrial and utility solar photovoltaic (PV) power plants.” Steven Magee CEng MIET - Q
- “I had been to the endocrinologist in 2017 due to my feet changing from size 9 to size 10 in just a few months. I had to throw out all of my shoes and buy new ones. I was told that there was nothing wrong with my hormones. The medical report shows they did not test my DHEA hormone levels, which I later showed a positive response to.” Steven Magee CEng MIET - Q
- “As I increased the levels of DHEA supplementation, I exhibited a major response to it at 75mg daily. My face felt like it was constantly blushing, even though it was not, and my mental functioning degraded at the same time. I continued to take the DHEA and after a few weeks these effects subsided.” Steven Magee CEng MIET - Q
- “DHEA (dehydroepiandrosterone) is one of the hormones produced by the adrenal glands. After being secreted by the adrenal glands, it circulates in the bloodstream as DHEA-sulfate (DHEAS) and is converted as needed into other hormones.”
- “DHEA Fact Sheet. DHEA, or Dehydroepiandrosterone, is produced by the adrenal gland and normally decreases with age, with levels starting to decline after the age of 30. DHEA has two types of actions in the body: Conversion: DHEA converts in the body into more potent male and female hormones including testosterone and estrogen. Actions of its own: DHEA enhances the immune system and may protect the blood vessels against atherosclerosis.”
- “The effect of ultraviolet radiation and pretreatment of dehydroepiandrosterone on RMK cells in culture...Recent reports suggest that ultraviolet radiation (UV) can easily target the genome as well as damage the cell membrane and contribute to cell death. Dehydroepiandrosterone (DHEA) is believed to be a powerful endogenous antioxidant, and is important in protection against aging as well as an immune stimulant... after UV treatment the MDA levels increased indicating that DHEA was efficient in protecting the cells from damage. Morphological evaluation of the cells treated with UV radiation showed an increase in degeneration of chromatin and a decrease in cell size as compared to non-treated groups.”
- “DHEA (Dehydroepiandrosterone)...DHEA reduced UV-induced DNA damage by 90%. These findings suggest that DHEA may help to prevent against chemically and physically-induced DNA damage...Symptoms of DHEA deficiency may include persisting fatigue, depression, anxiety, hypersensitivity to noise, loss of libido, dry eyes, skin, and hair, loss of head hair, axial (armpit) hair, and pubic hair.”
- “Lung Cancer Surgery, Radiation Therapy, and DHEA...'Administration of DHEA to laboratory mice and rats inhibits development of experimental tumors of the breast, lung, colon, liver, skin and lymphatic tissues.' (J Cell Biochem Suppl 1995; 22: 210)...'Total body radiation' used to destroy white cells before bone marrow transplantation is known to significantly reduce DHEA levels (Bone Marrow Transplant 1997; 20: 561) and (Horm Res 1995; 43: 279). Since I think all tissues live on DHEA, I think cancer does also. I think this is the mechanism whereby radiation works against cancers; radiation reduces available DHEA. Since cancers are rapidly growing,
they are more sensitive to high levels of DHEA. Radiation reduces DHEA, so the entire person is adversely affected by low DHEA, but the cancer is more affected. The cancer dies before the rest of the person.”

- “6 Symptoms of Low DHEA and What You Can Do About Them...One major problem with having low DHEA is that it causes your immune system to weaken. This will cause you to have an array of health problems. For starters, it will be easier for you to get infections and develop sicknesses. You may experience diarrhea, lack of hunger, and nausea in the early stages. Allergies may even be more noticeable too. As it continues to get worse, your internal and external organs will be more susceptible to inflammation. It is better to restore your DHEA as soon as you experience the early symptoms of a weak immune system.”
- “DHEA Deficiency Symptoms and Treatments...A deficiency can lead to problems with immune function, inflammation problems and an increased risk of heart problems and even certain cancers..Most studies are based on a dose of 50 mg per day. However, the dose you need could vary from 15 to 75 mg a day divided into three doses, taken a half hour before meals.”
- “The effect of six months treatment with a 100 mg daily dose of dehydroepiandrosterone (DHEA) on circulating sex steroids, body composition and muscle strength in age-advanced men and women...A daily oral 100 mg dose of DHEA for 6 months resulted in elevation of circulating DHEA and DS concentrations and the DS/cortisol ratio. Biotransformation to potent androgens near and slightly above the range of their younger counterparts occurred in women with no detectable change in men. Given this hormonal milieu, an increase in serum IGF-I levels was observed in both genders but dimorphic responses were evident in fat body mass and muscle strength in favour of men. These differences in response to DHEA administration may reflect a gender specific response to DHEA and/or the presence of confounding factor(s) in women such as oestrogen replacement therapy.”
- “DHEA...is helpful to treat: Addison's disease, Depression, Lupus, Obesity...Alzheimer's disease, Chronic fatigue syndrome, Erectile dysfunction (impotence), Osteoporosis, Parkinson's disease, Schizophrenia, Symptoms of menopause such as breast tenderness, fluid retention, mood changes, and hot flashes.”
- “Male Benefits of DHEA Supplements...DHEA reduces the risk of heart disease in men, assists with weight loss, reduces inflammation and increases metabolism. According to a 2003 study published in the "Journal of the Medical Association of Thailand," lowering inflammation in the body appeared to be one of the main ways in which the risk of heart disease was reduced. DHEA has been reported to lower high density lipoprotein, often referred to as "good cholesterol."”
- “Ageing and hormones are inter-related terms playing crucial role in human’s life. Dehydroepiandrosterone, commonly known DHEA, is among those hormones which directly interfere with the ageing process and its effects is remarkably visible. The role of DHEA in fighting against the signs of aging have been tested for a long time. Recent researches in the field of hormones and steroids has provided the researcher with new insights to investigate the potentials of DHEA and its sulfate esters in the field of skin aging complications.”
**ne_DHEA_in_Skin_ageing_process**

- “Younger, Healthier SKIN... The anti-stress hormone DHEA, and the sleep hormone melatonin, are both found in human skin...While the exact roles of DHEA and melatonin in human skin are still under scrutiny, researchers have identified several mechanisms through which these hormones protect against aging, maintain the health of skin, and affect how sunlight reacts with skin cells. All three are connected. For example, sunlight and aging suppress immunity; immunity affects health, and melatonin and DHEA affect them all.”

- “DHEA (Dehydroepiandrosterone)...the most abundant steroid in the human body, has been dubbed the ‘mother of all hormones’; it has many roles within the body and plays an important role in the manufacture of the hormones testosterone, estrogen, progesterone, and corticosterone. The decline of DHEA with age parallels that of HGH, so by age 65, our bodies make only 10 to 20% of what they did at age 20.”
  - [https://www.worldhealth.net/news/dhea_dehydroepiandrosterone/](https://www.worldhealth.net/news/dhea_dehydroepiandrosterone/)

- “Dehydroepiandrosterone (DHEA), also known as androstenolone, is an endogenous steroid hormone.[4] It is one of the most abundant circulating steroids in humans,[5] in whom it is produced in the adrenal glands,[6] the gonads, and the brain.[7] It functions as a metabolic intermediate in the biosynthesis of the androgen and estrogen sex steroids both in the gonads and in various other tissues.[4][8][9] However, DHEA also has a variety of potential biological effects in its own right, binding to an array of nuclear and cell surface receptors,[10] and acting as a neurosteroid and modulator of neurotrophic factor receptors.[11] In the United States, DHEA is sold as an over-the-counter supplement, and medication, called prasterone.”

- “Researchers Ponder The Benefits Of DHEA On Many Fronts...Human epidemiological and pilot clinical studies suggest that elevated levels of DHEA in the blood may be beneficial in preventing heart disease, improving immune function and well-being in the elderly, and combating depression. The hormone may also be helpful in treating systemic lupus erythematosus. Numerous animal studies have shown that DHEA may prevent obesity, diabetes, cancer, and heart disease, as well as enhance the immune system and expand life span.”

- “Lowered DHEA-S plasma levels in adult individuals with autistic disorder...The aim of this study was to determine for the first time neurosteroid levels, dehydroepiandrosterone (DHEA) and DHEA-sulfate (DHEA-S) in particular, in a group of adult patients with autistic disorder and compare these levels with normal healthy individuals. Levels of DHEA, DHEA-S and cortisol were compared between 15 adult drug-free patients with autistic disorder and 13 healthy controls. The Ritvo-Freeman Real-Life Rating Scale (RLRS) and the Overt Aggression Scale (OAS) were assessed as a measure of symptom severity. Significant lower DHEA-S levels were observed in the group with autistic disorder as compared to controls (p<0.05). DHEA-S levels appear to be low in patients with autistic disorder and, while speculative, may play a role in the etiopathophysiology of the disorder.”

- “Is Your Depression Linked to Low DHEA Levels?...DHEA exists in two forms, DHEA and DHEAS. DHEAS is the form most commonly measured in the bloodstream and many physicians believe that low levels are related to depressed mood, fatigue, and a general sense of not feeling well...Evaluating DHEAS levels and prescribing DHEA if levels are low should be part of a comprehensive plan for depression.”
  - [https://www.jamesgreenblattmd.com/depression-](https://www.jamesgreenblattmd.com/depression-)

---

*Environmental Radiation LLC - [https://www.environmentalradiation.com](https://www.environmentalradiation.com)*
“DHEA: What You Need to Know...When DHEA levels are low, your body does not have enough working material for proper endocrine function. This throws off your hormone production and you feel a general sense of malaise, along with other symptoms of hormonal imbalance — how severe depends on how many other demands are being made on your body at the same time. There is a growing body of evidence that healthy levels of DHEA may help support the bones, fight depression, fatigue, and aid in weight loss”

“Adrenal Syndrome - Cortisol and DHEA – Regulating Health...Adrenal syndrome results from chronic stress—conversely, chronic stress promotes adrenal syndrome—and creates an elevated cortisol-to-DHEA ratio from Pregnenolone Steal, the preferential hormone distribution when the body is under chronic stress. Ultimately, exhaustion of the adrenal glands leads to a deficiency of cortisol, DHEA, and other hormones, severely compromising your ability to be healthy and recover from illness.”

“Adrenal syndrome, also referred to as adrenal exhaustion, is one of the most undiagnosed, misdiagnosed, and mistreated health problems. The degree of its severity ranges from mild dysfunction to total failure of the adrenal glands (known as Addison’s disease). Because the adrenal glands are responsible for so many critical functions, even a minor impairment in their function can have a negative impact on the entire body. A chronic disruption—one that persists over time—of normal adrenal function can undermine immunity and metabolism, leading to debilitating health conditions.”

“Adrenal Fatigue: Symptoms & Healing Alternatives...Adrenal fatigue is characterized by relentless, debilitating fatigue. The adrenal glands are your body’s primary “shock absorbers.” These two little thumb-sized glands sitting on top of your kidneys produce hormones including norepinephrine, cortisol and DHEA that allow you to respond to the conditions of your daily life in healthy and flexible ways...Adrenal fatigue is characterized by cortisol levels that are too high at night and not high enough in the morning.”

“Adrenal Syndrome - Hans Selye, Stress Pioneer...The body's resistance to the stress may gradually be reduced, or may collapse quickly. Generally, this means the immune system, and the body's ability to resist disease, may be almost totally eliminated. Patients who experience long-term stress may succumb to heart attacks or severe infection due to their reduced immunity. For example, a person with a stressful job may experience long-term stress that might lead to high blood pressure and an eventual heart attack.”

“Addison's disease, also known as primary adrenal insufficiency and hypocortisolism, is a long-term endocrine disorder in which the adrenal glands do not produce enough steroid hormones. [1] Symptoms generally come on slowly and may include abdominal pain, weakness, and weight loss.[1] Darkening of the skin in certain areas may also occur.[1] Under certain circumstances, an adrenal crisis may occur with low blood pressure, vomiting, lower back pain, and loss of consciousness.[1] An adrenal crisis can be triggered by stress, such as from an injury, surgery, or infection.”

“The Health Benefits of Alpha-Lipoic Acid...Sun-Damaged Skin...An early study published in the Aesthetic Surgery Journal concluded that a topical 5% alpha-lipoic cream was able to reduce facial lines, especially around the eyes and upper lip, by as much as 50 percent in women ages 41 to 63 with moderate sun damage. The pore sizes of the participants were also seen to
decrease. The topical cream was well tolerated with no apparent side effects.”

- “Do any supplements help prevent sunburn or skin damage from sun exposure?...Supplements containing beta-carotene, cocoa, vitamin C, and/or vitamin E may provide modest protection from sun damage to the skin, according to small studies. There is also some preliminary evidence that a branded fern extract (Fernblock/Heliocare) may be helpful.”

- “Quick look at 10 oral antioxidants for sun protection...1. Beta-Carotene...2. Selenium...3. Lutein...4. Zeaxanthin...5. Lycopene...6. Pycnogenol...7. Fernblock...8. Omega-3s From Fish Oil...9. Vitamin C + E...10. Astaxanthin.”

- “β-Carotene and other carotenoids in protection from sunlight... This review focuses on the nutritional aspect of phytochemicals in humans-ie, the provision of carotenoid micronutrients by dietary means to the skin and their role in protection. Human intervention studies have documented protective effects for β-carotene or for lycopene provided either by a carotenoid-rich diet or by supplementation. In exposed tissues, light induces primary and secondary photooxidative processes. Scavenging of reactive oxygen species is considered to be a mechanism of action underlying the protective activity of carotenoids—an optimal supply of antioxidant micronutrients in the skin increases basal dermal defense against UV irradiation, supports longer-term protection, and contributes to maintenance of skin health and appearance.”

- “UV light, beta-carotene and human skin--beneficial and potentially harmful effects...Solar radiation is one of the most important environmental stress agents for human skin, causing sunburn, premature skin aging, and skin cancer. Beta-carotene is discussed to protect against photooxidative stress and thus prevent skin damage...Recent studies on skin cells in culture have revealed that beta-carotene acts not only as an antioxidant but also has unexpected prooxidant properties.”

- “β-Carotene and other carotenoids in protection from sunlight...The exposure to solar UV radiation has been estimated to be ~10% for outdoor-working adults and ~3% for indoor-working adults of the total available annual UV radiation (on a horizontal plane) (24). The UV doses that people are exposed to increase with increasing altitude and with decreasing latitude...In view of the potential detrimental health effects such as sunburn, ocular damage, photoaging, immune suppression, DNA damage, and skin cancer, it is important to consider protective strategies... Controlled exposure of human volunteers to sunlight for 12 d (total UV dose of ~10,000 mJ/cm2) led to significant decreases in skin and plasma β-carotene concentrations (25).”

- “β-carotene protects from solar radiation...Dunaliella salina algae is bombarded with the full brunt of solar UV (ultraviolet) radiation and has evolved a novel mechanism for defending itself from the radiation’s damaging effects. More than 8% of its dry body mass is β-carotene, more than any other organism that produces the compound. The algae produces β-carotene in response to UV stress and localizes it to lipid droplets within its chloroplasts. In that location it is able to absorb and neutralize the damaging oxygen radicals produced from excessive UV and sun exposure.”

- “Beta-Carotene and Vitamin E Help Prevent Sunburn...Supplementation results in a sunscreen factor of two or three, meaning that we can withstand two to three times more exposure without

- “Nutrition for Healthy Skin: Vitamin E, Pantothenic Acid, and Selenium...These nutrients are particularly important for antioxidant defense of the skin, which is crucial in slowing the aging process as well as protecting the skin from sun damage, pollutants, and other environmental toxins. They are also beneficial for treating acne, which is characterized by sebum overproduction, follicular hyperkeratinization, oxidative stress and inflammation. (1) By consuming foods rich in these vitamins and minerals, your skin will look clearer, brighter, and more youthful than ever before.” https://chriskresser.com/nutrition-for-healthy-skin-part-3/

- “The Top 5 Vitamins for Skin Care...Vitamin A...Vitamin B3...Vitamin B5...Vitamin C...Vitamin E.” http://www.dydermatology.com/blog/top-5-vitamins-skin-care/

- “List of Supplements to Protect your Skin from Sun Damage...Skin Support from the Inside. Vitamin E...Green Tea...Vitamin C...Vitamin B Complex...Vitamin D...Skin Support from the Outside. Coconut Oil...Aloe Vera...Oatmeal...Sunscreen.” https://vitarock.com/blog/post/list-of-supplements-to-protect-your-skin-from-sun-damage

- “Do Vitamins Really Help to Prevent & Reverse Sun Damaged Skin?...Since UV rays zap a lot of your skin’s nutrients, many people often ask if taking vitamin supplements can actually reverse the ravages of sun exposure...The Vitamin B complex helps your skin tissue rebuild and repair...Vitamin C encourages and increases the production of collagen in the skin. It’s also the most common antioxidant naturally found in our skin, and the sun can really zap it...Vitamin E is another antioxidant-rich element that battles the effects of free radicals and protects your cell membranes against damage. It helps reduce sun damage and counteract premature aging by preventing wrinkles and improving the texture of your skin.” https://www.skincarebyalana.com/blog/do-vitamins-really-help-sun-damaged-skin/

- “Vitamin B Cuts Skin Cancer Risk; Supplement Regimen To Be Used Alongside Sunscreen...Summertime is almost upon us, and with it brings the sun’s strong rays to lift our spirits and cause some potential damage to our fragile skin. Australian researchers from the University of Sydney recently discovered nicotinamide, a form of vitamin B powerful enough to reduce the recurrence of common skin cancers by 23 percent.” https://www.medicaldaily.com/vitamin-b-cuts-skin-cancer-risk-supplement-regimen-be-used-alongside-sunscreen-333334

- “How Vitamin B5 is the Perfect Skin Product After a Summer in the Sun...It’s no secret that UV rays damage the skin and cause it to age prematurely. Still, there’s only so much you can do to protect your skin during the summer when most people spend hours at a time outdoors. Fortunately, some of the best face serums for fall include vitamin B5 and can help repair damage the sun has done to your skin over the past few months. With regular use, vitamin B5 helps the skin regenerate itself after prolonged sun damage.” https://www.timelessha.com/blogs/news/how-vitamin-b5-is-the-perfect-skin-product-after-a-summer-in-the-sun

- “The Protective Role of Astaxanthin for UV-Induced Skin Deterioration in Healthy People—A Randomized, Double-Blind, Placebo-Controlled Trial...Skin is a major safeguard tissue in humans. Because biological barrier function is deteriorated by several kinds of stresses including exposure to ultra-violet (UV) rays, the protection and treatment of skin conditions by dietary supplements are important...Astaxanthin seems protective against UV-induced skin deterioration and helps maintain healthy skin in healthy people.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6073124/

- “Want to Look Younger? Take Astaxanthin Every Day for 2 Weeks...Astaxanthin's unique
"antioxidative artillery" provides for an impressive array of health benefits, including improving cardiovascular health, stabilizing blood sugar, boosting your immune system, fighting cancer, reducing inflammation, improving eye health—and even improving your athletic abilities...Researchers concluded that astaxanthin "can significantly prevent UV-induced collagen degradation, wrinkles, lipid peroxidation, sunburn, phototoxicity and photoallergy."”


- “Astraxanthin Provides Broad Spectrum Protection...Researchers have sought to explore the use of astaxanthin as a topical sunscreen because of its powerful ultraviolet light-absorbing properties. They soon found, however, that astaxanthin has many additional benefits, including free radical scavenging, mitochondrial protection, anti-inflammatory effects, and protection from glycation. In the words of one researcher, astaxanthin shows “demonstrable promise for slowing age-related functional decline.””

https://www.lifeextension.com/Magazine/2013/4/Astaxanthin-Provides-Broad-Spectrum-Protection/Page-01

- “Sun protection in a pill: the photoprotective properties of Polypodium leucotomos extract...Physical blocks (i.e. wearing appropriate clothing), exposure avoidance, and the use of sunscreens are the main methods of photoprotection currently used. However, phytochemical and natural botanical extracts such as polypodium leucotomos, a tropical fern found in Central and South America, demonstrate a strong potential as adjuncts to sunscreen protection...Oral administration of PL extracts and its favorable safety profile could have significant implications in the prevention of skin cancer.”


- “Safety and Efficacy of Oral Polypodium leucotomos Extract in Healthy Adult Subjects...Polypodium leucotomos extract 240mg taken twice daily for 60 days was a safe and effective means for reducing the damaging effects of ultraviolet radiation.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4345929/

- “What Is Polypodium Leucotomos?...Most commonly, Polypodium leucotomos is taken orally for the treatment of inflammation and a variety of skin ailments including psoriasis, vitiligo (the loss of pigment in patches of the skin), atopic dermatitis (eczema: inflammation of the skin), and melasma (over-pigmented patches of dark skin). It also serves as a protectant against sunburn (solar erythema) and helps prevent and relieve polymorphous light eruption (PMLE).”

https://www.sunsaferx.com/health-and-wellness/polypodium-leucotomos/

- “POLYPODIUM LEUCOTOMOS...Polypodium leucotomos is a fern from Central America. The underground “runners” (rhizomes) are used for medicine. Polypodium leucotomos is used to prevent certain skin problems including sunburn, eczema (atopic dermatitis), psoriasis, vitiligo, and skin cancer. It is also used for other cancers and Alzheimer’s disease.”

https://www.webmd.com/vitamins/ai/ingredientmono-1152/polypodium-leucotomos

- “Ability of PABA to protect mammalian skin from ultraviolet light-induced skin tumors and actinic damage...Application of 50 para-aminobenzoic acid (PABA) to hairless mice one hour prior to ultraviolet light (UV) irradiation will almost totally protect these animals from developing tumors induced by chronic exposure to UVL in the 290 to 320 nm range in conjunction with a chemical carcinogen.”


- “PARA-AMINOBENZOIC ACID (PABA)...Para-aminobenzoic acid (PABA) is a chemical found in the folic acid vitamin and also in several foods including grains, eggs, milk, and meat. PABA is taken by mouth for skin conditions including vitiligo, pemphigus, dermatomyositis, morphea, lymphoblastoma cutis, Peyronie’s disease, and scleroderma. PABA is also used to
treat infertility in women, arthritis, "tired blood" (anemia), rheumatic fever, constipation, systemic lupus erythematosus (SLE), and headaches. It is also used to darken gray hair, prevent hair loss, make skin look younger, and prevent sunburn. PABA is best known as a sunscreen that is applied to the skin (used topically)."

- “I was a towhead in my youth, and m still fair skinned. In my youth (until age 55 or so) I could never tan. I went straight to red, then straight back. In my mid 50's I starrrted supplements of Alpha Lipoic Acid and CoQ10 about 100 mg each for other reasons. I found out that: A) No more chapped lips, no lip balm for about 15 years and B) I could sunbathe at will without sunburn, I could actually get a tan (wow). BUT ultimately there was skin damage, maybe because I went to extreme. I quit after two seasons.”

- “Now You Can Be Safer in the Sun...It is sad to say that photo-oxidative ultraviolet A radiation reduces skin and blood antioxidants and damages cell components, not to mention DNA… Green tea polyphenols, in combination with sunscreens, may provide an effective strategy for reducing the risk of skin cancers...Taking L-tyrosine as a supplement can help the body to produce melanin, which helps tanning and is likely to reduce the risk of sunburn.”

- “L Tyrosine & Melanin...Melanin is the specific pigment that is responsible for the color of hair, skin and the iris of the eye. One of its primary functions is to protect the skin from sun damage and dissipate most of the UV radiation as heat...L-tyrosine is a precursor of melanin. This means that certain biochemical pathways convert L-tyrosine into melanin through the use of numerous "intermediate molecules" that are systematically modified into the end product.”

- “Pycnogenol clinically shown to help protect skin against UV damage... supplementation of Pycnogenol® in healthy volunteers was shown to inhibit the inflammation caused by UV-exposure and consequently protected the skin from sunburn...Pycnogenol® was demonstrated to be protective against chronic UV-exposure induced skin malignancies. These findings point to a significant photo-protective and antiphoto- ageing effect of Pycnogenol®.”

- “Protection from inflammation, immunosuppression and carcinogenesis induced by UV radiation in mice by topical Pycnogenol...topical Pycnogenol offered significant and dose-dependent protection from SSUV-induced acute inflammation, immunosuppression and carcinogenesis, when applied to the skin after daily irradiation. Pycnogenol, therefore, in addition to its recognized health benefits in other organs, appears to have potential in providing photoprotection for humans in a complementary role with sunscreens, having demonstrable activity when applied to the skin after, rather than before, UV exposure.”
People Exposed To Abnormally High Ultraviolet (UV) Levels

- High Altitude Disease (HAD):
  - Pilots.
  - Observatory workers.
  - Ski resort workers.
  - Antenna workers.
  - National park and forest rangers.
  - Hikers.
  - Mountain climbers.
  - High Altitude Adaptation Disease (HAAD): People with sea level adapted genetics living at high altitudes.

- Winter Sports Disease (WSD):
  - Skiers
  - Snowboarders.
  - Hikers.

- Reflective Environment Disease (RED):
  - Solar photovoltaic (PV) workers.
  - People living in a home with a view of a reflective solar photo-voltaic (PV) system.
  - Window cleaners.
  - Jobs in downtown areas filled with tall reflective buildings.
  - People with a large view of the ocean, large lake, or large river.
  - People that engage in water sports.
  - Sailors.

- Ultraviolet (UV) Emitting Products Disease (UEPD):
  - “Lights That Give Off UV Rays...Fluorescent bulbs are most commonly found in two varieties: compact fluorescent bulbs for use in homes and fluorescent tube lighting that is often used in offices and stores. Both bulbs emit more UV light than traditional incandescent bulbs...The lights used in tanning beds are typically long, tubular fluorescent bulbs that emit both UVA and UVB rays.” [https://sciencing.com/lights-give-off-uv-rays-8332010.html](https://sciencing.com/lights-give-off-uv-rays-8332010.html)
  - “High intensity discharge bulbs such as metal halide bulbsand high pressure sodium bulbs are a different story. Most HIDs emit a significant amount of UV radiation and require specific UV-blocking filters to meet safety standards in most working conditions. When an industrial sized space is lit by so many powerful HIDs, the safety concern is even greater.” [https://oeo.com/led-lights-emit-uv-radiation/](https://oeo.com/led-lights-emit-uv-radiation/)
  - Tanning lamps and beds.
  - Electricians working daily with ultraviolet emitting lighting products.
  - Workplaces lit by ultraviolet emitting lighting products.
  - People living in homes lit by ultraviolet emitting lighting products.
  - Using televisions and computer monitors that emit ultraviolet light.
  - Welders working with electrical arc welders and cutters.

- Radiation Sickness From High Ultraviolet (UV) Levels:
  - Sitting next to a sunny window daily.
  - Daily sunbathing.
- Outdoor jobs.
- Driving jobs.
- Police officers.
- Continent Adaptation Disease (CAD): People that have relocated from near the poles to near the equator.
- Vacation Disease (VD): People from cloudy and dull environments that vacation in sunny environments.
Oxygen Starvation Organ Damage

- “The organs that have been identified as having issues in very high altitude worker Steven Magee are: 1. Brain. 2. Lungs. 3. Heart. 4. Skin. 5. Liver. 6. Bones. 7. Gastrointestinal system. 8. Kidneys. 9. Vitamin B12 & iron absorption problems are currently being diagnosed and may involve the stomach, intestines, liver & blood. 10. Hormonal problems that involve various organ systems of the body.” Steven Magee CEng MIET - Q

- “Ischemia or ischaemia is a restriction in blood supply to tissues, causing a shortage of oxygen that is needed for cellular metabolism (to keep tissue alive).[3] Ischemia is generally caused by problems with blood vessels, with resultant damage to or dysfunction of tissue. It also means local anemia in a given part of a body sometimes resulting from congestion (such as vasoconstriction, thrombosis or embolism). Ischemia comprises not only insufficiency of oxygen, but also reduced availability of nutrients and inadequate removal of metabolic wastes. Ischemia can be partial (poor perfusion) or total.” https://en.wikipedia.org/wiki/Ischemia

- “Understanding the Full Spectrum of Organ Injury Following Intrapartum Asphyxia…Those who survive often suffer from a range of health issues including brain damage—manifesting as cerebral palsy (CP)—respiratory insufficiency, cardiovascular collapse, and renal dysfunction, to name a few…Severe hypoxia at birth is essentially a cardiorespiratory problem, and while brain damage has received the most attention, the global nature of the hypoxic–ischemic insult and myriad of biochemical disruptions that follow cause significant injury to many organ systems, as outlined in this review.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5313537/

- “Multiorgan dysfunction in infants with post-asphyxial hypoxic-ischaemic encephalopathy…There is consensus of opinion of representative obstetric and paediatric associations that multiorgan or multisystem dysfunction (MOD) is a constant feature of the neonatal post-asphyxial syndrome…All infants with severe post-asphyxial HIE had evidence of dysfunction of at least one organ/system in addition to the central nervous system.” http://fn.bmj.com/content/89/2/F152

- “Perinatal Asphyxia. Definition: Occurs when placental or pulmonary gas exchange to a fetus/newborn is compromised, resulting in hypoxia in the blood. Implications: Hypoxia forces fetal cells to undergo anaerobic respiration which produces less energy for cells and lactic acid as a byproduct. Energy produced from anaerobic respiration cannot properly supply fetal/newborn tissue therefore cell function becomes compromised. The tissues affected first include the heart, muscle, and brain. Myocardial function eventually becomes depressed and hypotension results in end organ damage to a variety of systems. When oxygen is reinstituted into the blood, reactive oxygen species can further damage tissues, this is known as reperfusion injury (1).” https://pedclerk.bsd.uchicago.edu/page/perinatal-asphyxia

- “Perinatal asphyxia, neonatal asphyxia or birth asphyxia is the medical condition resulting from deprivation of oxygen to a newborn infant that lasts long enough during the birth process to cause physical harm, usually to the brain. Hypoxic damage can occur to most of the infant's organs (heart, lungs, liver, gut, kidneys), but brain damage is of most concern and perhaps the least likely to quickly or completely heal. In more pronounced cases, an infant will survive, but with damage to the brain manifested as either mental, such as developmental delay or intellectual disability, or physical, such as spasticity.” https://en.wikipedia.org/wiki/Perinatal_asphyxia

- “Cerebral palsy (CP) is a group of permanent movement disorders that appear in early
childhood.[1] Signs and symptoms vary among people.[1] Often, symptoms include poor coordination, stiff muscles, weak muscles, and tremors.[1] There may be problems with sensation, vision, hearing, swallowing, and speaking.[1] Often babies with cerebral palsy do not roll over, sit, crawl, or walk as early as other children of their age.[1] Other symptoms may include seizures and problems with thinking or reasoning, either of which occurs in about one third of people with CP.[1] While the symptoms may get more noticeable over the first few years of life, the underlying problems do not worsen over time.”
https://en.wikipedia.org/wiki/Cerebral_palsy

- “Asphyxia or asphyxiation is a condition of severely deficient supply of oxygen to the body that arises from abnormal breathing. An example of asphyxia is choking. Asphyxia causes generalized hypoxia, which affects primarily the tissues and organs. There are many circumstances that can induce asphyxia, all of which are characterized by an inability of an individual to acquire sufficient oxygen through breathing for an extended period of time. Asphyxia can cause coma or death.”
https://en.wikipedia.org/wiki/Asphyxia

- “Reperfusion injury or reperfusion insult, sometimes called ischemia-reperfusion injury (IRI) or reoxygenation injury, is the tissue damage caused when blood supply returns to tissue (re- + perfusion) after a period of ischemia or lack of oxygen (anoxia or hypoxia). The absence of oxygen and nutrients from blood during the ischemic period creates a condition in which the restoration of circulation results in inflammation and oxidative damage through the induction of oxidative stress rather than (or along with) restoration of normal function...Reperfusion of ischemic tissues is often associated with microvascular injury, particularly due to increased permeability of capillaries and arterioles that lead to an increase of diffusion and fluid filtration across the tissues. Activated endothelial cells produce more reactive oxygen species but less nitric oxide following reperfusion, and the imbalance results in a subsequent inflammatory response.[1] The inflammatory response is partially responsible for the damage of reperfusion injury. White blood cells, carried to the area by the newly returning blood, release a host of inflammatory factors such as interleukins as well as free radicals in response to tissue damage. [2] The restored blood flow reintroduces oxygen within cells that damages cellular proteins, DNA, and the plasma membrane. Damage to the cell's membrane may in turn cause the release of more free radicals. Such reactive species may also act indirectly in redox signaling to turn on apoptosis. White blood cells may also bind to the endothelium of small capillaries, obstructing them and leading to more ischemia.[2] Another hypothesis would be that normally, tissues contain free radical scavengers to avoid damage by oxidizing species normally contained in the blood. Ischemic tissue would have decreased function of these scavengers because of cell injury. Once blood flow is reestablished, oxygen species contained in the blood will damage the ischemic tissue because the function of the scavengers is decreased. Reperfusion injury plays a part in the brain's ischemic cascade, which is involved in stroke and brain trauma. Similar failure processes are involved in brain failure following reversal of cardiac arrest;[3] control of these processes is the subject of ongoing research. Repeated bouts of ischemia and reperfusion injury also are thought to be a factor leading to the formation and failure to heal of chronic wounds such as pressure sores and diabetic foot ulcer.[4] Continuous pressure limits blood supply and causes ischemia, and the inflammation occurs during reperfusion. As this process is repeated, it eventually damages tissue enough to cause a wound.[4] In prolonged ischemia (60 minutes or more), hypoxanthine is formed as a breakdown product of ATP metabolism. The enzyme xanthine dehydrogenase acts in reverse, that is as a xanthine oxidase as a result of the higher availability of oxygen. This oxidation results in molecular oxygen being converted into...
highly reactive superoxide and hydroxyl radicals. Xanthine oxidase also produces uric acid, which may act as both a prooxidant and as a scavenger of reactive species such as peroxynitrite. Excessive nitric oxide produced during reperfusion reacts with superoxide to produce the potent reactive species peroxynitrite. Such radicals and reactive oxygen species attack cell membrane lipids, proteins, and glycosaminoglycans, causing further damage. They may also initiate specific biological processes by redox signaling. Reperfusion can cause hyperkalemia.”

- “Ischemia-reperfusion injury of the appendicular musculoskeletal system...Ischemia-reperfusion (IR) tissue injury is the resultant pathology from a combination of factors, including tissue hypoxia, followed by tissue damage associated with re-oxygenation. IR injury contributes to disease and mortality in a variety of pathologies, including myocardial infarction, ischemic stroke, acute kidney injury, trauma, circulatory arrest, sickle cell disease and sleep apnea.[1][2][3][4] Whether resulting from traumatic vessel disruption, tourniquet application, or shock, the extremity is exposed to an enormous flux in vascular perfusion during a critical period of tissue repair and regeneration.[5][6] The contribution of this ischemia and subsequent reperfusion on post-traumatic musculoskeletal tissues is unknown; however, it is likely that similar to cardiac and kidney tissue, IR significantly contributes to tissue fibrosis...During periods of ischemia, cellular break down products accumulate in the local tissue. Once reperfusion occurs, these cellular products are returned to the systemic circulation, and are exposed to other organs. Organs involved in filtration (e.g., the kidneys and the liver), may be overwhelmed by the high load of cellular break down products, and face injury themselves (e.g., acute kidney injury).”

- “Ischemia or ischaemia is a restriction in blood supply to tissues, causing a shortage of oxygen that is needed for cellular metabolism (to keep tissue alive).[3] Ischemia is generally caused by problems with blood vessels, with resultant damage to or dysfunction of tissue. It also means local anemia in a given part of a body sometimes resulting from congestion (such as vasoconstriction, thrombosis or embolism). Ischemia comprises not only insufficiency of oxygen, but also reduced availability of nutrients and inadequate removal of metabolic wastes. Ischemia can be partial (poor perfusion) or total...Signs and symptoms. Since oxygen is carried to tissues in the blood, insufficient blood supply causes tissue to become starved of oxygen. In the highly metabolically active tissues of the heart and brain, irreversible damage to tissues can occur in as little as 3–4 minutes at body temperature. The kidneys are also quickly damaged by loss of blood flow (renal ischemia). Tissues with slower metabolic rates may undergo irreversible damage after 20 minutes. Clinical manifestations of acute limb ischemia (which can be summarized as the "six P's") include pain, pallor, pulseless, paresthesia, paralysis, and poikilothermia.”

- “Reactive oxygen species (ROS) are chemically reactive chemical species containing oxygen. Examples include peroxides, superoxide, hydroxyl radical, and singlet oxygen.[2] In a biological context, ROS are formed as a natural byproduct of the normal metabolism of oxygen and have important roles in cell signaling and homeostasis.[3] However, during times of environmental stress (e.g., UV or heat exposure), ROS levels can increase dramatically.[3] This may result in significant damage to cell structures. Cumulatively, this is known as oxidative stress. The production of ROS is strongly influenced by stress factor responses in plants, these factors that increase ROS production include, drought, salinity, chilling, nutrient deficiency, metal toxicity and UV-B radiation. ROS are also generated by exogenous sources such as
ionizing radiation...Damaging effects. Effects of ROS on cell metabolism are well documented in a variety of species. These include not only roles in apoptosis (programmed cell death) but also positive effects such as the induction of host defence genes and mobilization of ion transport systems.[citation needed] This implicates them in control of cellular function. In particular, platelets involved in wound repair and blood homeostasis release ROS to recruit additional platelets to sites of injury. These also provide a link to the adaptive immune system via the recruitment of leukocytes.[citation needed] Reactive oxygen species are implicated in cellular activity to a variety of inflammatory responses including cardiovascular disease. They may also be involved in hearing impairment via cochlear damage induced by elevated sound levels, in ototoxicity of drugs such as cisplatin, and in congenital deafness in both animals and humans.[citation needed] ROS are also implicated in mediation of apoptosis or programmed cell death and ischaemic injury. Specific examples include stroke and heart attack.[citation needed] In general, harmful effects of reactive oxygen species on the cell are most often:[12] damage of DNA or RNA; oxidations of polyunsaturated fatty acids in lipids (lipid peroxidation); oxidations of amino acids in proteins; oxidative deactivation of specific enzymes by oxidation of co-factors...Oxidative damageIn aerobic organisms the energy needed to fuel biological functions is produced in the mitochondria via the electron transport chain. In addition to energy, reactive oxygen species (ROS) with the potential to cause cellular damage are produced. ROS can damage lipid, DNA, RNA, and proteins, which, in theory, contributes to the physiology of aging. ROS are produced as a normal product of cellular metabolism. In particular, one major contributor to oxidative damage is hydrogen peroxide (H2O2), which is converted from superoxide that leaks from the mitochondria. Catalase and superoxide dismutase ameliorate the damaging effects of hydrogen peroxide and superoxide, respectively, by converting these compounds into oxygen and hydrogen peroxide (which is later converted to water), resulting in the production of benign molecules. However, this conversion is not 100% efficient, and residual peroxides persist in the cell. While ROS are produced as a product of normal cellular functioning, excessive amounts can cause deleterious effects.[17] Memory capabilities decline with age, evident in human degenerative diseases such as Alzheimer's disease, which is accompanied by an accumulation of oxidative damage. Current studies demonstrate that the accumulation of ROS can decrease an organism's fitness because oxidative damage is a contributor to senescence. In particular, the accumulation of oxidative damage may lead to cognitive dysfunction, as demonstrated in a study in which old rats were given mitochondrial metabolites and then given cognitive tests. Results showed that the rats performed better after receiving the metabolites, suggesting that the metabolites reduced oxidative damage and improved mitochondrial function.[18] Accumulating oxidative damage can then affect the efficiency of mitochondria and further increase the rate of ROS production. [19] The accumulation of oxidative damage and its implications for aging depends on the particular tissue type where the damage is occurring. Additional experimental results suggest that oxidative damage is responsible for age-related decline in brain functioning. Older gerbils were found to have higher levels of oxidized protein in comparison to younger gerbils. Treatment of old and young mice with a spin trapping compound caused a decrease in the level of oxidized proteins in older gerbils but did not have an effect on younger gerbils. In addition, older gerbils performed cognitive tasks better during treatment but ceased functional capacity when treatment was discontinued, causing oxidized protein levels to increase. This led researchers to conclude that oxidation of cellular proteins is potentially important for brain function.” https://en.wikipedia.org/wiki/Reactive_oxygen_species
• “Reactive oxygen species. The reactive oxygen species are the contributors of oxidative stress which lead to various diseases and disorders such as cardiovascular disease, cancer, aging, and various neurodegenerative diseases”
  https://www.sciencedirect.com/topics/neuroscience/reactive-oxygen-species
Gastrointestinal Hazards

- “The gastrointestinal tract (digestive tract, digestional tract, GI tract, GIT, gut, or alimentary canal) is an organ system within humans and other animals which takes in food, digests it to extract and absorb energy and nutrients, and expels the remaining waste as feces. The mouth, esophagus, stomach and intestines are part of the gastrointestinal tract. Gastrointestinal is an adjective meaning of or pertaining to the stomach and intestines. A tract is a collection of related anatomic structures or a series of connected body organs” https://en.wikipedia.org/wiki/Gastrointestinal_tract
- “Gastrointestinal problems were a feature of working at the very high altitude summit of Mauna Kea, Hawaii, USA.” Steven Magee CEng MIET
- “While working extreme night shifts, I would take digestive supplements to offset gastrointestinal problems that would develop at the very high altitude summit of Mauna Kea, Hawaii, USA.” Steven Magee CEng MIET
- “The effects of high altitude on humans are considerable. The percentage oxygen saturation of hemoglobin determines the content of oxygen in blood. After the human body reaches around 2,100 m (7,000 feet) above sea level, the saturation of oxyhemoglobin begins to decrease rapidly.” https://en.wikipedia.org/wiki/Effects_of_high_altitude_on_humans
- “When flying leads to stomach pain...Patients with a chronic intestinal inflammation often experience bouts of inflammation after a journey. The main cause of this is not the stress of travelling, but the lack of oxygen experienced in an aircraft or during high altitude stays in the mountains.” https://www.scienceDaily.com/releases/2013/09/130916090838.htm
- “Oxygen Deprivation in Newborn Foals...Other organs in the respiratory and gastrointestinal systems are frequently affected if oxygen deprivation is severe or prolonged.” https://ker.com/equinews/oxygen-deprivation-in-newborn-foals/
- “Intestinal ischemia (is-KEE-me-uh) describes a variety of conditions that occur when blood flow to your intestines decreases due to a blocked blood vessel, usually an artery. Intestinal ischemia can affect your small intestine, your large intestine (colon) or both. Intestinal ischemia is a serious condition that can cause pain and make it difficult for your intestines to work properly. In severe cases, loss of blood flow to the intestines can damage intestinal tissue and possibly lead to death. Treatments are available for intestinal ischemia. To improve the chances of recovery, it's crucial to recognize the early symptoms and get medical help right away.” https://www.mayoclinic.org/diseases-conditions/intestinal-ischemic-syndrome/syc-20373946
- “Intestinal Ischemic Syndrome...Early signs and symptoms of acute mesenteric ischemia include: Severe abdominal pain, concentrated in one area of the abdomen. Nausea and/or vomiting. Bloody stools. History of chronic atrial fibrillation or cardiovascular disease” https://my.clevelandclinic.org/health/diseases/17136-intestinal-ischemic-syndrome
- “The physiology of intestinal oxygenation and the pathophysiology of intestinal ileus. Intestinal Ileus is Gut Shock caused by Bowel Hypoxia. The morbidity and mortality of Intestinal Ileus has puzzled more than two generations of investigators because they have overlooked the fact that the gas which collects in obstructed small intestine is mostly (90+%) Nitrogen. For some strange reason a gut full of nitrogen has not been looked on as comparable to a lung full of nitrogen, even though the lung and gut have a common embryological origin. My proposal is..."
that intestinal epithelium lining a nitrogen filled lumen becomes as oxygen starved as alveolar lining in a similar circumstance. Bowel hypoxia may be brought about either by failure of the intestine to "breathe out", having breathed in due to mechanical block, or gut paralysis, from any cause, of which one may be failure of blood borne oxygen transport to the bowel. Individually, or together, these may reduce or stop the flow of air and/or aerated intestinal contents along the lumen.” https://www.ncbi.nlm.nih.gov/pubmed/3553873

- “Physiologic hypoxia and oxygen homeostasis in the healthy intestine. A Review in the Theme: Cellular Responses to Hypoxia...In recent years, the intestinal mucosa has proven to be an intriguing organ to study tissue oxygenation. The highly vascularized lamina propria juxtaposed to an anaerobic lumen containing trillions of metabolically active microbes results in one of the most austere tissue microenvironments in the body. Studies to date have determined that a healthy mucosa contains a steep oxygen gradient along the length of the intestine and from the lumen to the serosa. Advances in technology have allowed multiple independent measures and indicate that, in the healthy mucosa of the small and large intestine, the lumen-apposed epithelia experience Po2 conditions of <10 mmHg, so-called physiologic hypoxia. This unique physiology results from a combination of factors, including countercurrent exchange blood flow, fluctuating oxygen demands, epithelial metabolism, and oxygen diffusion into the lumen. Such conditions result in the activation of a number of hypoxia-related signaling processes, including stabilization of the transcription factor hypoxia-inducible factor. Here, we review the principles of mucosal oxygen delivery, metabolism, and end-point functional responses that result from this unique oxygenation profile.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4572369/

- “Polyps of the Colon and Rectum...An intestinal polyp is any mass of tissue that arises from the bowel wall and protrudes into the lumen. Most are asymptomatic except for minor bleeding, which is usually occult. The main concern is malignant transformation; most colon cancers arise in a previously benign adenomatous polyp. Diagnosis is by endoscopy. Treatment is endoscopic removal.” https://www.merckmanuals.com/professional/gastrointestinal-disorders/tumors-of-the-gi-tract/polyps-of-the-colon-and-rectum

- “Colon Polyps...Symptoms. Many times, people are not aware they have colon polyps because there are no symptoms. Larger growths can bleed, causing blood in the stool. Sometimes bleeding polyps can cause fatigue and other symptoms of anemia (low levels of red blood cells). On rare occasions, a large polyp can cause diarrhea or secretion of large amounts of potassium. This can cause marked fatigue and muscle weakness.” https://www.drugs.com/health-guide/colon-polyps.html

- “What Causes, Prevents Colon Polyps. Vitamin D Shines in New Study; Smoking Worse Than Expected...Taking a multivitamin -- most of which contain 400 IUs of vitamin D -- was associated with reducing polyp risk by about 25%. These multivitamins also contain adequate amounts of calcium, folate, vitamin E, and selenium, which Lieberman also found to help lower polyp risk, "but not as much as vitamin D," he says. In order to get the full protective effect of vitamin D -- at 645 IU -- add a small glass of milk daily to the multivitamin.” https://www.webmd.com/men/news/20031209/what-causes-prevents-colon-polyps#1

- “How Your Diet Affects Your Risk of Colon Polyps...The foods that had the highest inflammation scores were processed meats and red meat, Bostick said. Dairy foods that contained fat also had pro-inflammatory scores, whereas poultry and fish were neutral; they didn't cause inflammation, but they didn't appear to fight it either, he said. Fruits, vegetables and nonfat dairy, on the other hand, were determined to be anti-inflammatory, he said.”
“Sigmoid Colon Pain: Causes, Symptoms, and Treatment...Sigmoid colon pain symptoms can vary from one person to the next. As indicated earlier, some people experience mildly annoying symptoms. If the following symptoms arise, medical attention should be sought as soon as possible. Bloody diarrhea. Rectal bleeding. Loss of appetite. Loss of weight. Fatigue. Fever and chills. Intestinal obstruction. Skin problems. Tenderness in abdomen.”

“In 2018 at the age of 48, many years after the onset of various gastrointestinal problems while working at very high altitude atop Mauna Kea, I had a colonoscopy that removed a 5mm polyp from the sigmoid colon.”

“The sigmoid colon (pelvic colon) is the part of the large intestine that is closest to the rectum and anus. It forms a loop that averages about 35–40 cm (13.78-15.75 in) in length. The loop is typically shaped like a Greek letter sigma (ς) or Latin letter S (thus sigma + -oid). This part of the colon normally lies within the pelvis, but on account of its freedom of movement it is liable to be displaced into the abdominal cavity.”

“Mapping the body: the sigmoid colon. This S-shaped stretch of large bowel is the site of a variety of problems – some very unpleasant to treat...Inflammatory bowel disease such as ulcerative colitis and Crohn's disease may occur here. Diverticulitis, in which little outpouchings of bowel form and become inflamed, is more common in the sigmoid than any other part of the bowel. Small growths called polyps, as well as cancers, also favour this site.”


“Signs and Symptoms of Colorectal Cancer...A change in bowel habits, such as diarrhea, constipation, or narrowing of the stool, that lasts for more than a few days. A feeling that you need to have a bowel movement that is not relieved by doing so. Rectal bleeding. Dark stools, or blood in the stool. Cramping or abdominal (belly) pain. Weakness and fatigue. Unintended weight loss.”

“Causes of Low Potassium...Gastrointestinal Tract Problems. Certain health conditions such as diarrhea or vomiting can lead to excess loss of potassium. Enemas or excessive use of laxatives can also cause hypokalemia. Significant hypokalemia can occur in people who have undergone ileostomy or other bowel surgeries. Villous adenoma is a type of colon polyp, which can cause the excessive excretion of potassium from the colon.”

“Potassium Deficiency and Potassium Supplements...Potassium is a mineral that is critical for various body functions. Potassium is also an electrolyte works in the body along with calcium, sodium, chloride and magnesium to conduct electricity. Maintaining the right balance of potassium in the body is important, for a deficiency will lead to hyperkalemia and an excess will result in hypokalemia...Loss of potassium from the GI tract can be due to diarrhea, vomiting or laxative use.”
“Potassium...Certain conditions can cause potassium deficiencies, or hypokalemia. These include: kidney disease, overuse of diuretics, excess sweating, diarrhea, and vomiting, magnesium deficiency, use of antibiotics, such as carbenicillin and penicillin.”

“Hypokalemia, also spelled hypokalaemia, is a low level of potassium (K+) in the blood serum. Hypokalemia is one of the most common water–electrolyte imbalances. It affects about 20% of people admitted to hospital...In the heart, hypokalemia cause arrhythmias because of more complete recovery from sodium-channel inactivation, making the triggering of an action potential less likely. In addition, the reduced extracellular potassium (paradoxically) inhibits the activity of the IKr potassium current and delays ventricular repolarization. This delayed repolarization may promote reentrant arrhythmias.”

“In 2018 I was showing a positive response to supplementing with 360mg of Potassium daily.”

“My job was called “Summit Lead” when on the very high altitude summit of Mauna Kea. A few of us would rotate through this position during the weekdays, as we only worked part time on the summit. One of the other “Summit Lead’s” died from fatal gastrointestinal disease. He had spent far more time on the summit than I ever did and had accumulated much larger biologically toxic exposures.”

“When dealing with mysterious sickness, I advise people to look at what their coworkers were dying from for clues. My coworkers were were dying from suicide, gastrointestinal disease, heart disease and brain disease.”

“Routine preventative 5 year interval Colonoscopies should be mandatory for all very high altitude workers, regardless of their age.”
**Blood Clot Hazards**

Supplements For High Altitude Sickness & Deficiency Hazards

- “There were no recommendations given to us about vitamin and mineral requirements in low oxygen, low pressure and high radiation environments when at high altitude by the astronomy management teams.” Steven Magee CEng MIET - Q
- “I exhibited a positive response to 400 iu vitamin E daily in 2018.” Steven Magee CEng MIET
- “Effects of Cold and Altitude on Vitamin and Mineral Requirements...Persons who live or who engage in prolonged physical exertion for extended periods of time in the cold or at high altitudes appear to have special nutritional needs...Supplementation with additional vitamins E, C, and pantothenic acid, however, would ensure that these critical nutrients would be provided in amounts that cannot be obtained from the consumption of food alone. Including other vitamins and minerals at or near the RDA and MRDA levels should ensure adequate nutrient status for all metabolic functions.” [https://www.nap.edu/read/5197/chapter/18#239](https://www.nap.edu/read/5197/chapter/18#239)
- “Oxidative Stress at High Altitudes and Effects of Vitamin E...supplementation with antioxidants is advisable. The only known studies (Simon-Schnass, 1994; Simon-Schnass and Korniszewski, 1990; Simon-Schnass and Pabst, 1988) available have shown a beneficial influence of vitamin E on physical performance, blood flow, and some parameters, indicating an increased oxidative stress at high altitudes. However, the synergistic functions of other antioxidants, such as β-carotene and vitamin C (Halliwell et al., 1987), justify the recommendation of a supplementation.” [https://www.ncbi.nlm.nih.gov/books/NBK232888/](https://www.ncbi.nlm.nih.gov/books/NBK232888/)
- “nutritional and herbal supplements to prevent altitude sickness... Ginkgo: 120-180 mg/day (any history of asthma)  Milk Thistle: 120-240 mg/day (any liver complaints).  Antioxidants: Vitamin C 2-3,000 mg/day.  Vitamin E 400 iu/day.  alpha lipoic Acid 150-300 mg/day.  Raise glutathione levels: Selenium 200 mcg/day (if you have a family history of cancer never stop taking this!).  N-acetyl-cysteine 1-2000 mg/day (especially if prone to nasal congestion).  L-glutamine: 3,000 mg/day (especially if prone to stomach irritation).  Adaptogenic herbs: your choice: Korean Ginseng, Siberian Ginseng, Ashwagandha, Reishi,(which has a growing reputation of being useful ) etc.  Cardiotonics: Hawthorne Berry Extract (Crataegus): 250-500 mg/dayand Co Q 10 90 mg/day (both especially if you have a weak heart)” [http://www.denvernaturopathic.com/news/altitude.html](http://www.denvernaturopathic.com/news/altitude.html)
- “Are there vitamins to take for altitude sickness?...Both vitamin C and vitamin E are said to help with altitude sickness, as are other antioxidants. Antioxidants like beta carotene, selenium and zinc help because they reduce the free radicals suspected to exacerbate altitude sickness. Antioxidants can help you breathe more easily… The recommended dosage of vitamin C is 2,000 to 3,000 milligrams per day while the dosage of vitamin E is 400 international units (iu) a day.” [https://health.howstuffworks.com/diseases-conditions/respiratory/are-there-vitamins-to-take-for-altitude-sickness.htm](https://health.howstuffworks.com/diseases-conditions/respiratory/are-there-vitamins-to-take-for-altitude-sickness.htm)
- “Acute Mountain Sickness; Prophylactic Benefits of Antioxidant Vitamin Supplementation at High Altitude...Free-radical-mediated damage to the blood-brain barrier may be implicated in the pathophysiology of acute mountain sickness (AMS)...The antioxidant group ingested 4 capsules/day-1 (2 after breakfast/2 after evening meal) that each contained 250 mg of L-ascorbic acid (Vitamin C), 100 IU of dl-α-tocopherol acetate (Vitamin E) and 150 mg of α-lipoic acid...Antioxidant supplementation resulted in a comparatively lower Lake Louise AMS score at high altitude.” [http://altituderx.com/vitamin-e/](http://altituderx.com/vitamin-e/)
- “Alpha lipoic acid and acetyl L-carnitine...The initial excitement about ALC/alpha lipoic acid
Environmental Radiation LLC - https://www.environmentalradiation.com

(ALA) supplementation began when a team of researchers in California fed elderly rats both nutrients for a period of seven weeks and then compared them with young rats(1). They were testing the theory that mitochondrial decline is caused by free radical damage (see panel opposite). There was already evidence that supplementation with acetyl L-carnitine (ALC) could reverse the age-related decline in mitochondrial activity in rats, increase fatty acid oxidation and boost general metabolic activity(2). However the down side to this increased mitochondrial function was that more oxidative damage occurred(3), so the researchers decided to add the powerful mitochondrial antioxidant alpha lipoic acid (ALA) to the mix to see if they could get the best of both worlds: increased mitochondrial energy output, with reduced mitochondrial damage. This two-pronged ‘punch’ to ageing cells seemed to work, with the two supplements together producing better results than either one alone. After a month on the supplements, elderly (24-month-old) and lethargic rats had more energy and did better on memory tests, while their mitochondria worked better. The decline in overall activity typical of aged rats was reversed to the level of young-to-middle-aged adult rats, aged 7-10 months. The researchers likened this result to a group of 80-year-old humans throwing away their walking sticks and starting to act 35 years younger!...The altitude sickness study (7) used 600mgs of alpha lipoic acid (ALA) per day, while studies showing that acetyl L-carnitine (ALC) improves brain function in Alzheimer’s patients (10) have used between 1,500 and 3,000mgs per day. However, the human study carried out in San Francisco, which used 400mgs of alpha lipoic acid (ALA) and 1,000mgs of acetyl L-carnitine (ALC) per day, was overseen by the same team that carried out the initial rat studies, so that might be a good place to start.”


• “Altitude sickness...Vitamin E: Vitamin E may offer some benefits in exposure to high altitude. Antioxidant supplementation (vitamin E with beta carotene, vitamin C, selenium, and zinc) may improve ventilatory threshold at high altitudes; however, antioxidants may not reduce inflammation after exercise at high altitudes.”
http://www.livingnaturally.com/ns/DisplayMonograph.asp?
StoreID=15f522d98a3a417fbeb8d6702f135785a&DdocID=condition-altitudesickness

• “Adjusting to Altitude in Jackson Hole... Studies have shown that increased levels of vitamin C have helped to prevent and reduce instances of altitude sickness. Vitamin E, glutathione, and alpha-lipoic acid are common antioxidants also shown to support your body at higher altitudes. Adaptogenic herbs can also help with lung function and oxygen transportation, the most common being ginko biloba and rhodiola.” https://jhrea.com/adjusting-to-altitude-in-jackson-hole/

• “Can Vitamins Increase Blood Oxygen Level?...You need iron and a variety of vitamins for maintaining high numbers of healthy red blood cells to keep oxygen levels in your blood as high as necessary...Vitamin C...vitamin B-5, and vitamin B-6...Vitamin B-12...Vitamin A”
https://www.livestrong.com/article/492282-vitamins-to-increase-blood-oxygen-level/

• “14 More Ways To Give Yourself Oxygen-Rich Blood...Maximize Your Glutathione levels...Take Baking Soda...Take CoQ10... Take a few drops of chlorophyll...Try Vitamin B-12 and Folate...Check Your Vitamin A...Take Alpha-Lipoic Acid (ALA)” http://www.myhdiet.com/healthnews/ampm/14-ways-give-oxygen-rich-blood/

• “Ingredient Spotlight: Alpha Lipoic Acid Can Make A Great Focus Energy Drink...Alpha Lipoic acid (ALA) is a nootropic supplement widely used to support brain function is found in plants, used in food, and even focus energy drinks. Alpha Lipoic acid (ALA) is also naturally occurring
Antioxidant made by the body. It works from the cellular level in the body, turning glucose into energy. In healthy bodies, the ALA produced is enough for normal bodily functions. ALA, just like other antioxidants, fight “free radicals” in the body. These are waste products from normal bodily functions that when in excess, cause harmful chemical reactions that damage cells, making it harder to ward off infections.  

“Supplements to Increase Oxygen While Running...Iron...B Vitamins...Vasodilators...Magnesium” https://woman.thenest.com/supplements-increase-oxygen-running-15547.html

“Cancer: Seven Ways to Oxygenate Your Cells...Supplement with antioxidants. Vitamin A, Vitamin C with bioflavonoids, and complete Vitamin E all are powerful antioxidants...Supplement with B-Vitamins...Supplement with Vitamin D3.” http://www.eattosaveyourlife.com/blog/2013/05/07/cancer-seven-ways-to-oxygenate-your-cells/

“Vitamin E Deficiency Clinical Presentation...Patients with vitamin E deficiency may show signs and symptoms of hyporeflexia that progress to ataxia, including limitations in upward gaze. Patients may present with profound muscle weakness and visual-field constriction. Patients with severe, prolonged vitamin E deficiency may develop complete blindness, cardiac arrhythmia, and dementia.” https://emedicine.medscape.com/article/126187-clinical

“Vitamin E Deficiency Is Rampant — Why You Don’t Want to Be...Insufficient vitamin E can increase your risk for a wide variety of diseases, including immune dysfunction, cognitive deterioration and cardiovascular disease.” https://articles.mercola.com/sites/articles/archive/2016/08/08/vitamin-e-deficiency.aspx

“Link between vitamin E & brain tumours found in metabolite study...A link between vitamin E levels in the blood and the increased risk of brain tumours has been established in a Scandinavian study.” https://www.nutraingredients.com/Article/2016/05/24/Link-between-vitamin-E-brain-tumours-found-in-metabolite-study?

“Antioxidants and Radiation Therapy...Vitamin E. Similar to selenium, with which it can act in synergistic fashion in protecting cells against radiogenic transformation (5), vitamin E has been shown to decrease radiation-induced chromosome damage in human tumor cells but not in normal cells and has an inhibitory effect on a variety of cancer cells (10). A combined treatment with vitamins E and C inhibits apoptosis in human endothelial cells more effectively than each alone, while increasing Bel-2 and downregulating the pro-apoptotic Bax (11). By contrast, vitamin E induces apoptosis in human breast and prostate cancer cells as well as leukemia (12) and glioblastoma cells (13). Pretreatment of cells with vitamin E and selenium increases the levels of glutathione, glutathione peroxidase, and catalase, while doubling the breakdown of toxic peroxide and reducing transformation (5).” https://academic.oup.com/jn/article/134/11/3207S/4688649

“Symptoms of Vitamin C Deficiency...A lack of vitamin C in the diet can result in vitamin C deficiency anemia. An acute vitamin C deficiency results in the disease scurvy. Signs and symptoms begin to manifest after 45 to 80 days of vitamin C deprivation. By that time, the body’s stored vitamin C pool falls to about 20 percent of its optimal amount” https://www.livestrong.com/article/276699-symptoms-of-vitamin-c-deficiency/

“Vitamin B5 (Pantothenic Acid) - Deficiency Risk and Symptoms...Symptoms of deficiency: Fatigue; Insomnia; Depression; Irritability; Vomiting; Stomach pains; Burning feet; Respiratory infections.” [https://www.justvitamins.co.uk/blog/vitamin-b5-pantothenic-acid-deficiency-risk-and-symptoms5/]

“Top 5 Signs of Deficiency of Vitamin B5...1...burning sensations in the hands and feet and numbness coupled with poor coordination. 2...muscle cramps, numbness, and tingling sensations of muscles which make them very uncomfortable. 3...irritability, fatigue, tiredness, and apathy. 4. Intestinal symptoms like diarrhea, vomiting, and water retention...5…Hypoglycemia. Sleep disturbances, restlessness, and irritability.” [https://www.newsmax.com/fastfeatures/signsofvitaminb5signsanddeficiencyofvitaminb5deficiencyandsignofvitaminb5/2011/03/17/id/389851/]

“Vitamin A Deficiency Clinical Presentation...Subclinical forms of VAD may not cause any symptoms, but the risk of developing respiratory and diarrheal infections is increased, the growth rate is decreased, and bone development is slowed. Patients may have a recent history of increased infections, infertility secondary to impaired spermatogenesis, or recent spontaneous abortion secondary to impaired embryonic development. The patient may also report increased fatigue, as a manifestation of VAD anemia.” [https://emedicine.medscape.com/article/126004-clinical]

“Vitamin A deficiency...Night blindness and its worsened condition, xerophthalmia, are markers of VAD, as it can also lead to impaired immune function, cancer, and birth defects. Collections of keratin in the conjunctiva, known as Bitot's spots, are also seen. Imtiaz's sign is the earliest ocular sign of VAD. Conjunctival epithelial defects occur around lateral aspect of the limbus in the subclinical stage of VAD. These conjunctival epithelial defects are not visible on a biomicroscope, but they take up black stain and become readily visible after instillation of kajal (surma); this is called "Imtiaz's sign".[10] Vitamin A deficiency is one of several hypovitaminoses implicated in follicular hyperkeratosis.” [https://en.wikipedia.org/wiki/Vitamin_A_deficiency]

“Radiation-induced small bowel disease: latest developments and clinical guidance...Radiation therapy may disturb the indigenous gut flora which are important in maintaining a normal mucosal function [Berthrong, 1986] and there is emerging evidence that probiotics may have a radio-protective effect.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3871275/]

“Antioxidants & Treatment...It is possible that taking antioxidant supplements during (radiation) treatment can protect normal tissues from the damaging side effects of treatments and may improve tumor response and patient survival (1-3). On the other hand, some studies indicate that taking antioxidant supplements may interfere with chemotherapy and radiation therapy by reducing their effectiveness. It is possible that antioxidants may protect tumor cells, in addition to healthy cells, from the oxidative damage intentionally caused by conventional treatments. This, in turn, may reduce the effectiveness of the treatments (4-7).” [http://dpgstorage-prd.s3.amazonaws.com/ondpg/documents/592b6012255530ee/Antioxidants_&_Treatment.pdf]

“Antioxidants and Radiation Therapy...Antioxidants decrease painful side effects. Vitamin supplementation may help treat side effects of radiation therapy. Vitamin E (400 IU) and vitamin C (500 mg) have been shown to offer protection against proctitis, a painful chronic injury that affects 5–20% of people receiving radiation therapy for cervical and prostate cancer (15); a striking regression of chronic radiation-induced fibrosis was seen in a clinical trial that
combined radiation treatment of head and neck cancer with vitamin E (1000 IU) and pentoxyfylline (0.8 g/d) supplementation (16).”

https://academic.oup.com/jn/article/134/11/3207S/4688649


https://www.medicalnewstoday.com/articles/322384.php
Commercial Altitude Supplements

- "I never took supplements atop the mountains, as the professional astronomy management teams never advised us to do so." Steven Magee CEng MIET - Q
- "ALTITUDE ADVANTAGE BENEFITS: Supports the body’s extraordinary physiological demands of performing at high elevation* Helps reduce fatigue, inflammation, and lactic acid build-up* Improves circulation throughout the body, including brain and lungs which are particularly sensitive to low oxygen conditions* Contains potent, natural antioxidants to quell free-radicals produced under physically-demanding environmental conditions* Increases enjoyment of high-elevation sports and activities by reducing the unpleasant, undesirable side effects of diminished oxygen and barometric pressure*"
- "ALTITUDE RX OXYBOOST. Be free to enjoy every moment in the mountains as you reduce the symptoms of altitude sickness and vertigo. It has alpha lipoic acid, ginkgo biloba, and rhodiola to increase oxygen, maximize energy, and prevent fatigue at altitude. TRAVEL AND FAMILY FRIENDLY. Whether you’re hiking Machu Picchu, skiing, or snowboarding with your family, Altitude RX gives you relief from Mountain Sickness by accelerating altitude acclimation. VALIDATED BY SCIENCE. In a double-blind, randomized, placebo-controlled trial at 12,126ft, researchers found that the ingredients in Altitude-Rx reduced mountain sickness in treated participants who had no previous experience in high altitude. COMMITTED TO NUTRITION. Made with natural ingredients, Altitude RX boosts the saturation of oxygen in your bloodstream and maximizes your metabolism, so you feel as energized and healthy at high altitude as you do near sea level." [https://www.amazon.com/Altitude-Rx-OxyBoost-Complex-Vegetarian/dp/B004U2JN70/ref=mp_s_a_1_1_sspa?dchild=1&keywords=altitude+supplement&qid=1593026375&sprefix=altitude+supp&sr=8-1-spons&psc=1&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEwMjk5NjIxM0JPVUlBRCZlbmNyeXB0ZWRBZElkPUEwMzgwN3IyMjYyQyZ3aWRnZXROYW1lPXNwX3Bob25lX3NlcHRpb25zPUEwMzgwN3IyMjYyQyZ3aWRnZXROYW1lPXNwX3Bob25lX3NlcHRpb25zPUEwMzgwQlJlZGJ6eXBlPUEwMzgwN3IyMjYyQyZ3aWRnZXROYW1lPXNwX3Bob25lX3NlcHRpb25zPUEwMzgwQlJlZGJ6eXBlPUEwMzgwQlJlZGJ6eXBlPUEwMzgwQlJlZGJ6eXBl](https://www.amazon.com/Altitude-Rx-OxyBoost-Complex-Vegetarian/dp/B004U2JN70/ref=mp_s_a_1_1_sspa?dchild=1&keywords=altitude+supplement&qid=1593026375&sprefix=altitude+supp&sr=8-1-spons&psc=1&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEwMjk5NjIxM0JPVUlBRCZlbmNyeXB0ZWRBZElkPUEwMzgwN3IyMjYyQyZ3aWRnZXROYW1lPXNwX3Bob25lX3NlcHRpb25zPUEwMzgwN3IyMjYyQyZ3aWRnZXROYW1lPXNwX3Bob25lX3NlcHRpb25zPUEwMzgwQlJlZGJ6eXBlPUEwMzgwN3IyMjYyQyZ3aWRnZXROYW1lPXNwX3Bob25lX3NlcHRpb25zPUEwMzgwQlJlZGJ6eXBlPUEwMzgwQlJlZGJ6eXBlPUEwMzgwQlJlZGJ6eXBlPUEwMzgwQlJlZGJ6eXBlPUEwMzgwQlJlZGJ6eXBl)
- "Altitude Boost. High Altitude Training in a Bottle to Increase VO2 Max, Endurance, Oxygen with Alpha Lipoic Acid, Iron and Vitamin B 12 (60 Tablets)...ALTITUDE BOOST. With natural compounds that mimic the effects of high altitude training, Altitude Boost stimulates red blood cell production for more efficient oxygen use and increased lung capacity for increased speed, strength and endurance. NEXT FRONTIER IN PERFORMANCE. Safe, effective, and natural, Altitude Boost has been shown to significantly increase EPO levels in athletes. This results in substantial gains in EPO levels on endurance and recovery." [https://www.amazon.com/ALTITUDE-BOOST-Endurance-Supplement-Efficiency/dp/B0155KQP5S](https://www.amazon.com/ALTITUDE-BOOST-Endurance-Supplement-Efficiency/dp/B0155KQP5S)
Prescription Drug Treatments For Altitude Sickness

- “I never observed any prescription drugs other than medical oxygen being given to sickened Mauna Kea workers during my time on the very high altitude summit of Mauna Kea.” Steven Magee CEng MIET - Q
- “Thieves grab RAF Viagra and £7m of equipment...The MoD was quick to point out that “Viagra has other medical uses — for example it is also often used to treat low blood pressure and altitude sickness”.” https://www.thetimes.co.uk/article/thieves-grab-raf-viagra-and-pound7m-of-equipment-f05hjtq8kr5
- “Trump says he didn't know about military spending on Viagra...The Military Times reported in 2017 the Defense Department spent $84.2 million on erectile dysfunction medications such as Viagra — 10 times more than it spent on health care services for transgender personnel.” https://www.axios.com/trump-didnt-know-about-military-viagra-spending-4edc6e58-70a5-4aaa-ba6a-0776d085e3bd.html
- “High Altitude Headache? I get headaches at high altitudes. Is there anything I can do to prevent them?...Viagra and Cialis to prevent and treat severe symptoms of mountain sickness. They increase blood flow to other vital organs, not just the penis, and some mountain climbers report better success with them than with Diamox.” https://www.drweil.com/health-wellness/body-mind-spirit/headache/high-altitude-headache/
- “Sildenafil, sold as the brand name Viagra among others, is a medication used to treat erectile dysfunction and pulmonary arterial hypertension.[3] Its effectiveness for treating sexual dysfunction in women has not been demonstrated.[3] Common side effects include headaches and heartburn, as well as flushed skin. Caution is advised in those who have cardiovascular disease. Rare but serious side effects include prolonged erections, which can lead to damage to the penis, and sudden-onset hearing loss. Sildenafil should not be taken by people who take nitrates such as nitroglycerin (glycerin trinitrate), as this may result in a severe and potentially fatal drop in blood pressure.[3] Sildenafil acts by inhibiting cGMP-specific phosphodiesterase type 5 (phosphodiesterase 5, PDE5), an enzyme that promotes degradation of cGMP, which regulates blood flow in the penis. Pfizer scientists Andrew Bell, David Brown, and Nicholas Terrett originally discovered sildenafil as a treatment for various cardiovascular disorders.[4][5] Since becoming available in 1998, sildenafil has been a common treatment for erectile dysfunction; its primary competitors are tadalafil (trade name Cialis) and vardenafil (Levitra).” https://en.wikipedia.org/wiki/Sildenafil
- “Tadalafil (INN)[2] is a PDE5 inhibitor marketed in pill form for treating erectile dysfunction (ED) under the name Cialis /siˈæls/ see-AL-iss, and under the name Adcirca /ædˈsɜːrkə/ ad-SUR-ka for the treatment of pulmonary arterial hypertension. In October 2011 the U.S. Food and Drug Administration (FDA) approved Cialis for treating the signs and symptoms of benign prostatic hyperplasia (BPH) as well as a combination of BPH and erectile dysfunction when the conditions coincide. It initially was developed by the biotechnology company ICOS, and then again developed and marketed worldwide by Lilly ICOS, LLC, the joint venture of ICOS Corporation and Eli Lilly and Company. Cialis tablets, in 2.5 mg, 5 mg, 10 mg, and 20 mg doses, are yellow, film-coated, and almond-shaped. The approved dose for pulmonary arterial hypertension is 40 mg (two 20 mg tablets) once daily. Tadalafil is also manufactured and sold under the name of Tadacip by the Indian pharmaceutical company Cipla in doses of 10 mg and 20 mg. On November 21, 2003 the FDA approved tadalafil (as Cialis) for sale in the United
States as the third ED prescription drug pill (after sildenafil citrate (Viagra) and vardenafil (Levitra)). Like sildenafil and vardenafil, tadalafil is recommended as an 'as needed' medication. Cialis is also offered as a once-daily medication. Tadalafil was approved in May 2009 in the United States for the treatment of pulmonary arterial hypertension[3] and is under regulatory review in other regions for this condition. In late November 2008, Eli Lilly sold the exclusive rights to commercialize tadalafil for pulmonary arterial hypertension in the United States to United Therapeutics for an upfront payment of $150 million.”

- “Diamox - my experience in preventing altitude sickness...It is useful to take the Diamox at night before sleeping. This helps to reduce the strange phenomenon known as "periodic breathing" or "Cheyne Stokes respiration." When this happens, your breathing alternates between rapid breathing and almost not breathing at all for a short time. You might sleep better if it can be reduced as it is a bit frightening for some people.”

- “Acetazolamide for altitude sickness...Acetazolamide increases the amount of urine produced and changes the acidity of the blood. The net effect is to improve breathing and reduce fluid around the brain and in the lungs. Acetazolamide is not licensed to prevent and treat altitude sickness, although it has long been used for this purpose.”

- “Acetazolamide, sold under the trade name Diamox among others, is a medication used to treat glaucoma, epilepsy, altitude sickness, periodic paralysis, idiopathic intracranial hypertension, and heart failure.[2][3] It may be used long term for the treatment of open angle glaucoma and short term for acute angle closure glaucoma until surgery can be carried out.[4] It is taken by mouth or injection into a vein.[2] Common side effects include numbness, ringing in the ears, loss of appetite, vomiting, and sleepiness.[2] It is not recommended in those with significant kidney problems, liver problems, or who are allergic to sulfonamides.[2][4] Acetazolamide is in the diuretic and carbonic anhydrase inhibitor families of medication.[2] It works by decreasing the amount of hydrogen ions and bicarbonate in the body.[2] Acetazolamide came into medical use in 1952.[5] It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system.[6] Acetazolamide is available as a generic medication.[2] The wholesale cost in the developing world is about 1.40 to 16.93 USD per month.[7] In the United States the wholesale cost is about 125.34 USD per month.[8]...In the treatment of mountain sickness, acetazolamide forces the kidneys to excrete bicarbonate, the conjugate base of carbonic acid. By increasing the amount of bicarbonate excreted in the urine, the blood becomes more acidic.[12] As the body equates acidity of the blood to its CO2 concentration, artificially acidifying the blood fools the body into thinking it has an excess of CO2, and it excretes this imaginary excess CO2 by deeper and faster breathing, which in turn increases the amount of oxygen in the blood.[17][18] Acetazolamide is not an immediate cure for acute mountain sickness; rather, it speeds up part of the acclimatization process which in turn helps to relieve symptoms.[19] Acetazolamide is still effective if started early in the course of mountain sickness. As prevention it is started one day before travel to altitude and continued for the first 2 days at altitude.”

- “Dexamethasone is a type of corticosteroid medication.[1] It is used in the treatment of many conditions, including rheumatic problems, a number of skin diseases, severe allergies, asthma, chronic obstructive lung disease, croup, brain swelling, and along with antibiotics in
tuberculosis.[1] In adrenocortical insufficiency, it should be used together with a medication that has greater mineralocorticoid effects such as fludrocortisone.[1] In preterm labor, it may be used to improve outcomes in the baby.[1] It may be taken by mouth, as an injection into a muscle, or intravenously.[1] The effects of dexamethasone are frequently seen within a day and last for about three days.[1] The long-term use of dexamethasone may result in thrush, bone loss, cataracts, easy bruising, or muscle weakness.[1] It is pregnancy category C in the United States meaning use should be based on benefits being predicted to be greater than risks.[2] In Australia, it is category A, meaning it has been frequently used in pregnancy and not been found to cause problems to the baby.[3] It should not be taken when breastfeeding.[1] Dexamethasone has anti-inflammatory and immunosuppressant effects.[1] Dexamethasone was first made in 1957.[4] It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system.[5] Dexamethasone is not expensive.[6] In the United States a month of medication typically costs less than 25 USD.[1] In India a course of treatment for preterm labor is about 0.5 USD.[6] It is available in most areas of the world.[6] Dexamethasone is used in the treatment of high-altitude cerebral edema (HACE), as well as high-altitude pulmonary edema (HAPE). It is commonly carried on mountain-climbing expeditions to help climbers deal with complications of altitude sickness.”

- “Furosemide for High Altitude Pulmonary Edema...Dr Mason suggests that furosemide (Lasix) given in large doses orally and intravenously may have dramatic beneficial effect in the treatment of high altitude pulmonary edema (HAPE). A case is described in which 120 mg orally and 80 mg intravenously were given, resulting in a 4,000-ml diuresis in 6 1/2 hours, with allegedly beneficial results. Unfortunately, such anecdotal reports have led to the indiscriminate use of furosemide in the treatment of HAPE as well as for the prevention of mountain sickness.” https://jamanetwork.com/journals/jama/article-abstract/341844

- “Furosemide, sold under the brand name Lasix among others, is a medication used to treat fluid build-up due to heart failure, liver scarring, or kidney disease.[1] It may also be used for the treatment of high blood pressure.[1] It can be taken intravenously or by mouth.[1] When taken by mouth, it typically begins working within an hour, while intravenously, it typically begins working within five minutes.[1] Common side effects include low blood pressure with standing, ringing in the ears, and sensitivity to sunlight.[1] Potentially serious side effects include electrolyte abnormalities, low blood pressure, and hearing loss.[1] Blood tests are recommended regularly for those on treatment.[1] Furosemide is a type of loop diuretic that works by decreasing the reabsorption of sodium by the kidneys.[1] Furosemide was discovered in 1962.[2] It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system.[3] The wholesale price in the developing world is between US$0.004 and US$0.02 per day.[4] In the United States it is available as a generic medication and costs about US$0.15 per day.[1] Furosemide is on the World Anti-Doping Agency's banned drug list due to concerns that it may mask other drugs.[5] It has also been used to prevent and treat race horses for exercise-induced pulmonary hemorrhage.[6][7]” https://en.wikipedia.org/wiki/Furosemide
Altitude Acclimatization Hazards

- “The incorrect acclimatization guide for the 13,796 feet high summit of Mauna Kea: ‘It's important to acclimatize at least a 1/2 hour (1 to 1 ½ hours for first timers) at the Hale Pohaku facility or the Visitor Information Station (9,200 foot/2,800 m level) before going to the summit.’” Steven Magee CEng MIET - Q 
  http://www2.keck.hawaii.edu/observing/ObserverPacket/highaltitude101.htm
- "to adapt to 4,000 metres (13,000 ft) of altitude would require 45.6 days" 
- “climbers are advised by medical experts to ascend only 300 meters a day at altitudes over 3,000 meters to give their bodies time to adapt.” https://www.ucalgary.ca/utoday/issue/2016-01-27/study-looks-effects-oxygen-depletion-high-altitude-workers-chile
- “Abrupt exposure to high altitude negatively affects mental and physical performance and overall health because it lowers the oxygen supply to the body's tissues for a significant amount of time. This condition, known as hypoxia, is what leads to altitude sickness.” https://www.army.mil/article/111471/Army_developing_tool_to_reduce_altitude_sickness_in_deployed_Soldiers/
- "It not only predicts whether a soldier would get ill at certain altitudes, it gives a prescription for exposure. This tool can prescribe, for example, that if [soldiers spend] two days at 8,000 feet before they go to their final altitude of 14,000 feet, the likelihood and severity of AMS would be drastically reduced." https://www.livescience.com/40337-military-altitude-sickness.html
- “Mountain Warfare- High Altitude Illness & Prevention...Describe the Ascend by Stages method of Acclimatization...Spend 2 or 3 days at each stage, beginning at 8,000 feet and subsequent stages of 2,000 to 3,000 feet increments, will insure that the ultimate destination is reached. By this time, a considerable degree of acclimatization will have occurred, mountain sickness greatly reduced and the operational potential greatly increased...Over what altitude can substantial disability and ineffectiveness occur in 50-80% of troops? Rapid ascension over 12,000 feet” https://quizlet.com/33077235/mountain-warfare-high-altitude-illness-prevention-flash-cards/
- “But inside the control room at 16,500 feet, my head was splitting. I was out of breath and couldn’t tell if my shot was in focus. My cameraman Josh Barajas was struggling too. He asked repeatedly where his memory card was, and repeatedly I told him he’d already put it in the camera. ...My blood oxygen read 83 — that’s low. At sea level, I would be in the hospital for a reading of 93.” http://www.pbs.org/newshour/updates/reporters-notebook/
- “some employees report blacking out or falling asleep at the wheel as they wind their way back down the mountain... some of the body and brain-altering effects of oxygen depletion are causing untold accidents at the observatory... the most significant issue is an employee’s ability to undertake the complex tasks necessary for safe work performance — memory, attention and planning....These likely become compromised at altitude because of the lack of oxygen and the inadequate time for the body to adapt” https://www.ucalgary.ca/utoday/issue/2016-01-27/study-looks-effects-oxygen-depletion-high-altitude-workers-chile
- “Training to prepare for oxygen deficiency in the high mountains...acclimatizing has its limits, somewhere between 5,000 and 8,000m any length of time is detrimental due to the decrease in air pressure, so you can't just climb half-way up Everest, spend a week resting and the kick it
for the last part, you'll be worse off after that week than when you began.”
https://outdoors.stackexchange.com/questions/1254/training-to-prepare-for-oxygen-deficiency-in-the-high-mountains

- "Altitude sickness, unregulated drugs and medical gas enabled workers to become drug abusers/addicts." Steven Magee CEng MIET – Q http://www.keckobservatory.org/
- "Over-the-counter drug abuse or addiction was a problem that I observed at Mauna Kea."
  Steven Magee CEng MIET – Q http://www.crchealth.com/addiction/otc-drug-abuse/
- "During my five years on Mauna Kea, workers routinely displayed symptoms of Cerebral Hypoxia."
- “Oxygen deprivation and supplemental oxygen are both bio-hazards for Mauna Kea workers.” - Q Steven Magee CEng MIET http://elsmar.com/Forums/showthread.php?t=48325
- "It is well documented that high altitude expeditions may elicit alterations in both emotional and cognitive functioning. These changes are likely due to the cumulative effects of hypoxia, high altitude deterioration, physical exhaustion, fluid and electrolyte disturbances, and preexisting psychological morbidity." http://onlinelibrary.wiley.com/doi/10.1111/j.1708-8305.2009.00369.x/full
- "Journeying to these places of high altitude carries significant risk of illness and death." Centre for Altitude Space and Extreme Environment Medicine (CASE Medicine) http://www.case-medicine.co.uk/news_detail.php?article=33
- “It was common for sea level adapted staff to report tiredness and fatigue daily after returning to sea level from the high altitude mountain observatory.” Steven Magee CEng MIET - Q
- “A Review of the Physiology and Nutrition in Cold and in High-Altitude Environments by the Committee on Military Nutrition Research...the many adverse physiological reactions, physical, or cognitive performance difficulties, and mood changes at high altitudes, when combined with increased risks for mountain illnesses, trauma, and malnutrition, create obvious difficulties for military operations.” https://www.ncbi.nlm.nih.gov/books/NBK232855/
- “I moved from the day shift to the extreme night shift because I knew that they had a better acclimatization of a few hours at 9,200 feet, as opposed to the ridiculous half hour at 9,200 feet for the day shift. There was only one acclimatization from near sea level to 9,200 feet per week for the night shift workers, as they lived on the mountain for the duration of their shifts.” Steven Magee CEng MIET - Q
**Altitude Case Studies**

- “High altitude cerebral edema with a fatal outcome within 24 h of its onset: Shall acclimatization be made compulsory?...We present a case of a 39-year-old healthy male patient who developed HACE with fatal out-come within 24 h of travelling to a height of 3524 meters above sea level...Here, the patient had rapidly ascended to an altitude of 3343 meters and went into coma within 3 h of developing symptoms of AMS (headache, nausea, and vomiting). The recommended ascent is 300 m/day while the ascent in our case was almost 10 times the recommended ascent...This patient was a middle-aged healthy person with no risk factors.” [Source](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3858714/)

- “High altitude pulmonary edema (HAPE) in a Himalayan trekker: a case report...High altitude pulmonary edema is a non-cardiogenic form of pulmonary edema that develops in unacclimatized individuals at altitudes over 2500 m...A 55 years of age Indian ethnic South African lady was emergency air-lifted from 4410 m altitude in the Nepal Himalayas to Kathamandu (1300 m) with a suspected case of high altitude pulmonary edema. She had continued ascending despite experiencing mild altitude symptoms at Namche (3440 m), and these symptoms worsened considerably at Tengboche (3860 m).” [Source](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3984695/)

- “Retinal Hemorrhages Associated with High Altitude...A 50-year-old man presented with blurry vision and scotomas in his right eye immediately after a 2-week hiking trip in the Andes at an altitude of 19,600 ft (6000 m). During the 2 weeks, he was taking acetazolamide in an effort to prevent altitude sickness and reported having no symptoms during his hike...High-altitude retinopathy is a common finding among hikers at altitudes above 16,000 ft (4900 m) and may portend the onset of more serious manifestations of high-altitude sickness, including cerebral or pulmonary edema.” [Source](https://www.nejm.org/doi/full/10.1056/NEJMicm0909506)

- “Retinopathy as a Matter of Altitude. Hiking at 11,000 feet results in startling discovery of underlying retinal pathology...A 28-year-old man presented to the Los Angeles County + University of Southern California Medical Center after he experienced sudden onset of visual loss in his right eye while hiking at 11,000 feet a week earlier. He returned to sea level 24 hours after hiking. His vision had improved by the time he visited the clinic, but he still experienced what he described as a ring scotoma...Ascent to high altitude is well known to induce characteristic changes in the posterior segment. Vascular engorgement and tortuosity as well as disc hyperemia have been observed in individuals at an altitude of at least 16,400 feet and are considered to be normal responses to the hypoxic environment.1 Knowing at what altitude these changes are first observed is difficult, but they have been documented as low as 10,800 feet above sea level.” [Source](http://www.retina-specialist.com/article/retinopathy-as-a-matter-of-altitude)

- “ring scotoma. An annular area of blindness in the visual field surrounding the point of fixation, associated with glaucoma and pigmentary degeneration of the retina.” [Source](https://www.dictionary.com/browse/ring-scotoma)

- “High Altitude Retinal Hemorrhage...sudden atmospheric pressure changes can generate vascular modifications in the retina. We present a clinical case of retinal hemorrhage related to high altitude and propose to revise its pathophysiology...36 year old Male patient came to our institute with sudden diminished vision in the right eye associated with loss of consciousness while climbing a mountain. In the ophthalmological examination, we could appreciate in the right eye a macular hemorrhage and in both eyes few diffuse hemorrhages in mild periphery.
The patient lost follow-up and return after 1 year for a check-up. He had spontaneous resolution of all hemorrhages. Conclusion: the acute mountain sickness affects mostly not climatized people. Changes in atmospheric pressure generate reduction of the partial pressure of oxygen in the blood. This can lead to vascular changes in the retina. This change may not appear if there is a proper climatization while climbing a mountain. The presence of high altitude retinopathy alerts about cerebral oedema related to high altitude.”

- “Mountain Medicine, A Review of the Eye at Altitude...In 1988, on the southwest face of Mt. Everest, two climbers died above 8000 meters; their last radio message was that they were both totally blind.”
- “A Mount Everest record-holder says summit 'traffic jams' aren’t the problem — it’s the trek down that kills people...When returning, their body is out of energy, and many people die due to this cause...10 of the 11 climbers who died on Everest this month — Seamus Lawless, Ravi Thakar, Donald Cash, Anjali Kulkarni, Nihal Bagwan, Kalpana Das, Ernst Landgraf, Dhruba Bista, Robin Fisher, and Christopher Kulish — had already reached the apex. They were on their way down when they either fell, collapsed, died of exhaustion or illness, stopped to rest and mysteriously expired, or went to sleep and never woke.”
- “Does Altitude Increase Your Risk of a Heart Attack? Last November, Conrad Anker suffered a heart attack at 20,000 feet. Did the altitude have something to do with it?...The biggest predictor of a heart attack wasn’t the altitude at which they occurred, but rather the age and sex of the individual and whether they’d taken time to acclimate.”
- “Miss Teen Universe Lotte van der Zee, 20, died after suffering cardiac arrest on skiing holiday.”
- “The death of two Keystone skiers recently due to cardiac issues are stark reminder of heart risks at altitude...twin tragedies took place within days of each other at Keystone Resort. Arvada resident Daniel Mares, 53, and Silverthorne resident Durwood Marshall, 66, died at Keystone while skiing during the Christmas holiday weekend. In both cases, Summit County Coroner Regan Wood determined that cardiac issues were the proximate cause of death...cardiovascular problems are also a common — if more mundane — cause for sudden death on the slopes, especially among lowlanders.”
- “Russian mountain death caused by high altitude, coroner rules...A man died from an irregular heartbeat caused by high altitude while climbing Europe's highest mountain, a coroner has ruled. Daniel Read, 37, of Woodbridge, Suffolk, died in July climbing 5,642m (18,510 ft) Mount Elbrus in Russia...The coroner recorded a verdict of cardiac arrhythmia, or irregular heartbeat, caused by high altitude.”
- “‘Hero’ ER Doctor Who Treated NYC Coronavirus Patients Dies by Suicide at 49, Father Says "She tried to do her job, and it killed her," Dr. Philip C. Breen said of his daughter, Dr. Lorna M. Breen...Lorna was a member of the New York ski club and often traveled west to ski and snowboard.”
- “Gabriel Wortman: 5 Fast Facts You Need to Know...Gabriel Wortman has been identified as
the 51-year-old man who was shot dead after killing at least 18 people, including a Royal Canadian Mounted Police officer, in a rural Nova Scotia, Canada...Gabriel’s likes are good skiing...The shooting spree surpasses the previous deadliest mass shooting in Canada, the École Polytechnique massacre.” [5](https://heavy.com/news/2020/04/gabriel-wortman/)

- “Woman, 20, died of altitude sickness hiking Colorado trail, coroner confirms...Susanna Deforest was hiking the popular Pitkin County trail on Aug. 17 with three other friends when she became severely ill. The Collegeville, Penn., woman died overnight while waiting for rescue crews...“The decedent most likely started developing HAPE during the 15th and 16th as it commonly develops on the second or third day at altitudes above 6,600 feet when it occurs,” Ayers said. “She then traveled to a higher camping site at an altitude where HACE can develop.”” [5](https://www.thedenverchannel.com/lifestyle/health/woman-20-died-of-altitude-sickness-hiking-colorado-trail-coroner-confirms)

- “The mystery of Dead Mountain: In February 1959, a group of nine experienced hikers in the Russian Ural Mountains died mysteriously on an elevation known as Dead Mountain. Eerie aspects of the incident—unexplained violent injuries, signs that they cut open and fled the tent without proper clothing or shoes, a strange final photograph taken by one of the hikers, and elevated levels of radiation found on some of their clothes—have led to decades of speculation over what really happened.” [5](https://www.amazon.com/Dead-Mountain-Untold-Dyatlov-Incident-ebook/dp/B00CUSQQOA/ref=gbps_img_s-5_cd34_0ae82738?smid=A3T7DQBB0CKEM6&pf_rd_p(fd51d8cf-b5df-4144-8086-80096db8ed34)&pf_rd_s=slot-5&pf_rd_t=701&pf_rd_i=gb_main&pf_rd_m=ATVPDKIKX0DER&pf_rd_r=DZ2B2GFCSMEDRJ6PQAM11)

- “He climbed the tallest mountain on each continent, then died as he descended Mount Everest...Cash's children said their father had been working for years toward his dream of joining the "Seven Summits Club" and that he knew the risks. A previous expedition left him without parts of his fingers on his right hand due to frostbite...Cash's family says they believe he died due to cardiac arrest. Sherpas attempted CPR and gave him oxygen, but Cash died as they descended the congested route.” [5](https://www.usatoday.com/story/news/world/2019/05/23/mount-everest-climber-death-seven-summits-club/1205607001/)

- "An avid mountain climber, Konrath is one of less than 300 people who have climbed to the highest point on all seven continents...Konrath appeared to explain a plan to sneak into his ex-wife’s house at night and shoot her while their children were asleep in their rooms...Konrath told ABC News' "20/20" in a jailhouse interview." [5](http://abcnews.go.com/US/inside-bizarre-case-indiana-surgeon-accused-plotting-wifes/story?id=33800834)

- "Lisa Marie Nowak is an American former naval flight officer and NASA astronaut...Florida prosecutors filed three formal charges against Nowak: (1) attempted kidnapping with intent to inflict bodily harm or terrorize, (2) burglary of a conveyance with a weapon, and (3) battery...Her lawyer stated that she suffered from major depression, obsessive-compulsive disorder, insomnia, and "brief psychotic disorder with marked stressors" at the time of the incident. She was also suffering from Asperger Syndrome" [5](https://en.wikipedia.org/wiki/Lisa_Nowak)

- “NASA astronaut accused of stealing identity, accessing bank account of estranged wife while in space: report...A NASA astronaut has been accused of committing the first crime in outer space after her estranged wife alleged she stole her identity and accessed her bank account

“Anne Charlotte McClain (born June 7, 1979) is a lieutenant colonel in the U.S. Army, engineer and a NASA astronaut... On August 23, 2019, The New York Times reported that Worden has filed a complaint against McClain through the Federal Trade Commission accusing her of illegally accessing financial information while residing in the International Space Station. This accusation "outed" McClain as a homosexual woman, making her the first openly homosexual astronaut.” https://en.wikipedia.org/wiki/Anne_McClain

“Sally Kristen Ride (May 26, 1951 – July 23, 2012) was an American astronaut and physicist. Born in Los Angeles, she joined NASA in 1978 and became the first American woman in space in 1983... She is the first known LGBT astronaut.” https://en.wikipedia.org/wiki/Sally_Ride

“At least 59 people were killed and more than 500 were injured in a shooting... "Lone wolf" gunman behind deadly mass shooting was... Stephen Paddock... a licensed pilot who owned two planes... Neighbors characterized Stephen Paddock as a "reclusive" and "weird" man who "never went out in back and enjoyed the backyard, nature."” http://www.rollingstone.com/culture/news/las-vegas-shooter-stephen-paddock-what-we-know-so-far-w506562

“A person who avoids sunlight may eventually develop solar radiation deficiency sickness.” Steven Magee CEng MIET - Q

“Stephen Paddock had a pilot's license and flew small airplanes in the past. The altitudes that he flew at and whether he used oxygen above 10,000 feet in un-pressurized planes to prevent Cerebral Hypoxia from occurring is unknown. The highest altitude that he has been exposed to in an un-pressurized environment is a mystery. In 2017 he committed the worst mass shooting in modern USA history, killing many and wounding hundreds.” Steven Magee CEng MIET - Q

“Pilots have an established history of committing mass murder during their suicides.” Steven Magee CEng MIET - Q

“Suicide by pilot” https://en.wikipedia.org/wiki/Suicide_by_pilot

“On 24 March 2015, the aircraft, an Airbus A320-211, crashed 100 kilometres (62 mi) north-west of Nice in the French Alps. All 144 passengers and six crew members were killed. It was Germanwings' first fatal crash in the 18-year history of the company. The crash was deliberately caused by the co-pilot, Andreas Lubitz, who had previously been treated for suicidal tendencies and declared "unfit to work" by a doctor. Lubitz kept this information from his employer and instead reported for duty. Shortly after reaching cruise altitude and while the captain was momentarily out of the cockpit, he locked the cockpit door and initiated a controlled descent that continued until the aircraft impacted a mountainside.” https://en.wikipedia.org/wiki/Germanwings_Flight_9525

“It is not surprising that two of the most notorious modern mass murderers in the USA and Europe were both high altitude pilots.” Steven Magee CEng MIET - Q

“Airline pilot charged with killing 3 in Kentucky in 2015... American Airlines said in a statement it is cooperating in the investigation. The airline said Martin has been a pilot for subsidiary PSA Airlines since January 2018. Martin's jail mugshot shows him wearing a pilot's uniform.” https://abcnews.go.com/US/wireStory/airline-pilot-charged-killing-kentucky-2015-62981756

“Howard Robard Hughes Jr. (December 24, 1905 – April 5, 1976) was an American business
magnate, investor, record-setting pilot, engineer,[4] film director, and philanthropist, known during his lifetime as one of the most financially successful individuals in the world. He first became prominent as a film producer, and then as an influential figure in the aviation industry. Later in life, he became known for his eccentric behavior and reclusive lifestyle—oddities that were caused in part by a worsening obsessive-compulsive disorder (OCD), chronic pain from a near-fatal plane crash and increasing deafness...Hughes had a "phobia about germs", and "his passion for secrecy became a mania."...In 1958, Hughes told his aides that he wanted to screen some movies at a film studio near his home. He stayed in the studio's darkened screening room for more than four months, never leaving. He ate only chocolate bars and chicken and drank only milk, and was surrounded by dozens of Kleenex boxes that he continuously stacked and re-arranged. He wrote detailed memos to his aides giving them explicit instructions neither to look at him nor speak to him unless spoken to. Throughout this period, Hughes sat fixated in his chair, often naked, continually watching movies. When he finally emerged in the summer of 1958, his hygiene was terrible. He had neither bathed nor cut his hair and nails for weeks; this may have been due to allodynia, which results in a pain response to stimuli that would normally not cause pain.” [https://en.wikipedia.org/wiki/Howard_Hughes#Last_years_and_death

- “Frederick Crist Trump Jr. (October 14, 1938 – September 26, 1981) was an American airplane pilot and the older brother of Donald Trump...Fred Jr. left E. Trump & Son to pursue his dream of being a pilot, quickly being accepted at Trans World Airlines, which created tension with his father.[9] According to Fred Jr.'s daughter, Mary L. Trump (born 1965), her grandfather "dismantled him by devaluing and degrading every aspect of his personality." Both he and Donald mocked him for his decision to become an airline pilot, comparing it to driving a bus. By 1970, after a series of domestic incidents, Clapp asked Fred Jr. to leave and arranged for Fred Sr. to change the locks.[13] When his alcoholism prevented him from continuing to function as a pilot, he returned to work for his father's business. He eventually moved into the unfurnished attic of his parents' house, and once again did maintenance on Trump properties. [14][15] On September 26, 1981,[14] at the age of 42, he died from a heart attack caused by his alcoholism."

- “The McDonald gun shooting incident...On the 5th of February, 1970, a rather bizarre incident happened at the McDonald Observatory, at the 2.7m reflector telescope. A newly hired employee was apparently very dissatisfied with his new job, or, something else was very wrong. Whatever the reason was for said person to be angry with the world, he had decided to take it out on the telescope itself. Bringing with him a 9mm gun, he first fired a shot at his supervisor, and then fired seven shots, point blank, into the primary mirror of the telescope, no doubt hoping to shatter it. Alas, big chunks of glass like telescope mirrors, do luckily not break so easily, so the bullets merely created small holes in the mirror. Not being happy with this outcome, he also attacked the mirror with a hammer, but to no avail. The mirror did still not shatter. Shortly after, the person was subdued by the rest of the astronomer staff, rushing to the site.” [https://astroanecdotes.com/2015/03/26/the-mcdonald-gun-shooting-incident/]

- “James Coleman...A telescope technician working at the Very Long Baseline Array said Coleman followed a co-worker to the radio telescope Tuesday and used his truck to drive through a gate and ram a small office building three times. He allegedly spent the next 45 minutes trying to break down a door from inside a foyer and attempted to ram an Office of Mauna Kea Management ranger’s truck.” [http://westhawaiitoday.com/news/local-news/mental-exam-ordered-alleged-telescope-attacker]

- “Is Station 31 making Seattle firefighters sick? Study hopes to find answers about ‘Cancer
House’...So when firefighter Steve Roberts — a healthy man who has summited Mount Rainier (14,411 feet) twice and has no family history of cancer — developed brain cancer, forcing his retirement in March 2016, the desire for answers acquired a new urgency.”

https://www.seattletimes.com/seattle-news/is-station-31-making-seattle-firefighters-sick-study-hopes-to-find-answers-about-cancer-house/

• "Kurt “Charlie” Steil...used to run competitively in marathons and ultramarathons, including a grueling race up Pikes Peak (14,115 feet)... About four years ago he was diagnosed with amnestic mild cognitive impairment, or short-term memory loss, robbing him of his ability to go about his daily life the way he once did. The condition also has caused him to lose some physical strength" https://www.uwstout.edu/news/upload/LT_021715_N_PolingTrail.pdf

• “By the time I was 30, I was diagnosed with the rapid onset of second-phase thrombin-induced platelet aggregation. Basically, my blood was thick, like sludge...brain fog – grasping for words and slow recall – can be a symptom of brain inflammation...I discovered that I had thyroid, adrenal, testosterone, and estrogen problems. I was even diagnosed with Hashimoto’s disease...I first learned about the power of blended butter from a tiny Tibetan woman at 18,300 feet of elevation in a remote part of Tibet near Mt Kailash...At the age of 30, I had the testosterone level of a 50 year old man, the estrogen level of a middle aged woman, and stress hormone levels nearly 10 times higher than the level that triggers burnout.” The Bulletproof Diet by Dave Asprey.

• “Dave Asprey (born October 30, 1973) is an American entrepreneur and author....As of 2019, Asprey said he had spent at least $1 million "hacking his own biology," including having his own stem cells injected into him, taking 100 daily supplements, following a strict diet, bathing in infrared light, using a hyperbaric oxygen chamber, and wearing special lenses when flying.” https://en.wikipedia.org/wiki/Dave_Asprey

• “Mount Kailash (also Kailasa; Kangrinboqê or Gang Rinpoche; Tibetan: གངས་རིན་པོ་ཆེ ; simplified Chinese: 冈仁波齐峰; traditional Chinese: =崗仁波齊峰; Sanskrit: कैलास, IAST: Kailāsa), is a 6,638 m (21,778 ft) high peak in the Kailash Range (Gangdisê Mountains), which forms part of the Transhimalaya in the Tibet Autonomous Region of China. The mountain is located near Lake Manasarovar and Lake Rakshastal, close to the source of some of the longest Asian rivers: the Indus, Sutlej, Brahmaputra, and Karnali also known as Ghaghara (a tributary of the Ganges) in India. Mount Kailash is considered to be sacred in four religions: Bon, Buddhism, Hinduism and Jainism.” https://en.wikipedia.org/wiki/Mount_Kailash

• “Venous thrombosis at altitude presents with distinct biochemical profiles: a comparative study from the Himalayas to the plains...HA exposure alters hemostatic systems and contributes to the onset of VTE at a younger age. Aggravated disruption of coagulation, platelet, and endothelial function differentiates HA-induced VTE from VTE on the plains.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6880906/

• "Steven Magee, Chartered Electrical Engineer, was medically diagnosed with Amnestic Disorder which is characterized by short term memory loss in 2016 at the age of 46. He had worked for five years on the 13,796 feet very high altitude summit of Mauna Kea, Hawaii, USA from 2001 to 2006 and had noticed memory problems developing during the last years that he worked there. The condition has now progressed into a disability." Steven Magee CEng MIET -

534
Mountain Case Study: Mount Kilimanjaro

- "Mount Kilimanjaro or just Kilimanjaro (/ˌkɪlɪmənˈdʒɑːroʊ/),[7] with its three volcanic cones, "Kibo", "Mawenzi", and "Shira", is a dormant volcano in Tanzania. It is the highest mountain in Africa, about 4,900 metres (16,100 ft) from its base, and 5,895 metres (19,341 ft) above sea level...A small study of people attempting to reach the summit of Kilimanjaro in July and August 2005 found that 61.3 percent succeeded and 77 percent experienced acute mountain sickness (AMS).[58] A retrospective study of 917 persons who attempted to reach the summit via the Lemosho or Machame routes found that 70.4 percent experienced AMS, defined in this study to be headache, nausea, diarrhea, vomiting, or loss of appetite.[59] Kilimanjaro's summit is well above the altitude at which life-threatening high altitude pulmonary edema (HAPE) or high altitude cerebral edema (HACE), the most severe forms of AMS, can occur...A daily dose of 250 milligrams of acetazolamide is associated with a 48 percent relative-risk reduction of AMS compared to placebo, with a higher dose not providing additional protection but causing more adverse side effects.[62] The six-day Machame route, which involves one night of "sleeping low", may delay the onset of AMS but does not ultimately prevent its occurrence...According to the Kilimanjaro Christian Medical Centre in Moshi, 25 people died from January 1996 to October 2003 while climbing the mountain. Seventeen were female and eight were male, ranging in age from 29 to 74. Fourteen died from advanced high altitude illness, including one with HACE, five with HAPE, and six with both HACE and HAPE. The remaining eleven deaths resulted from trauma (three), myocardial infarction (four), pneumonia (two), cardio-pulmonary failure of other underlying cause (one), and acute appendicitis (one). The overall mortality rate was an estimated 13.6 per 100,000 climbers (0.0136 percent)...Large animals are rare on Kilimanjaro and are more frequent in the forests and lower parts of the mountain.”

- "Is Climbing Kilimanjaro Safe?...Climbing Kilimanjaro is probably one of the most dangerous things you will ever do. Every year, approximately 1,000 people are evacuated from the mountain, and approximately 10 deaths are reported. The actual number of deaths is believed to be two to three times higher. The main cause of death is altitude sickness. Everyone climbing Mount Kilimanjaro should be familiar with the symptoms of altitude sickness...On our descent, we noticed 10 people who appeared to be suffering from HACE, with clear evidence of altered consciousness and ataxia. Many were only able to walk with the physical support of two porters....At over 10,000 feet (3,000 m), more than 75% of climbers will experience at least some form of mild AMS.”

- "Kilimanjaro climbers 'take health risks'...Climbers scaling Mount Kilimanjaro are taking unnecessary risks with their health, experts have warned...The researchers camped for three weeks on the mountain at a height of 4,730m - not far below the 5,895m summit. They assessed climbers using the Lake Louise consensus scoring system, which records symptoms such as headache, sickness and fatigue. The academics found almost half, or 47%, of those who had climbed Kilimanjaro, were suffering from altitude sickness before they reached the summit and most were ascending too high, too quickly. Signs of sickness include vomiting, headaches, difficulty sleeping and sometimes problems with co-ordination. Effects can be felt from as low as 2,500m above sea level and 75% of people will have mild symptoms at 3,000m or higher, the study said.”

- "10 Possible Causes Of Death And Danger On Mount Kilimanjaro, And How To Avoid..."
Environmental Radiation LLC - https://www.environmentalradiation.com

1. Acute Mountain Sickness
2. Hypothermia
3. Rock Fall and Avalanches
4. Cliff Falls
5. Heart Attacks
6. Diarrhea
7. Colds and Respiratory Infections
8. Twisted Ankles and Sore Joints
9. Tropical Diseases
10. Coincidental Illnesses.

“Mt. Kilimanjaro – How dangerous is it, really? Why do 12,000 trekkers fail to reach the summit every year? The different symptoms from AMS, disillusionment and cold are the main reasons most of the 12,000 trekkers per year turn around and walk off. Individuals with HACE or HAPE cases are, hopefully, carried off the mountain. To me, this is a much more important issue because it affects 40% of the attempts made on Kilimanjaro. Nobody interviews these 12,000 folks that don’t reach the summit but all of them have spent money to get to Africa and climb the mountain. I’ll wager the majority has come on a “budget”, picked an “affordable” outfitter and chosen the 5 or 6 day climbs clinging to the notion that Kilimanjaro is a non-technical walk-up (which it is) but it’s the altitude and the potential malaise associated with it, which brings people to their knees.”

“9 things no one ever tells you about climbing Mt. Kilimanjaro…5. It’s not always easy on a relationship…We heard that one honeymooning husband left his new wife alone on the mountain because the climb caused them to fight so much…9. You can be in the best shape of your life and fail to reach the summit. Altitude sickness is an equal opportunity bully. You may be able to run marathons, but the vomiting, nausea and sometimes hallucinations can knock you out well before you reach 19,000 feet…We had to bail at 16,000 feet with headaches and nausea worse than any hangover. My husband imagined he saw fish flopping on rocks in the alpine desert. We had to go down or risk serious illness.”

“OTHER KILIMANJARO HEALTH ISSUES…Simple precautions avoid common health problems associated with African climbing expeditions on Kilimanjaro mountain. Rapid changes in humidity and temperature cause coughs and colds, with flu-like symptoms from breathing cold air at high altitude. Aspirin, warm salt water gargles and anesthetic or menthol throat lozenges ease discomfort.”

“For my family of four, climbing Mount Kilimanjaro was true test of faith…The grayish tint of the suffering man's skin and his unfocused eyes weren't the only signs something was wrong. He seemed barely able to hang onto the man carrying him over the rocky terrain. With each step, the hiker's head bobbed like a soccer ball attached to a slinky…Kilimanjaro soars well above the altitude at which life-threatening altitude sickness can occur. In its mild form, it feels like a hangover with a headache, nausea and exhaustion. At its most severe, lungs can fill with fluid, hikers may cough up blood, and in the worst case, they die…I blame it on the altitude. It does funny things to the brain. It can distort distance and time, fatigue and hunger and all sorts of rational thought.”
Altitude Sickness Progression

- “6,000 Feet: A few people will start showing signs and symptoms of Acute Mountain Sickness (AMS).” Steven Magee CEng MIET - Q
- “8,000 Feet: Various people will be showing signs and symptoms of Acute Mountain Sickness (AMS).” Steven Magee CEng MIET - Q
- “10,000 Feet: Many people will be showing signs and symptoms of Acute Mountain Sickness (AMS). Sea level adapted humans will be in oxygen starvation, also known as Asphyxia.” Steven Magee CEng MIET - Q https://en.wikipedia.org/wiki/Asphyxia
- “12,000 Feet: Some people will be showing serious signs and symptoms of Acute Mountain Sickness (AMS). Many people will be in oxygen starvation, also known as Asphyxia. Mental impairment will be evident, often called “Summit Brain”. Immediate descent to lower altitude is recommended for these people.” Steven Magee CEng MIET - Q
- 14,000 Feet: Many people will be showing serious signs and symptoms of Acute Mountain Sickness (AMS). Some people may be experiencing visions and hallucinations. Many people will be displaying mental impairment, often called “Summit Brain”. Immediate descent to lower altitude is recommended for these people. Most people will be in oxygen starvation, also known as Asphyxia. - Q https://en.wikipedia.org/wiki/Asphyxia
**Light Toxicity**

- “The second edition of Toxic Light takes a look at the light pollution that may be in your local environment and relates it to the health problems that it may cause. Light in the human environment is only just starting to be understood and something as innocent as your sunglasses may be able to make you ill! There are many examples of commonplace items in your environment that may have the ability to affect your health. Get ready for enlightenment about the most important human nutrient of light!” [http://amzn.com/1461151880](http://amzn.com/1461151880)
- “Sunlight by Zane R. Kime...A vital book on the relationship of sunlight to human health. Studies from scientific literature are described which demonstrate the sunlight's effects on lowering cholesterol, blood pressure and blood sugar; on increasing endurance, sex hormones and resistance to infection. Crucial dietary suggestions are made to insure healthy skin when exposed to sunlight.” [http://a.co/2DTlwoG](http://a.co/2DTlwoG)
- “Chasing the Sun: The Epic Story of the Star That Gives Us Life by Richard Cohen...interviewing psychologists in the Norwegian Arctic about the effects of darkness...Einstein helped duplicate the source of the Sun’s power to create the atomic bomb....extraordinary myths (in India, just a few years ago, pregnant women were still being kept indoors during an eclipse, for fear their babies would be born blind or with cleft palates); and surprising anecdotes (during the Vietnam War, a large number of mines dropped into Haiphong harbor blew up simultaneously in response to a large solar flare....It not only explains the star that so inspires us, but shows how complex our relations with it have been—and continue to be.” [http://a.co/imx7iCu](http://a.co/imx7iCu)
Computer Toxicity

- “Astronomy was field in which computers where extensively used and in some cases, multiple computers with several screens.” Steven Magee CEng MIET - Q
- “Computer vision syndrome (CVS) is a condition resulting from focusing the eyes on a computer or other display device for protracted, uninterrupted periods of time. Some symptoms of CVS include headaches, blurred vision, neck pain, fatigue, eye strain, dry eyes, irritated eyes, double vision, vertigo/dizziness, polyopia, and difficulty refocusing the eyes. These symptoms can be further aggravated by improper lighting conditions (i.e. glare or bright overhead lighting) or air moving past the eyes (e.g. overhead vents, direct air from a fan).” [https://en.wikipedia.org/wiki/Computer_vision_syndrome](https://en.wikipedia.org/wiki/Computer_vision_syndrome)
- “Digital Eye Strain...With an increase in digital technology, many individuals suffer from physical discomfort after screen use for longer than two hours at a time. The Vision Council refers to this collection of symptoms as digital eye strain. More than 83 percent of Americans report using digital devices for more than two hours per day, and 53.1 percent report using two digital devices simultaneously, with 60.5 percent reporting experiencing symptoms of digital eye strain.” [https://www.thevisioncouncil.org/content/digital-eye-strain](https://www.thevisioncouncil.org/content/digital-eye-strain)
- “With teen mental health deteriorating over five years, there’s a likely culprit...We found that teens who spent five or more hours a day online were 71 percent more likely than those who spent only one hour a day to have at least one suicide risk factor (depression, thinking about suicide, making a suicide plan or attempting suicide). Overall, suicide risk factors rose significantly after two or more hours a day of time online.” [https://mailchi.mp/be80fffa67e5/with-teen-mental-health-deteriorating-over-five-years-theres-a-likely-culprit?e=2ae974ca77](https://mailchi.mp/be80fffa67e5/with-teen-mental-health-deteriorating-over-five-years-theres-a-likely-culprit?e=2ae974ca77)
- “Working the astronomy night shift required sitting and staring at many computer screens for up to eighteen hours per night for several nights.” Steven Magee CEng MIET - Q
- “Repetitive strain injuries (RSI) are to the body's muscles, joints, tendons, ligaments, bones, or nerves caused by repetitive movements. Such injuries are more likely if the movements required force or were accompanied by vibrations, compression, or the maintenance of sustained or awkward positions. Prolonged use of computer equipment can result in upper limb disorders, notably in the wrist or the back. RSIs are a subset of musculoskeletal disorders. This article discusses and lists some specialized software that is available to aid individuals avoid injury or manage current discomfort/injury associated with computer use.” [https://en.wikipedia.org/wiki/List_of_repetitive_strain_injury_software](https://en.wikipedia.org/wiki/List_of_repetitive_strain_injury_software)
- “A repetitive strain injury (RSI) is an "injury to the musculoskeletal and nervous systems that may be caused by repetitive tasks, forceful exertions, vibrations, mechanical compression, or sustained or awkward positions".” [https://en.wikipedia.org/wiki/Repetitive_strain_injury](https://en.wikipedia.org/wiki/Repetitive_strain_injury)
- “Purposelessness, burnout, interpersonal difficulties, under-confidence or overconfidence, competitiveness, lack of empathy, impulse control, depression, anxiety—all of these are rampant in my tech industry clients.” [https://hackernoon.com/technology-and-the-mind-an-](https://hackernoon.com/technology-and-the-mind-an-)
existential-psychotherapists-thoughts-on-the-meaning-of-tech-308fe7b223f3

• “Is Computer Radiation Damaging Your Health?...If you use computers at work or at home, or both, then computers may be your biggest source of electromagnetic radiation (EMR). Could this radiation threaten your health?” http://emwatch.com/computer-radiation-may-damage-your-health/

• “My 9 Tips To Cut Down On Exposure To Computer Radiation...All computers emit radiation or electromagnetic fields (EMFs) on many different frequencies. These EMFs can be extremely harmful to your health. Cancer and other serious diseases have been linked to these exposures – studies indicate pregnant women and small children are particularly vulnerable.” https://www.electricsense.com/1138/my-9-tips-to-cut-down-on-exposure-to-computer-radiation/

• “Dr. John Ott: The Light Side of Health...We used a friend of mine, a real computer buff, as our guinea pig. On a Friday evening, after he had spent his customary eight-hour day in front of the VDT, we took a sample of his blood and found severe rouleaux clumping. Well, he spent a lot of time outdoors that weekend, didn't watch television or go near his computer, and on Sunday we took him sailing, without sunglasses. Monday morning, we tested his blood again, and it was perfectly clear. No cell clumping at all.” https://www.motherearthnews.com/nature-and-environment/john-ott-zm0z86zhun
Triggering Of The Human Mating Cycle

- "Astronomers Are Finally Doing Something About Sexual Harassment. Recent scandals have forced the field to confront a pervasive culture of gender discrimination and abuse...famed planet-hunter Geoff Marcy had violated Title IX sexual-harassment policies at the University of California, Berkeley, with the accusations against him spanning nine years. Soon after the initial report, three women who had worked with him during his previous post at San Francisco State University came forward, suggesting that his serial harassment of junior female colleagues had gone on for decades." [http://www.theatlantic.com/science/archive/2016/01/gender-discrimination-astronomy/422817/]
- “He Fell In Love With His Grad Student — Then Fired Her For It. Christian Ott, a young astrophysics professor at Caltech, engaged in “discriminatory and harassing” behavior toward two female graduate students, a university investigation has found.” [https://www.buzzfeed.com/azeenghorayshi/ott-harassment-investigation?utm_term=.ob4A3LjaOm#sf6rLwAN6b]
- “Congresswoman Speier on Sexism in Science” [https://youtu.be/FyWeNycz1mA]
- “A Professor’s Sexual Harassment Case Came Out In Congress, And He’s Fighting Back. Astronomer Timothy Slater is demanding over $30 million from a woman who shared details of an investigation into his case with journalists. He’s also suing the university that conducted the investigation.” [https://www.buzzfeed.com/tylerkingkade/a-professors-sexual-harassment-case-came-out-in-congress?utm_term=.xka5mE1aRK#.usYQjaPN8z]
- “The lawsuit claims that even after serious complaints were lodged, Dartmouth encouraged the women to continue working with Heatherton, Kelley and Whalen. “Dartmouth warned the victims that the accused professors would likely retaliate against students who discontinued working with them by disparaging them and revoking their academic support, actions which could result in the victims being expelled or placed on academic probation,” the lawsuit said. “Thus, at Dartmouth’s suggestion, the victims continued working with their harassers for nearly four months.”” [https://www.washingtonpost.com/education/2018/11/15/seven-women-sue-dartmouth-alleging-sexual-assault-animal-house-climate/?utm_term=.5515683d13c6]
- “Report shows increase in sexual assault cases at Dartmouth.” [https://youtu.be/beBwXtmE48E]
- "I worked the extremely long night shifts for three years on the 13,796 feet very high altitude summit of Mauna Kea and I noticed during that time that my mating cycle was being repeatedly triggered. It cleared up when I left for my next job." Steven Magee CEng MIET - Q
- “Sleep sex, or sexsomnia, is a condition in which a person will engage in sexual activities while asleep. This condition falls within the broad class of sleep disorders known as parasomnias. In extreme cases, sexsomnia has been alleged, and accepted, as at least a part of the cause of sexual assault, including rape. The proposed medical diagnosis is NREM arousal parasomnia – sexual behaviour in sleep. Sexsomnia is considered a type of non-rapid eye movement sleep (NREM) parasomnia. Sexsomniacs do not remember the acts that they perform while they are asleep. Sexsomnia can co-occur alongside other sleep disorders such as sleepwalking, sleep apnea, night terrors and bedwetting and can be triggered by stress, previous sleep deprivation..."
and excessive consumption of alcohol or other drugs; it is one of the possible adverse effects of zolpidem. Sleep related epilepsy may be associated with sexual arousal, pelvic thrusting and orgasms. Sexsomnia episodes may be triggered by physical contact with a bed partner. Sexsomnia, which is a fairly new medically recognized behaviour, has been used in criminal defense cases of rape.” [https://en.wikipedia.org/wiki/Sleep_sex](https://en.wikipedia.org/wiki/Sleep_sex)

- “The drugs can also slash inhibitions, most famously the sexual variety. "The effect here can be quite potent for many," says W. Christopher Winter, M.D., a Men's Health advisor and the medical director of the sleep medicine center at Martha Jefferson Hospital, in Charlottesville, Virginia. In his practice he's seen die-hard prudes turn wanton under Ambien's influence.” [https://www.menshealth.com/health/sleeping-pill-dangers](https://www.menshealth.com/health/sleeping-pill-dangers)

- “The U.S. Food and Drug Administration (FDA) is warning that compulsive or uncontrollable urges to gamble, binge eat, shop, and have sex have been reported with the use of the antipsychotic drug aripiprazole (Abilify, Abilify Maintena, Aristada, and generics). These uncontrollable urges were reported to have stopped when the medicine was discontinued or the dose was reduced.” [https://www.fda.gov/Drugs/DrugSafety/ucm498662.htm](https://www.fda.gov/Drugs/DrugSafety/ucm498662.htm)

- “Technology and the Mind: An Existential Psychotherapist’s Thoughts on the Meaning of Tech...This is most profound in high-level tech execs who experience burnout or those who have problematic porn use. Psychologists are deluged with cases of both right now.” [https://hackernoon.com/technology-and-the-mind-an-existential-psychotherapists-thoughts-on-the-meaning-of-tech-308fe7b223f3](https://hackernoon.com/technology-and-the-mind-an-existential-psychotherapists-thoughts-on-the-meaning-of-tech-308fe7b223f3)

- “A particular team of world leading male astronomers that I regularly worked with engaged in extensive sordid conversations about their female counterparts that I had not witnessed in the many other astronomy teams. It was unique to their group. What was also unique to their group was the intensive all night long computer work. It was so intense that getting rest room breaks during the night was always a problem.” Steven Magee CEng MIET - Q

- “Excessive masturbation is a sign that you are routinely in a high electromagnetic interference (EMI) environment.” Steven Magee CEng MIET - Q

- “My research is indicating that sleep deprivation and unnatural electromagnetic radiation exposures can trigger the human mating cycle.” Steven Magee CEng MIET - Q
**Island Hazards**

- “It is common in high altitude astronomy to find astronomical observatories located on sparsely populated remote volcanic islands.” Steven Magee CEng MIET - Q
- “Island Fever. A psychological illness that usually affects poor people found in Hawaii and other islands. Island Fever is the realization that you are stuck on which ever island you are living and not going anywhere. Sure, you can take a plane to Asia, United States and Europe if you have the money to pay for it. Most beach bums do not have it so they are stuck on Oahu. Sure you can take a plane to Maui, Lanai, etc... But getting the money (around $100 RT) is also a problem too. Besides, don't forget SSDI... Same Sh*, Different Island. People who live on mainlands have trouble understanding Island Fever because they can hop on a cheap bus or train and travel to many different countries. While people in Oahu are stuck on a rock the size of Chicago.” https://www.urbandictionary.com/define.php?term=Island%20Fever
- “Islanded. The feeling of hopelessness, isolation or being trapped. The inability to make progress. Generally the emotions and feelings associated with being trapped on a desert Island. Due to lack of resources I'm feeling very Islanded on this project.” https://www.urbandictionary.com/define.php?term=Islanded
- “Heart failure and bacterial pneumonia are among the top three health issues in Hawai‘i, but officials say the number one concern is mental health. "Mental health is a crisis," described Dr. Ginny Pressler, Vice President of Hawai‘i Pacific Health. http://www.hawaiinewsnow.com/story/22758669/statewide-study-identifies-hawaiis-top-health-concerns
- “What Are the Social Problems in Hawaii?...As you can see, there is plenty going on in Hawaii that could get on your nerves. As nice as the state is to live in, there are many problems. Some people are severely affected by racism. I didn’t experience it much, but it depends where you live and how much money you have. Really, that’s the truth.” https://www.aimforawesome.com/hawaii/what-are-the-social-problems-in-hawaii/
- “What is vog? The term ‘vog’ refers to the hazy air pollution caused by the volcanic emissions from Kīlauea volcano, which are primarily water vapor (H2O), carbon dioxide (CO2), and sulfur dioxide (SO2) gas. As SO2 is released from the summit and east rift eruptive vents, it reacts in the atmosphere with oxygen, sunlight, moisture, and other gases and particles and, within hours to days, converts to fine particles, which scatter sunlight, causing the visible haze that is observed downwind of Kīlauea. Areas far downwind (e.g., the west side of Hawai‘i Island and other islands in the state) are mostly affected by the fine particles, however, areas closer to the eruptive vents, including the communities ranging from Ocean View to Hilo, can be exposed to both SO2 gas and fine particles during periods of vog. SO2 is a colorless, irritating gas that has an acid odor like fireworks or a burning match. It is also emitted from sources such as fossil fuel power plants and motor vehicles. Fine particles consist of particulate matter less than 2.5 micrometers in diameter and are referred to as ‘PM2.5’. These particles are smaller than the width of a human hair. PM2.5 in vog is mainly composed of acid and neutral sulfate particles. Other sources of PM2.5 include vehicle exhaust and smoke from fires. Vog contains mostly SO2 and acid particles, in contrast to urban, industrial, and other pollution sources, which also contain additional toxic contaminants, such as ozone and hydrocarbons.” http://www.ivhhn.org/vog/what-vog
- “The Wrath of Vog...It comes on the Kona winds—the dreaded yellow-brown haze of vog that
makes eyes burn and lungs protest. On the Big Island, of course, it has done far more damage. How bad could it get? And what do we really know about vog and its effects?"


- “Health Effects. Is vog harmful to my health? People with pre-existing respiratory conditions are more prone to adverse effects of vog which may include: headaches, breathing difficulties, increased susceptibility to respiratory ailments, watery eyes, and sore throat. The long-term health effects of vog are unknown.” http://ltgov.hawaii.gov/emergency-information/important-information-about-vog/health-effects/

- “Volcanic air pollution over the Island of Hawai’i: Emissions, dispersal, and composition. Association with respiratory symptoms and lung function in Hawai’i Island school children...Chronic exposure to acid vog is associated with increased cough and possibly with reduced FEV1/FVC, but not with asthma or bronchitis. Further study is needed to better understand how volcanic air pollution interacts with host and environmental factors to affect respiratory symptoms, lung function, and lung growth, and to determine acute effects of episodes of increased emissions.” https://www.sciencedirect.com/science/article/pii/S0160412016301052


- “Mercury poisoning is a type of metal poisoning due to mercury exposure.[3] Symptoms depend upon the type, dose, method, and duration of exposure.[3][4] They may include muscle weakness, poor coordination, numbness in the hands and feet, skin rashes, anxiety, memory problems, trouble speaking, trouble hearing, or trouble seeing….Human-generated sources, such as coal-burning power plants[14] emit about half of atmospheric mercury, with natural sources such as volcanoes responsible for the remainder.” https://en.m.wikipedia.org/wiki/Mercury_poisoning

- “This Is What Happens When You Breathe In Volcanic Ash...This is one particularly insidious way in which volcanic ash can kill you, but generally speaking, inhaling it will be the primary cause of people pushing up the daisies. Remember, you’re inhaling glass, so at the very least, the ash is lacerating the insides of your bronchioli, alveoli and capillaries….In the long-term, it can cause silicosis, an ailment that results in potentially permanent scars to your lungs. If the ash falls into the water supply and people drink it, the same painful condition affects their digestive system too.” https://www.forbes.com/sites/robinandrews/2017/05/20/this-is-what-happens-when-you-breathe-in-volcanic-ash/#624a8d9f1c5e

- “Hawaii vog changes the environmental conditions in many areas including air quality, creates acid rain, drinking water quality, environmental radiation, light transmission, human health impacts, and so on.” Steven Magee CEng MIET - Q
Fatigue Hazards

- “Daily fatigue was a problem for many very high altitude workers.” Steven Magee CEng MIET
- “The 14 Most Common Causes of Fatigue...1: Not Enough Sleep...2: Sleep Apnea...4: Anemia...5: Depression...7: Caffeine Overload...10: Dehydration...11: Heart Disease...12: Shift Work Sleep Disorder.” https://www.onhealth.com/content/1/causes_of_fatigue
- “Using vitamin B-12 for the management of Chronic Fatigue Syndrome (CFS)...In these patients, problems such as numbness or tingling in the extremities, abnormal gait, memory loss, weakness of the limbs, changes in mood and personality and even fatigue were improved, and even resolved, with B-12 therapy. In addition, during this period of time Dr. Les Simpson was describing how changes in the red blood cells in persons with CFS reversed when high doses of B-12 were administered. With this in mind, we began treating patients with cyanocobalamin (a form of vitamin B-12 that is readily available in the U.S.) at doses from 1000 mcg weekly to 5000 mcg three times weekly, given subcutaneously (through injections under the skin).” http://www.prohealth.com/library/showarticle.cfm?libid=3466
- “Fatigue & Fibro Fog: Could You Have a B-12 Deficiency?...A feeling of being tired all the time. Problems with memory and concentration. Trouble sleeping. Diarrhea and/or constipation. These can all be important signs of the body’s need for more vitamin B-12...A B-12 deficiency can be difficult to diagnose because serum blood levels of B-12 may test normal. Having circulating B-12 in the blood doesn't mean it is being utilized properly by the body's cells.” http://www.prohealth.com/library/showarticle.cfm?libid=17236&B2=BNRHPFA&utm_source=BNRHPFA&utm_campaign=Home-Page-Featured-Article
- “9 Ways to Get Your Energy Back...1. Rule out health problems. Fatigue is a common symptom of many illnesses, including diabetes, heart disease, arthritis, anemia, thyroid disease, and sleep apnea. Talk to your doctor if you feel unusually tired...Many medications can contribute to fatigue. These include some blood pressure medicines, antihistamines, diuretics, and other drugs.” https://www.webmd.com/balance/features/get-energy-back#1
- “Why Fatigue Can Be Dangerous or Even Deadly...Chronic fatigue is a complex medical condition characterized by feeling tired to such an extent that it limits someone’s ability to carry out daily routine activities.” https://www.careworkshealth.com/blog/why-fatigue-can-be-dangerous/
- “The Dangers Of Fatigue In The Workplace...Fatigue increases the risk of injuries or other accidents. As an employer, ensure your workers are not experiencing signs or effects of fatigue on the job. You can help make your workers and your business safer by including information on fatigue and sleep in your safety guidelines and orientations. You can also develop a fatigue management plan.” https://safetyalliancebc.ca/the-dangers-of-fatigue-in-the-workplace/
- “The Danger Of Worker Fatigue. Every year OSHA releases a list of its Top 10 most frequently cited workplace safety violations, and every year we see the usual suspects: fall protection, hazard communications, respiratory protection, and scaffolding. All of these violations are a real threat to the health and safety of workers on the job site, but the most dangerous issue is not one that can be seen by OSHA inspectors or your Safety Director, and that’s worker fatigue.” https://coderedsafety.com/blog/the-dangers-of-work-fatigue/
“Dangers of Worker Fatigue – 7 warning signs...Fatigue is a common problem in workplaces and can greatly increase health and safety risks for workers. Fatigued workers can cause harm to themselves and others through impaired judgement and reduced capacity to perform their work. Workers who are fatigued may have a slower reaction time or be unable to make good decisions. Fatigue can also lower the immune system, leading to illness, and can result in long-term health effects, such as heart disease. Anyone who does not receive adequate quality sleep is susceptible to fatigue. Depending on the nature of their work, this could carry a high degree of risk.”  

Depression Hazards

- “Out of a group of eight (8) extreme night shift workers, I was aware of four (4) workers who appeared to be displaying symptoms of depression. That is fifty percent of the team. That number may be higher if you include those that were already on successful depression treatment and were not publicly showing the symptoms.” Steven Magee CEng MIET - Q
- “It was well known to the team of eight (8) extreme night shift workers that group needed nine (9) workers to prevent overwork and accumulation of excess night shift hours that could not be taken because there were not enough workers to cover for the absence.” Steven Magee CEng MIET - Q
- “During my time at the W. M. Keck Observatory, I had formed the opinion that overworking of workers was part of the company's toxic culture.” Steven Magee CEng MIET - Q
- “Causes of Depression...It is generally believed that all mental disorders — including clinical depression — are caused by a complex interaction and combination of biological, psychological, and social factors. This theory is called the bio-psycho-social model of causation and is the most generally accepted theory among mental health professionals and researchers of the cause of disorders such as depression.”
  [https://psychcentral.com/disorders/depression/depression-causes/](https://psychcentral.com/disorders/depression/depression-causes/)
- “What causes depression?...It's often said that depression results from a chemical imbalance, but that figure of speech doesn't capture how complex the disease is. Research suggests that depression doesn't spring from simply having too much or too little of certain brain chemicals. Rather, there are many possible causes of depression, including faulty mood regulation by the brain, genetic vulnerability, stressful life events, medications, and medical problems. It's believed that several of these forces interact to bring on depression.”
- “Depression. Causes of Depression. There is no single known cause of depression. Rather, it likely results from a combination of genetic, biochemical, environmental, and psychological factors. Trauma, loss of a loved one, a difficult relationship, or any stressful situation that overwhelms the ability to cope may trigger a depressive episode. Subsequent depressive episodes may occur with or without an obvious trigger.”
  [https://www.psychologytoday.com/basics/depression/causes-depression](https://www.psychologytoday.com/basics/depression/causes-depression)
- “Depression (major depressive disorder)...Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest. Also called major depressive disorder or clinical depression, it affects how you feel, think and behave and can lead to a variety of emotional and physical problems. You may have trouble doing normal day-to-day activities, and sometimes you may feel as if life isn't worth living. More than just a bout of the blues, depression isn't a weakness and you can't simply "snap out" of it. Depression may require long-term treatment. But don't get discouraged. Most people with depression feel better with medication, psychotherapy or both.”
  [https://www.mayoclinic.org/diseases-conditions/depression/symptoms-causes/syc-20356007](https://www.mayoclinic.org/diseases-conditions/depression/symptoms-causes/syc-20356007)
- “What causes depression?...Changes in the brain. Although there’s been a lot of research in this complex area, there’s still much we don’t know. Depression is not simply the result of a ‘chemical imbalance’, for example because you have too much or not enough of a particular brain chemical. It’s complicated, and there are multiple causes of major depression. Factors such as genetic vulnerability, severe life stressors, substances you may take (some medications,
drugs and alcohol) and medical conditions can affect the way your brain regulates your moods.”


- “12 Surprising Causes of Depression...Poor sleep habits. It's no surprise that sleep deprivation can lead to irritability, but it could also increase the risk of depression. A 2007 study found that when healthy participants were deprived of sleep, they had greater brain activity after viewing upsetting images than their well-rested counterparts, which is similar to the reaction that depressed patients have, noted one of the study authors.”If you don't sleep, you don't have time to replenish [brain cells], the brain stops functioning well, and one of the many factors that could lead to is depression,” says Matthew Edlund, MD, director of the Center for Circadian Medicine, in Sarasota, Fla., and author of The Power of Rest.”

http://www.health.com/health/gallery/0,,20515167,00.html#why-am-i-depressed--0

- “Common Causes of Depression...Gender. Women are about twice as likely as men to become depressed. No one's sure why. The hormonal changes that women go through at different times of their lives may play a role.”

https://www.webmd.com/depression/common-causes-depression
Digestive Tract Hazards

- "I developed strange intestinal problems when working at very high altitude on Mauna Kea. Intestinal pains and bouts of loose stools. Dietary experimentation lead to the conclusion that eating a diet that comprised of lots of steamed vegetables when home would reduce the symptoms.” Steven Magee CEng MIET - Q
- "Could Air Travel Trigger an Autoimmune Response? 4 Tips to Protect Your Health...GASTROINTESTINAL FLARE-UPS AND AIR TRAVEL...At the 2012 Digestive Disease Week conference in San Diego, scientists revealed that people struggling with inflammation in the gut may be at a higher risk for inflammatory flare-ups when they fly.” [https://bodyecology.com/articles/could-air-travel-trigger-an-autoimmune-response-tips-to-protect-your-health](https://bodyecology.com/articles/could-air-travel-trigger-an-autoimmune-response-tips-to-protect-your-health)
- "High-altitude gastrointestinal bleeding: An observation in Qinghai-Tibetan railroad construction workers on Mountain Tanggula...RESULTS: The overall incidence of GIB was 0.49% in 13 502 workers. The incidence increased with increasing altitude. The onset of symptoms in most patients was within three weeks after arrival at high altitude. Bleeding manifested as hematemesis, melaena or hematochezia, and might be occult. Endoscopic examination showed that the causes of altitude GIB included hemorrhage gastritis, gastric ulcer, duodenal ulcer, and gastric erosion. Experimental studies suggested that acute gastric mucosal lesion (AGML) could be induced by hypoxic and cold stress, which might be the pathogenesis of altitude GIB. Those who consumed large amount of alcohol, aspirin or dexamethasone were at a higher risk of developing GIB. Persons who previously suffered from peptic ulcer or high-altitude polycythemia were also at risk of developing GIB. Early diagnosis, evacuation, and treatment led to early recovery.” [http://europepmc.org/articles/PMC4066012](http://europepmc.org/articles/PMC4066012)
- "Over-starvation aggravates intestinal injury and promotes bacterial and endotoxin translocation under high-altitude hypoxic environment...Multiple organs can be damaged by rapid ascent to an altitude above 3000 m....Studies have shown that high altitude hypoxia can directly cause pathological damage to the intestinal mucosa, and increase intestinal permeability. High altitude hypoxia can reduce secretion of IgG from the gastrointestinal mucosa, decrease the mucosal immune barrier, reduce bile secretion, cause enterohepatic circulation disorders, and destroy the intestinal biological barrier. Intestinal barrier damage can increase intestinal permeability, which results in bacterial translocation and occurrence of SIRS and MODS. Therefore, observation of intestinal translocation of bacteria and endotoxins can indirectly reflect intestinal mucosal barrier function....This is a study of the effects of hypobaric hypoxia on intestinal integrity in rats (n = 40). Animals exposed to hypobaric hypoxia for 72 h demonstrated histological damage to the small intestine, translocation of lanthanum particles, and increased serum levels of DAO, MDA and endotoxin. This was accompanied by increased translocation of bacteria into lymph nodes and the spleen. Concomitant treatment of rats with glucosamine reduced the severity of intestinal injury.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3070130/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3070130/)
- "High-Altitude-Induced alterations in Gut-Immune Axis: A review...ABSTRACT. High-altitude sojourn above 8000 ft is increasing day by day either for pilgrimage, mountaineering, holidaying or for strategic reasons. In India, soldiers are deployed to these high mountains for their duty or pilgrims visit to the holy places, which are located at very high altitude. A large population also resides permanently in high altitude regions. Every year thousands of pilgrims visit Holy cave of Shri Amarnath ji, which is above 15 000 ft. The poor acclimatization to high
altitude may cause alteration in immunity. The low oxygen partial pressure may cause
alterations in gut microbiota, which may cause changes in gut immunity. Effect of high altitude
on gut-associated mucosal system is new area of research. Many studies have been carried out
to understand the physiology and immunology behind the high-altitude-induced gut problems.
Few interventions have also been discovered to circumvent the problems caused due to high-
altitude conditions. In this review, we have discussed the effects of high-altitude-induced
changes in gut immunity particularly peyer's patches, NK cells and inflammatory cytokines,
secretary immunoglobulins and gut microbiota.

Food Hazards

- “The food was so bad at one particular high altitude observatory that I stopped eating there and brought sandwiches to work every day.” Steven Magee CEng MIET - Q
- “I came to know the food at high altitude observatories as some of the worst I had ever been served.” Steven Magee CEng MIET - Q
- “One of the bad habits that I developed in very high altitude astronomy was eating a bowl of free ice cream for breakfast, as the free cooked breakfast would make me feel really sickly when at the summit of Mauna Kea.” Steven Magee CEng MIET - Q
- “Poor quality food was a feature of high altitude observatories.” Steven Magee CEng MIET - Q
- “Recommended foods and supplements to help protect your health and Counter the Effects of Radiation...Radiation and pollutants destroy vitamins A, C, E, K, several N vitamins, essential fatty acids, calcium and neuro-hormones. If your body lacks calcium, potassium and other nutrients, it will more readily absorb the radioactive elements that are similar in structure to these nutrients. Your best bet is to eat natural, fresh, organic (as much as possible) unprocessed foods, avoiding white sugar, red meat, refined wheat, caffeine and homogenized milk.” [Website Link]
- “Top 5 Ingredients Of A Healthy Diet During Radiation Therapy...Foods to avoid or reduce include sodium (salt), added sugars, solid fats, and alcohol. Some salt is needed in all diets. Your doctor or dietician can recommend how much salt you should consume based on your medical history.” [Website Link]
- “Nutrition in Cancer Care (PDQ®)–Patient Version…A healthy diet includes eating and drinking enough of the foods and liquids that have important nutrients (vitamins, minerals, protein, carbohydrates, fat, and water) the body needs....Malnutrition can cause the patient to be weak, tired, and unable to fight infection.” [Website Link]
- “The Plant Paradox: The Hidden Dangers in "Healthy" Foods That Cause Disease and Weight Gain” [Website Link]
- “Wheat Belly: Lose the Wheat, Lose the Weight, and Find Your Path Back to Health. A renowned cardiologist explains how eliminating wheat from our diets can prevent fat storage, shrink unsightly bulges, and reverse myriad health problems.” [Website Link]
- “The Evolution of Diet...Cordain came up with his own Paleo prescription: Eat plenty of lean meat and fish but not dairy products, beans, or cereal grains—foods introduced into our diet after the invention of cooking and agriculture. Paleo-diet advocates like Cordain say that if we stick to the foods our hunter-gatherer ancestors once ate, we can avoid the diseases of civilization, such as heart disease, high blood pressure, diabetes, cancer, even acne.” [Website Link]
- “Radiation...Research indicates that ginger and lemon balm may help provide some protection against radiation. Also, fruit and vegetable intake may decrease radiation-induced chromosome damage. Dr. Dean Ornish was able to use a plant-based diet, without any surgery, chemotherapy, or radiation, to reduce prostate cancer progression.” [Website Link]
High Altitude Diets

- “Dietary Recommendations for Cyclists during Altitude Training...A high carbohydrate diet is recommended for athletes exercising intensively at altitude with the upper daily range of CHO consumption close to 12 g/kg. A well-balanced diet with an increased caloric intake should provide a sufficient amount of all antioxidants, so we do not recommend additional supplements which could hinder the adaptive processes related to aerobic endurance. Antioxidant supplementation should be considered only when natural food sources such as fruits and vegetables are not available at altitude. One of the more significant elements of altitude nutrition relates to the monitoring of iron, for which intake needs to amount to at least 100 mg/day. A deficit of iron may disturb erythropoiesis. Despite the increased UVB radiation from sunlight, it is recommended to supplement athletes training at altitude with up to 4000 IU/day of vitamin D, especially in the winter months of the year.”

- "Vitamin Status of High Altitude (3660m) Acclimatized Human Subjects During Consumption of Tinned Rations...Objective. To find out the nutritional status of sea-level residents acclimatized to an altitude of 3660 m with respect to vitamin and nutrient requirements while consuming fresh and tinned rations. Methods. Initially, high altitude acclimatized human subjects (n = 40) were evaluated for their general nutritional status along with energy intake and expenditure and physical fitness score while they were on fresh rations. Thereafter, subjects were fed tinned rations in two groups of 20 each. Of the two groups, one group had vitamin supplementation and the other was without any vitamin supplementation for 30 days. Thereafter, all the variables were studied once again. Results. Daily total energy intake when subjects consumed fresh and tinned rations was 19.087 ± 0.347 MJ and 19.417 ± 0.342 MJ, respectively, whereas the total energy expenditure was 15.705 ± 1.054 MJ per day for both the groups. After consuming tinned rations for 30 days, the placebo group showed a significant (P < .01) decrease in levels of plasma vitamin A and erythrocyte transketolase activity (a marker of thiamin status) in comparison to the status when subjects were on fresh rations. However, levels of these variables were well within acceptable range. Subjects maintained their body weights and physical fitness scores. No clinical deficiency was seen after consuming tinned rations for 30 days. Conclusion. The study indicates that no additional vitamin supplementation is required at high altitude after acclimatization when consuming fresh rations and at least for 30 days when consuming tinned rations."

- "Effects of Cold and Altitude on Vitamin and Mineral Requirements...The predominantly Western foods now being consumed by expeditions in the cold and at high altitudes as well as the RCW that is consumed during military operations provide the majority of the essential nutrients in adequate amounts (according to the RDA and MRDA). Supplementation with additional vitamins E, C, and pantothenic acid, however, would ensure that these critical nutrients would be provided in amounts that cannot be obtained from the consumption of food alone. Including other vitamins and minerals at or near the RDA and MRDA levels should ensure adequate nutrient status for all metabolic functions. Amounts of each of the nutrients suggested in the micronutrient intake goal in Table 13-1 are recommended as a prudent and safe guide. The recommended amounts are subject to revision as more data are generated. As with most areas of scientific investigation, substantially more research is needed to establish the..."
effects of cold and altitude on vitamin and mineral requirements. Due to the critical role of vitamins and minerals in energy production, a well-designed human study should be conducted in a location such as the South Pole or Fort Greely, Alaska. During such a study, intake, excretion, and numerous status indices for each of the vitamins and minerals can be measured accurately and correlated with energy intake, expenditure, changes in body composition, and environmental conditions. Duration of this study must be sufficient to allow for changes in nutrient status if any, to occur; that is, a range of 3 to 4 months."

"Senior Scene : Vitamin B-12, Deficiency at Altitude...When I first arrived in Nederland, a friend sadly moved “down below” because she felt tired all the time at altitude. Another complained that they just feel “spacey” up here and feel more forgetful and distracted. Granted, the scenery is a wonderful distraction even for the most focused minds, but it was a chemical disturbance she didn’t feel elsewhere. Nutrition books don’t mention this much, but one thing we mountain dwellers need to watch is our Vitamin B-12. This vitamin aids folic acid in regulating the formation of red blood cells, since we need to make extra ones up here, and helps in the utilization of iron, says Dr. Balch in “Prescription for Nutritional Healing.” It is also required for proper digestion, absorption of foods, the synthesis of protein, and the metabolism of carbohydrates and fats. Aiding in cell formation and longevity, it prevents nerve damage and is linked to the production of the neurotransmitter that assists memory and learning."

"Sickness at Altitude...Nearly half of all athletes ascending to 8,000-14,000 ft. altitude experience headache, malaise, and decreased appetite. This is "Sickness at Altitude." Since elevation gain predictably induces sickness associated with altitude, the cause and the cure for managing these symptoms in order to reduce their effect on performance is a real and present concern. The preventatives discussed are time required for the body to adapt to less oxygen, adequate hydration, sufficient carbohydrates, pace-associated calorie expense, devices utilized to monitor or reduce altitude-associated edema, oral preventative medication, or over-the-counter NSAIDS (e.g. analgesics such as ibuprofen, aspirin).... DIET - A high carbohydrate, low salt diet stimulates physiological adaptation and lowers the risk of "Altitude Sickness." Some people experience significant decline in appetite resulting in loss of muscle. Iron is used to make oxygen-carrying hemoglobin. To make red blood cells our body requires iron-adequate foods. Most of us consume adequate levels of iron though females and vegetarians may lack the Vitamin B-12, Folate and Iron to make red blood cells at an increased rate for the blood's oxygen carrying needs at altitude...CONCLUSION. While it would seem reasonable to slow down when oxygen saturation volume is reduced due to the thin air at altitude, very few athletes possess the ability to restrain their competitive instincts to perform well. Fluid intake needs to be up to 30 fluid ounces per hour, including electrolytes (3-6 Endurolytes) per hour in divided dose in an isotonic solution containing between 240-280 calories. Acclimatizing to a given altitude for 10-14 days is ideal. If this is not convenient, the athlete is advised to show up the day the event starts in order to avoid performance-inhibiting gradual onset of pulmonary or cerebral edema that occurs prior to completing the ideal 10-14 days acclimatization. The athlete's physician in anticipation of cerebral or pulmonary edema may determine the prescription drug Acetazolamide."
induced polycythemia, parasitosis, and dietary inadequacy; however, school-aged children are often overlooked in research and public health efforts. The objectives of this study were to determine the prevalence of anemia among school-aged children in rural Ecuador and to investigate the etiology of anemia in this population to assist program development. A cross-sectional design and cluster sampling was used to sample 347 children aged 5 to 12 years in 5 communities in the Andean region. Altitude ranged from 2795 to 3240 m above sea level. Data collection included health and diet questionnaires, fecal parasite and finger-stick hemoglobin analysis, and anthropometric measures. World Health Organization standards were applied to adjust hemoglobin for altitude and determine the rate of anemia. Parasitosis affected 95% of children tested but showed no statistical impact on anemia. Anemia prevalence rose from 15% to 65%, once adjusted for altitude. Significant factors affecting anemia included failure to adjust for altitude and low dietary intakes of vitamins A, B12, folate, and zinc, with a minimal proportion of nutrients from animal-source foods. Dietary niacin and calcium were significantly correlated with the reduction of anemia (P < .05). Anemia prevention programs may benefit from increased emphasis on animal-source foods."

https://journals.sagepub.com/doi/pdf/10.1177/1941406410383013
Drinking Water Hazards

- “It was common to drink from plastic bottles and cans in high altitude astronomy.” Steven Magee CEng MIET - Q
- “Health Risks from Long Term Consumption of Reverse Osmosis Water...RO industry has become aware of the reality that long term consumption of demineralised water is not good for health.” https://www.ripublication.com/ijac17/ijacv13n2_11.pdf
- “Reverse Osmosis Water Exposed. What They Don't Tell You...Within several weeks or months various health complaints suggestive of acute magnesium (and possibly calcium) deficiency were reported. Among these complaints were cardiovascular disorders, tiredness, weakness or muscular cramps.” Again, serious side effects within just several weeks or months.” https://www.aqualiv.com/reverse-osmosis-water-filter-health/
- “World Health Organization Issues Reverse Osmosis Water Warning...After analyzing hundreds of scientific studies concerning demineralized or reverse osmosis water, the World Health Organization released a report stating that such water “has a definite adverse influence on the animal and human organism.”” https://drinknatureswater.wordpress.com/2017/12/03/world-health-organization-issues-reverse-osmosis-water-warning/
- “HEALTH RISKS FROM DRINKING DEMINERALISED WATER... In addition to an increased risk of sudden death, it has been suggested that intake of water low in magnesium may be associated with a higher risk of motor neuronal disease, pregnancy disorders (so-called preeclampsia), sudden death in infants, and some types of cancer. Recent studies suggest that the intake of soft water, i.e. water low in calcium, is associated with a higher risk of fracture in children, certain neurodegenerative diseases, pre-term birth and low weight at birth and some types of cancer. Furthermore, the possible role of water calcium in the development of CVD cannot be excluded.” http://www.who.int/water_sanitation_health/dwq/nutrientschap12.pdf
- “Gastrointestinal health effects associated with the consumption of drinking water produced by point-of-use domestic reverse-osmosis filtration units...During a prospective epidemiological study of gastrointestinal health effects associated with the consumption of drinking water produced by reverse-osmosis domestic units, a correlation was demonstrated between the bacterial counts on R2A medium incubated at 35 degrees C and the reported gastrointestinal symptoms in families who used these units. A univariate correlation was found with bacterial counts on R2A medium at 20 degrees C but was confounded by the bacterial counts at 35 degrees C. Other variables, such as family size and amount of water consumed, were not independently explanatory of the rate of illness. These observations raise concerns for the possibility of increased disease associated with certain point-of-use treatment devices for domestic use when high levels of bacterial growth occur.” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC182827/
- “Bottled Water is hazardous to you and our world... A recent Environmental Working Group test found 38 contaminants in 10 brands of bottled water. Findings included caffeine, toxic bacteria, carcinogenic DBP’s, nitrates, arsenic, various industrial chemicals, and pharmaceutical agents.” https://www.naturalnews.com/032744_bottled_water_environment.html
- “Health Effects of Plastic Water Bottles...Some types of plastic water bottles contain chemicals that may leach into your drinking water. Bisphenol A, or BPA, is one of the most commonly cited culprits, and is found in hard plastic bottles marked with plastic code "7." Other plastics also pose a potential health threat.” https://www.livestrong.com/article/131685-health-effects-
“Why drinking from a can may be dangerous..."To test the effects of drinking from cans, researchers in South Korea provided 60 adults over the age of 60 with soy milk either in a can or a glass bottle. Urine tests showed that those who drank from cans saw BPA levels up to 1,600% higher than those who drank from bottles”


“That bottled water you paid $3 for may contain tiny particles of plastic: Study..."There are connections to increases in certain kinds of cancer to lower sperm count to increases in conditions like ADHD and autism,” said Mason. "We know that they are connected to these synthetic chemicals in the environment and we know that plastics are providing kind of a means to get those chemicals into our bodies.”"


“In 2006, the US Government sponsored an assessment of the scientific literature on BPA. Thirty-eight experts in fields involved with bisphenol A gathered in Chapel Hill, North Carolina to review several hundred studies on BPA, many conducted by members of the group. At the end of the meeting, the group issued the Chapel Hill Consensus Statement,[57] which stated "BPA at concentrations found in the human body is associated with organizational changes in the prostate, breast, testis, mammary glands, body size, brain structure and chemistry, and behavior of laboratory animals."[58] The Chapel Hill Consensus Statement stated that average BPA levels in people were above those that cause harm to many animals in laboratory experiments.”

https://en.wikipedia.org/wiki/Bisphenol_A

“Phthalates, or phthalate esters, are esters of phthalic acid. They are mainly used as plasticizers, i.e., substances added to plastics to increase their flexibility, transparency, durability, and longevity...Due to the ubiquity of plasticized plastics, the majority of people are exposed to some level of phthalates. For example, most Americans tested by the Centers for Disease Control and Prevention have metabolites of multiple phthalates in their urine. In studies of rodents exposed to certain phthalates, high doses have been shown to change hormone levels and cause birth defects...Several phthalates are "plausibly" endocrine disruptors. The long-term health effects of exposure to endocrine disruptors, such as phthalates, are unclear. Authors of a 2006 study of boys with undescended testis hypothesized that exposure to a combination of phthalates and anti-androgenic pesticides may have contributed to that condition. A scientific review in 2013 came to the conclusion that epidemiological and in vitro studies generally converge sufficiently to conclude that phthalate anti-androgenicity is plausible in adult men.”

https://en.wikipedia.org/wiki/Phthalate

“Mechanisms underlying the anti-androgenic effects of diethylhexyl phthalate in fetal rat testis...Diethylhexyl phthalate (DEHP) is widely used as a plasticizer in consumer products and is known to disturb the development of the male reproductive system in rats. The mechanisms by which DEHP exerts these effects are not yet fully elucidated, though some of the effects are related to reduced fetal testosterone production.”


“Research Proves 'Gender-Bending' Chemicals Affect Reproduction..."It is believed that phthalates have these adverse effects because they reduce testosterone synthesis by interfering with an enzyme needed to produce the male hormone. In one study, women who had higher concentrations of two types of phthalates (DEHP and DBP) also had boys who appeared more

- "Pharmaceuticals in Our Water Supply Are Causing Bizarre Mutations to Wildlife. Federal officials are studying the effects of pharmaceuticals such as pain killers and depression medicine in our water supply...From inter-sex fish in the Potomac River to frog mutations in Wisconsin, federal officials are spending this summer studying the effects of pharmaceuticals such as pain killers and depression medicine on the environment, because the drugs have turned up in America's drinking water.” https://www.alternet.org/story/59305/pharmaceuticals_in_our_water_supply_are_causing_bizarre_mutations_to_wildlife

- "When used at specified levels for water disinfection, the reaction of chlorine with water is not a major concern for human health. Other materials present in the water may generate disinfection by-products that are associated with negative effects on human health.” https://en.wikipedia.org/wiki/Chlorine

- "Chlorinated disinfection agents such as chlorine and chloramine are strong oxidizing agents introduced into water in order to destroy pathogenic microbes, to oxidize taste/odor-forming compounds, and to form a disinfectant residual so water can reach the consumer tap safe from microbial contamination. These disinfectants may react with naturally present fulvic and humic acids, amino acids, and other natural organic matter, as well as iodide and bromide ions, to produce a range of DBPs such as the trihalomethanes (THMs), haloacetic acids (HAAs), bromate, and chlorite (which are regulated in the US), and so-called "emerging" DBPs such as halonitromethanes, haloacetonitriles, haloamides, halofuranones, iodo-acids such as iodoacetic acid, iodo-THMs (iodotrihalomethanes), nitrosamines, and others.[1] Chloramine has become a popular disinfectant in the US, and it has been found to produce N-nitrosodimethylamine (NDMA), which is a possible human carcinogen, as well as highly genotoxic iodinated DBPs, such as iodoacetic acid, when iodide is present in source waters.” https://en.wikipedia.org/wiki/Disinfection_by-product

- "Don't Take These Risks with Your Water Dispensers...Water dispensers are like every other appliance in that they require cleaning and maintenance...Risks involved in using a water dispenser can be avoided if you exercise certain precautions.” http://www.newair.com/articles/dont-take-these-risks-water-dispensers/

- "Health Warning Over Water Coolers...Dirty water coolers may be putting people’s health at risk, a consumer watchdog has warned. In a recent environmental health survey 23 out of 87 samples from dispensers showed bacterial contamination. Coolers in leisure centres, offices, care homes and schools were among those to fail the tests.” http://www.justsafety.co.uk/category/blog-articles/health-warning-over-water-coolers/

- “I never observed a water dispenser be cleaned or sterilized during my time in high altitude astronomy.” Steven Magee CEng MIET - Q

- “Plastic bottles of Gatorade were given free to very high altitude workers on Mauna Kea and they were advised to drink it while on the summit.” Steven Magee CEng MIET - Q

- “Effects of Too Much Gatorade... Though Gatorade is an excellent tool to provide athletes with important electrolytes lost during exercise, it should only be drunk in small amounts as needed. Drinking too much Gatorade can have serious health consequences.” https://www.livestrong.com/article/68710-effects-much-gatorade/

- “Negative Effects of Gatorade...Gatorade was developed to improve the performance and endurance of athletes. It effectively accomplishes the job by replacing fluids, carbohydrates and
Electrolytes such as sodium and potassium. However, if you don’t need the extra boost of sugar and minerals, drinking Gatorade may add more calories and sodium to your diet than you need, which could put your health at risk.” [https://www.livestrong.com/article/485761-negative-effects-of-gatorade/]

- “The Risks of Drinking Too Many Electrolyte Replacement Drinks...Electrolyte replacement drinks contain ingredients intended to sustain optimal physical performance and prevent dehydration in people engaged in intense exercise. To accomplish the job, these drinks are a mix of water, carbohydrates for energy and electrolytes such as sodium, which are lost due to excessive sweating. While these drinks are beneficial when you need the nutrients, the extra sugar and sodium can lead to problems if you drink too much or consume sports drinks instead of water.” [https://www.livestrong.com/article/395825-the-risks-of-drinking-too-many-electrolyte-replacement-drinks/]

- “Negative Effects of Drinking Too Many Electrolytes...Hypernatremia...Hyperkalemia...Hypercalcemia...too much magnesium” [https://www.livestrong.com/article/507396-negative-effects-of-drinking-too-many-electrolytes/]

- “Symptoms of Electrolyte Imbalance, Plus How to Solve It...The major electrolytes found within the body include calcium, magnesium, potassium, sodium, phosphate and chloride. Because these crucial nutrients help stimulate nerves throughout the body and balance fluid levels, an electrolyte imbalance can cause a variety of serious negative symptoms, including some that are potentially deadly.” [https://draxe.com/electrolyte-imbalance/]

- "Electrolyte Side Effects...Convulsions (seizures), dizziness, fast heartbeat, high blood pressure, irritability, muscle twitching, restlessness, swelling of feet or lower legs, weakness, Puffy eyelids, Vomiting (mild)” [https://www.drugs.com/sfx/electrolyte-side-effects.html]

- “The Little-Known Reasons Behind Sleep Disorders like Restless Legs and Sleep Apnea...Vitamin and Mineral Balance. Magnesium and potassium are often related to sleep challenges, including restless legs, periodic leg movement sleep, night terrors and nighttime reflux. A very clever neurologist, Dr. Stasha Gominak, began wondering why so many of her slim, young patients (who did not fit the profile for sleep apnea) were suffering from sleep apnea, headaches, REM apnea and leg movement. She began treating her patients with magnesium, vitamin D, vitamin B12 — and she noticed iron deficiencies. She was successful at getting patients of CPAP (a sleep apnea device sending oxygen into airways at night) and relieving them of headaches.” [http://heatherdane.com/the-little-known-reasons-behind-sleep-disorders-like-restless-legs-and-sleep-apnea/]

- “How can high Altitude Systemic Edema be prevented?...Avoiding salt may help.” [https://quizlet.com/33077235/mountain-warfare-high-altitude-illness-prevention-flash-cards/]

- “We were advised to drink plenty of fluids during our very high altitude summit work days to offset altitude sickness.” Steven Magee CEng MIET - Q

- “Water intoxication, also known as water poisoning or hyperhydration, is a potentially fatal disturbance in brain functions that results when the normal balance of electrolytes in the body is pushed outside safe limits by overhydration (excessive water intake).” [https://en.wikipedia.org/wiki/Water_intoxication]
**High Altitude Beverages**

- “Tibetan Butter Tea is the Cold-Weather Breakfast of Champions. Centuries before there was Bulletproof Coffee, there was Tibetan Butter Tea...Bulletproof Coffee may be this decade's hottest breakfast craze, but in Tibet, putting butter in your morning beverage is a centuries-long tradition. In the cold, high-altitude conditions of the Himalayan region, the salty, caloric, and energizing po cha—or butter tea—is a daily ritual, forming a large part of the often-sparse Tibetan diet. "Tibet is the highest plateau in the world, so butter tea is like a special kind of oxygen for us," says Tsering Tamding la, a Tibetan chef based in Oakland, CA.”

- “9 Best Benefits of Butter Tea...Boosts Energy...Brain Enhancer...Appetite Suppressant...Aids in Digestion... Moisturizing Qualities...Altitude Sickness: Altitude sickness affects many people, but anecdotal evidence suggests that this unique type of tea can counter the effects of dizziness, lightheadedness, and nausea that often accompanies life in the clouds. If you travel extensively or are planning a trip to Nepal any time soon, consider trying this tea to negate the effects of altitude...Improves Heart Health...Boosts Immunity...Controls Diabetes.”
  [https://www.organicfacts.net/health-benefits/animal-product/butter-tea.html](https://www.organicfacts.net/health-benefits/animal-product/butter-tea.html)

- “Butter tea, also known as po cha (Tibetan: བོད་ཇ་, Wylie: bod ja, "Tibetan tea"), cha süma (Tibetan: བོད་སྲུབ་མ་, Wylie: bo sgrub ma, "churned tea"), Mandarin Chinese: sūyóu chá (酥油茶) or gur gur cha in the Ladakhi language, is a drink of the people in the Himalayan regions of Nepal, Bhutan, India (particularly in Ladakh, Sikkim, and Arunachal Pradesh) and Tibet and other Western regions of modern-day People's Republic of China. Butter tea probably originated in the Himalayan region between Greater Tibet and the Indian subcontinent. Traditionally, it is made from tea leaves, yak butter, water, and salt, although butter made from cow's milk is increasingly used, given its wider availability and lower cost.”

- “Acli-Mate® Mountain Sport Drink contains electrolytes for hydration, Vitamin C, Rhodiola, and Schizandra for adrenal wellness and acclimatization support, and B-Vitamins for energy. Our unique and effective formula makes Acli-Mate® Mountain Sport Drink the perfect natural remedy for High Altitude Sickness, also called Acute Mountain Sickness. This makes Acli-Mate® Mountain a healthy, natural choice for every mountain traveler, outdoor enthusiast, and athlete at any age. Ensure you feel your best while in the mountains by preparing for your trip. Start using Acli-Mate® Mountain Sport Drink three days prior to arrival at high elevation and continue for the duration of your stay. It is recommended you drink three servings daily before 7 pm for best results. Acli-Mate® Mountain Sport Drink is great for hydration, energy, and acclimatization in both kids and adults. Common symptoms of High Altitude Sickness / Acute Mountain Sickness include: fatigue, headaches, nausea, vomiting, dizziness, muscle cramping, insomnia, elevated blood pressure, shortness of breath, water retention, and dehydration. Recognizing the symptoms of High Altitude Sickness, getting to a lower elevation, using supplemental oxygen, staying hydrated with water and Acli-Mate® Mountain Sport Drink may help to prevent or reduce the severity of altitude sickness. (Immediate medical attention is advised for moderate to severe AMS!) See “For Best Results” for additional information on optimal acclimatization and performance. Don’t let your vacation or trip to the mountains be spoiled by having to deal with High Altitude Sickness. Instead, on your next adventure try Acli-Mate® Mountain, stay hydrated, and enjoy yourself. We receive countless testimonials.”
detailing how Acli-Mate® Mountain has aided travelers with acclimatization to high elevation. Acli-Mate® Mountain Sport Drink is available in three delicious flavors, pick your favorite or buy a mountain mix to sample them all.” https://acli-mate.com/products/altitude-sickness/
Feet Hazards

- “Why do I get swelling in my hands and feet? Swelling sometimes occurs in the arms, legs and even the face at altitude and is called peripheral edema. It is sometimes associated with altitude illness but occurs frequently in people without any other symptoms. Women experience peripheral edema more than men. Exercise may increase edema.”
  [http://www.altitudemedicine.org/altitude-illness/](http://www.altitudemedicine.org/altitude-illness/)

- “At the age of 45, I started to experience severe pains in one foot that progressed into both feet as I aged. I do wonder if it is the long term effects of high altitude peripheral edema.” Steven Magee CEng MIET - Q

- “Peripheral edema is edema (accumulation of fluid causing swelling) in tissues perfused by the peripheral vascular system, usually in the lower limbs. In the most dependent parts of the body (those hanging distally), it may be called dependent edema. The condition is commonly associated with aging, but can be caused by many other conditions, including congestive heart failure, trauma, alcoholism, altitude sickness, pregnancy, hypertension, sickle cell anemia, compromised lymphatic system, or merely long periods of time sitting or standing without moving.”
  [https://en.wikipedia.org/wiki/Peripheral_edema](https://en.wikipedia.org/wiki/Peripheral_edema)
Mercury Vapor Detectors

- “I have no recollection of seeing a mercury vapor detector at facilities where mercury was in use.” Steven Magee CEng MIET
- “The Mercury Vapour Indicator (MVI) is a revolutionary instrument accurately detecting hazardous mercury vapours in just 3 seconds! The instrument’s unique advantage is its dual beam UV absorption technology and ability to measure high concentrations of mercury without saturating; requiring no regeneration between readings, eliminating downtime.”
  [https://info.ionscience.com/mvi-mercury-detector](https://info.ionscience.com/mvi-mercury-detector)
- “The Tekran® Model 2537 Ambient Air Mercury Monitor was the first product developed by Tekran® and remains a driving force of innovation. The Model 2537 is the only analyzer available that is capable of automated, continuous, unattended atmospheric mercury speciation. Our instruments produce high-resolution, accurate data that continues to advance the understanding of mercury cycling in the environment.”
Mercury Training Courses

- “While handling mercury systems in the employment of Columbia University and Dartmouth College, I have no recollection of receiving industry recognized health and safety training for the workplace hazards present.” Steven Magee CEng MIET - Q
- “Certain states do have 10 and/or 30 hour training, expiration, and renewal requirements… NEW HAMPSHIRE: State and local municipality funded projects of $100,000 or more, require that all employees have their OSHA 10 hour certification job before starting any work onsite. Employees who fail to obtain their 10 hour card after 15 days of starting work, will be removed from the jobsite and their employer can face penalties up to $2,500 and a civil penalty of $100 per employee for each day of noncompliance!...NEW YORK: Any public project where the contract is greater than $250,000, requires all employees to have their OSHA 10 hour training card prior to starting on a jobsite and turn in proof that they’ve done so. Once you have completed OSHA 10 training for work on Article 8 public projects, New York State does not require renewal. However, New York City does require renewal of the training every 5 years. NYC March 1, 2018 training requirements update: All workers onsite must be able to show that they have taken at least an OSHA 10 class within the previous five years. Supervisors are required to receive 60 hours of training, while new entrants to the construction workforce need to obtain a 10 hour OSHA training class and then a minimum of 40 hours of training to continue working.”
- “Mercury Awareness Course...The course covers the basics of mercury: its properties and characteristics; regulations and exposure limits; basic safety and personal protective measures; and release response for individuals performing work involving mercury or involving the possibility of mercury exposure. Training can be tailored to your specific work procedures and conditions and can include a practical demonstration. We can conduct sessions at our facility or a location of your choice.”
- “Handling Hazardous Materials. Learn to Safely Work with the Chemicals at Your Workplace. Becoming complacent or not staying up-to-date on the latest safety precautions and procedures can lead to dangerous situations, especially when working with hazardous chemicals. Having daily contact with hazardous materials, whether in a factory, a hospital or in the maritime field, can be extremely dangerous, and is not something to be taken lightly.”


Oxygen Hazards

- “The closer you get to the Sun, the lower your blood oxygen levels go.” Steven Magee CEng MIET - Q
- "Levels of Oxygen Deficiency - Concentration of Oxygen Effects"
  http://www.bodydesigncenter.com/oxygen-service/oxygen-deficiency
- “OSHA, FDA and DOT have guidelines developed for precautionary labels for use on oxygen cylinders and cryogenic vessels...the FDA requires "Rx Only" on the label, among a few other things”
  http://applied-inc.com/new-osha-requirements-for-oxygen-cylinder-labels
- “FDA Issues Final Rule Permitting Use of Symbols on Device Labeling...The final rule also now formally allows device manufacturers to use the Rx Only symbol in lieu of the longer prescription use only statement.”
  http://www.fdalawblog.net/2016/06/fda-issues-final-rule-permitting-use-of-symbols-on-device-labeling/
- "KEEP OUT OF REACH OF CHILDREN. WARNING! For emergency use only when administered by properly trained personnel for Oxygen deficiency and resuscitation. For all other medical applications, Rx ONLY. Uninterrupted use of high concentrations of Oxygen over a long duration, without monitoring its effects on Oxygen content of arterial blood, may be harmful. Use only with pressure reducing equipment and apparatus designed for Oxygen."
  http://www.drugs.com/pro/oxygen.html
- "Why do portable oxygen concentrators require a prescription? Like other medications, supplemental oxygen is a medical treatment and treatment is specific to the user. Your doctor may prescribe an oxygen flow rate, as well as the length of time you should use the oxygen each day." http://www.domorewithoxygen.com/bid/340083/Do-Portable-Oxygen-Concentrators-Require-a-Prescription
- “Inside the world's largest sun-spotting telescope...once the observatory is complete, it will remain a potentially hazardous place to visit. With an altitude just over 10,000 feet (3,050 meters), the observatory sits above much of the Earth's atmosphere. The high altitude can affect visitors, and oxygen equipment and other health monitors were visible throughout the facility. High altitudes can cause shortness of breath, weakness, nausea and other symptoms, an issue that the group was reminded of when one visitor had to be taken to the hospital mid-visit.”
- "At 3:31 in the first video you can clearly see four people in the video wearing what appear to be portable oxygen units and nasal cannula's on the 13,796 feet very high altitude summit of Mauna Kea." Steven Magee CEng MIET
- "QUESTION: Why are compressed medical gases for medical use considered prescription drugs? ANSWER: Because their use as drugs, without the supervision of a licensed practitioner or by properly instructed emergency personnel, is not safe."
  http://www.fda.gov/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/ucm124716.htm
- "Medical oxygen (or oxygen USP) is considered both a hazardous material by the U.S. Department of Transportation (DOT) and a prescription drug regulated by the U.S. Food and Drug Administration (FDA)."
  http://www.homecaremag.com/law/jan-2014/protect-your-
"Working on the summit of Mauna Kea was comparable to working on the hospital pulmonary ward with sick people sucking on oxygen cylinders." Steven Magee CEng MIET - Q

“The most unhygienic thing that I observed during my time in very high altitude astronomy was dozens of workers all sharing the same oxygen administration mask for treating their daily oxygen starvation sicknesses.” Steven Magee CEng MIET - Q

“How long can a patient go with low oxygen of 85 to 90% saturation? I am on oxygen 24 hrs a day….Home oxygen is a PALLIATIVE intervention. Is NOT curative and generally when a patient is on home Oxygen, the MEDIAN survival time is 2 years. People on Home oxygen DO NOT SURVIVE for prolonged periods. The combination of the disease process that caused the chronic hypoxia, the right heart failure, the lack of mobility and the potential for complications ie infections and most definitely DVTs and PEs put these patients at a high risk of dying.” [https://www.quora.com/How-long-can-a-patient-go-with-low-oxygen-of-85-to-90-saturation-I-am-on-oxygen-24-hrs-a-day](https://www.quora.com/How-long-can-a-patient-go-with-low-oxygen-of-85-to-90-saturation-I-am-on-oxygen-24-hrs-a-day)

“The Oxygen Dilemma: Can Too Much O2 Kill? Without it, cells die. With too much, they die even faster...Evidence suggests that pumping in too much oxygen too quickly can strip the molecule of a single electron, creating a free radical. Free radicals, linked to rapid aging, are highly reactive with other molecules, including vital DNA and proteins, the destruction of which can damage or kill cells. Treating with too much oxygen, therefore, could increase the production of free radicals and make a bad situation even worse.” [https://www.scientificamerican.com/article/the-oxygen-dilemma/](https://www.scientificamerican.com/article/the-oxygen-dilemma/)

“Oxygen Inhalation: May cause breathing difficulty. Prolonged exposure to high oxygen levels (>75%) can cause central nervous system depression: signs/symptoms can include headache, dizziness, drowsiness, poor coordination, slowed reaction time, slurred speech, giddiness and unconsciousness. May cause coughing and chest pain. May cause lung damage. May cause soreness of the throat.” [http://www.uigi.com/MSDS_gaseous_O2.html](http://www.uigi.com/MSDS_gaseous_O2.html)

“Supplying oxygen to animals has been known to produce tissue damage, with toxicity increasing with the increase of oxygen concentrations and exposure pressures. End-organ damage from hyperoxia depends on both the concentration of oxygen administered and the oxygen pressure during exposure. Prolonged exposure to hyperbaric oxygen causes central nervous system and pulmonary toxicity, which results in atelectasis, pulmonary edema, and seizures. Lung damage may occur as a result of normobaric hyperoxia.” [https://www.ncbi.nlm.nih.gov/pubmed/8087571](https://www.ncbi.nlm.nih.gov/pubmed/8087571)

“Oxygen therapy is like a two-edged sword, at one edge oxygen is essential for human survival, while at the other edge it may become toxic at an elevated partial pressure. This is a hazard, especially in intensive care units, where oxygen therapy may be administered over a period of days. Oxygen toxicity usually manifests in one of several forms including central nervous system manifestations, pulmonary manifestations, and ocular manifestations, especially in premature neonates. The major factors affecting the onset and the severity of the toxicity are the concentration of the gas used, the duration of the exposure, and the susceptibility of the individual person.” [http://medind.nic.in/jac/t03/i3/jact03i3p234.pdf](http://medind.nic.in/jac/t03/i3/jact03i3p234.pdf)

“What Are the Side Effects of Oxygen Therapy?...Pulmonary Oxygen Toxicity. When it comes to oxygen therapy, there can be too much of a good thing. Prolonged administration of highly concentrated oxygen can potentially damage the lung lining tissues and air sacs, a condition known as pulmonary oxygen toxicity.” [https://www.livestrong.com/article/234287-what-are-the-side-effects-of-oxygen-therapy/](https://www.livestrong.com/article/234287-what-are-the-side-effects-of-oxygen-therapy/)

“Though oxygen therapy is helpful in many disorders, its injudicious use may lead to toxic
effects usually involving the CNS, the lungs and the eyes.”
http://medind.nic.in/jac/t03/i3/jact03i3p234.pdf

- “Although supplemental oxygen is valuable in many clinical situations, excessive or inappropriate supplemental oxygen can be deleterious. According to human and animal studies, high concentrations of inspired oxygen can cause a spectrum of lung injury, ranging from mild tracheobronchitis to diffuse alveolar damage (DAD). The latter is histologically indistinguishable from that observed in the acute respiratory distress syndrome (ARDS).” http://www.uptodate.com/contents/oxygen-toxicity

- “Exposure time, atmospheric pressure, and fraction of inspired O2 (FIO2) determine the cumulative O2 dose leading to toxicity.” https://www.hindawi.com/journals/nrp/2011/260482/

- “We have always known that oxygen is necessary for all animal life, and that lack of oxygen damages tissues. It is beyond argument that patients who are hypoxic must receive supplemental oxygen. What we’ve not always known is that too much oxygen can harm patients in a number of ways... These can damage tissues throughout the body, but of particular concern are lung, heart and brain tissues.” http://www.emsworld.com/article/10915304/the-dangers-of-giving-too-much-oxygen

- “Like every other drug, oxygen administration has complications. Common complications include skin irritation and breakdown as well as a drying of the mucous membranes. Less common but more serious complications include oxygen toxicity, absorbative atelectasis and carbon dioxide narcosis.” http://www.emsworld.com/article/10523286/oxygen-toxicity

- “In high altitude astronomical facilities we routinely discharged large amounts of nitrogen gas into closed spaces. We were never informed by the astronomy management team about the abnormally low oxygen environments that the use of liquid nitrogen creates, how long term exposure to it manifests itself in human health and the resulting abnormal mental behaviors.” Steven Magee CEng MIET - Q

- “Although the body requires oxygen for metabolism, low oxygen levels normally do not stimulate breathing. Rather, breathing is stimulated by higher carbon dioxide levels. As a result, breathing low-pressure air or a gas mixture with no oxygen at all (such as pure nitrogen) can lead to loss of consciousness without ever experiencing air hunger. This is especially perilous for high-altitude fighter pilots. It is also why flight attendants instruct passengers, in case of loss of cabin pressure, to apply the oxygen mask to themselves first before helping others; otherwise, one risks losing consciousness.” https://en.wikipedia.org/wiki/Carbon_dioxide#Regulation_of_respiration

- “My memories of my time in high altitude astronomy indicate that there were no oxygen concentration monitors or alarms in the areas that liquid nitrogen was in use inside of the astronomical facilities where I had worked.” Steven Magee CEng MIET

- “Astronomy staff that routinely discharged industrial gas into the indoor environment at high altitudes did not wear oxygen deficiency monitors.” Steven Magee CEng MIET - Q

- “This fits in with what I saw in staff in astronomical facilities and was reporting to the management team: 10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration.” Steven Magee CEng MIET - Q http://www.centralwelding.com/MSDS-P/Nitrogen,%20Liquid.pdf

- “A good rule of thumb is that women normally need oxygen about 2,000 feet sooner than men. Of course there are exceptions.” http://www.c-f-c.com/supportdocs/abo2.htm

- “In 2001 workers were using intermittent oxygen numerous times daily on the very high
altitude summit of Mauna Kea in Hawaii. By the time I left in 2006 some workers were using portable oxygen units and nasal cannula's for continuous medical oxygen administration for the treatment of altitude sickness.” Steven Magee CEng MIET - Q

- “I never met anyone in high altitude astronomy that had a prescription for daily medical oxygen use.” Steven Magee CEng MIET - Q

- “Very high altitude workers were using medical oxygen to treat numerous health conditions that included fatigue, confusion, headaches, feeling faint and digestive issues.” Steven Magee CEng MIET - Q

- “There are numerous types of oxygen available for purchase. These are industrial oxygen – generally for welding and not suitable for human consumption, aviation oxygen – regulated by the FAA rules, medical oxygen - regulated by the FDA and DOT. It was unclear what type of oxygen was inside the oxygen cylinders that employees were using at the summit of Mauna Kea and most employees assumed it was medical oxygen for treating their medical conditions.” Steven Magee CEng MIET – Q [https://www.scubaboard.com/community/threads/medical-vs-aviation-grade-o2.349095/](https://www.scubaboard.com/community/threads/medical-vs-aviation-grade-o2.349095/)
Nitrogen Hazards

- “Health effects of nitrogen - Nitrates and nitrites are known to cause several health effects. These are the most common effects: Reactions with haemoglobin in blood, causing the oxygen carrying capacity of the blood to decrease (nitrite). Decreased functioning of the thyroid gland (nitrate). Vitamin A shortages (nitrate). Fashioning of nitro amines, which are known as one of the most common causes of cancer (nitrates and nitrites)”


- “When I worked at the W. M. Keck Observatory on the 13,796 feet very high altitude summit of Mauna Kea, we would routinely be engulfed in cold clouds of helium and nitrogen gas as we discharged it into the video camera systems daily. The management team never warned us that we were in a hazardous oxygen deprived environment during this activity that was known for its ability to adversely affect physical and mental health, and possibly bring on death by asphyxiation.” Steven Magee CEng MIET - Q

- “Five technicians are asphyxiated while setting up a ground test for the space shuttle Columbia, then in preparation for STS-1, the first operational shuttle mission. Two of them die. The accident occurred during a nitrogen purge of the orbiter.”


- “Nitrogen tends to displace Oxygen from the air, whenever it comes in contact with it. Thus if a continuous flow of Nitrogen is released into air, the Oxygen level in the air depletes very fast and can choke a person who is breathing this Nitrogen rich air.”

http://industrialplantsafety.com/dangers-of-nitrogen.html

- “Being odorless, colorless, tasteless, and nonirritating, nitrogen has no properties that can warn people of its presence. Inhalation of excessive amounts of nitrogen can cause dizziness, nausea, vomiting, loss of consciousness, and death. Death may result from errors in judgment, confusion, or loss of consciousness, which prevent self-rescue.”


- “Nitrogen Gas Safety Hazards: Nitrogen can cause oxygen deficiencies. The danger will increase if nitrogen is used in a confined space where limited air or ventilation exist. A simple safety tip for operation involving nitrogen is to measure oxygen contain in the atmosphere by using oxygen detector such as GA24XT-X form BW Technologies.”


- “Failure to detect an oxygen deficient (nitrogen-enriched) atmosphere was a significant factor in several incidents.”

http://www.csb.gov/assets/1/19/SB-Nitrogen-6-11-031.pdf

- “Nitrogen: The Silent Killer - Nitrogen is an invisible, tasteless and odorless gas that comprises about 78 percent of the air we breathe. But its potential to kill workers in or near confined spaces should never be underestimated.”


- “When I worked in astronomy, I routinely observed young college and university students working with liquid nitrogen and breathing nitrogen gas as they discharged it into the indoor environment at high altitude.” Steven Magee CEng MIET - Q

- “My memories of high altitude astronomy indicate that up to four (4) liquid nitrogen flasks were left venting gas into a small indoor workshop and office area where workers were permanently stationed.” Steven Magee CEng MIET - Q
“New requirements for use and storage of liquid nitrogen, dry ice...An employee of a non-CAP-accredited laboratory in Georgia was critically injured in 2017 when an LN2 leak occurred. LN2 converts to colorless, odorless gas and replaces environmental oxygen. The unsuspecting laboratory worker was burned and then fell unconscious. One of the first responders who arrived on the scene to rescue her died of asphyxiation. The employee survived...All laboratories must know that proper ventilation and high turnover of air in storage and usage areas are imperative, he adds. Other additions to the requirement call for “training on the safe handling of LN2 and dry ice” and signs marking areas where LN2 and dry ice are used and stored. “The training referenced in the note alerts labs to provide training specific to LN2 and dry ice,” Dr. West says. “We wanted to bring attention to the need to understand certain things about safe use of LN2, including storage tanks,” for example.”...Because LN2 is a heavy gas, it falls to the floor first and fills the room from floor to ceiling. “If an alarm is six to eight feet above the floor, the entire room would have to fill with nitrogen before the alarm goes off,” he says. “If a lab worker were seated on the floor or on a low stool, the alarm would be too late for them. They could be passed out or dead by the time it sounded. Sensors must be at the height you are working, more likely waist level than eye level.””

https://www.captodayonline.com/new-requirements-use-storage-liquid-nitrogen-dry-ice/
Helium Hazards

- “After inhaling helium, the body's oxygen level can plummet to a hazardous level in a matter of seconds.” [http://www.slate.com/articles/news_and_politics/explainer/2006/06/stay_out_of_that_balloon.html](http://www.slate.com/articles/news_and_politics/explainer/2006/06/stay_out_of_that_balloon.html)
- “On February 4, 2015 it was revealed that during the recording of their main TV show on January 28, a 12-year-old member (name withheld) of Japanese all-girl singing group 3B Junior suffered from air embolism, losing consciousness and falling in a coma as a result of air bubbles blocking the flow of blood to the brain, after inhaling huge quantities of helium as part of a game. The incident was not made public until a week later. The staff of TV Asahi held an emergency press conference to communicate that the member had been taken to the hospital and is showing signs of rehabilitation such as moving eyes and limbs, but her consciousness has not been sufficiently recovered as of yet. Police have launched an investigation due to a neglect of safety measures.” [https://en.wikipedia.org/wiki/Helium](https://en.wikipedia.org/wiki/Helium)
- “Inhalation of this product may cause dizziness, an irregular heartbeat, narcosis, nausea or asphyxiation. NEVER INHALED, OR ALLOW TO BE INHALED, EVEN FOR A SHORT PERIOD, HELIUM CONTAINED IN A BALLOON, A GAS CONTAINER OR FILLING EQUIPMENT. INHALATION CAN CAUSE DEATH OR SEVERE DAMAGES.” [http://www.centralwelding.com/MSDS-P/Helium.pdf](http://www.centralwelding.com/MSDS-P/Helium.pdf)
- “Most terrestrial helium present today is created by the natural radioactive decay of heavy radioactive elements (thorium and uranium, although there are other examples), as the alpha particles emitted by such decays consist of helium-4 nuclei. This radiogenic helium is trapped with natural gas in concentrations as great as 7% by volume, from which it is extracted commercially by a low-temperature separation process called fractional distillation.” [https://en.wikipedia.org/wiki/Helium](https://en.wikipedia.org/wiki/Helium)
Carbon Dioxide Hazards

- “Snow cleaning of the world’s largest telescope mirrors was an impressive sight. The optics technicians would climb into a huge telescopic boom lift and spray immense clouds of cold carbon dioxide snow and gas onto the ten meter diameter mirrors high above the floor indoors. It would cause some of the accumulated dirt to magically fall off, leaving it less dirty.” Steven Magee CEng MIET

- “the telescope mirrors are periodically “dusted,” not with Windex, but with a spray of carbon dioxide snow. The carbon dioxide particles and gas, which are nondestructive, nonabrasive, residue-free and environmentally friendly, blow dust and grit from the mirror surface through a process called sublimation.”

- “Occupational CO2 exposure limits have been set in the United States at 0.5% (5000 ppm) for an eight-hour period. At this CO2 concentration, International Space Station crew experienced headaches, lethargy, mental slowness, emotional irritation, and sleep disruption. Studies in animals at 0.5% CO2 have demonstrated kidney calcification and bone loss after eight weeks of exposure. A study of humans exposed in 2.5 hour sessions demonstrated significant effects on cognitive abilities at concentrations as low as 0.1% (1000ppm) CO2 likely due to CO2 induced increases in cerebral blood flow. Another study observed a decline in basic activity level and information usage at 1000 ppm, when compared to 500 ppm.”

- “By January 1993, Biosphere 2’s carbon dioxide levels were 12 times that of the outside, and oxygen levels were what mountaineers get at 17,000 feet. The crew’s doctor was having trouble adding up simple figures and disqualified himself from duty.”

- “Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.”

- “Carbon Dioxide is an asphyxiant and a powerful cerebral vasodilator. If the concentration of Carbon Dioxide reaches 10% or more, suffocation can occur within minutes. At concentrations between 2 and 10%, Carbon Dioxide can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate. Carbon Dioxide initially stimulates respiration and then causes respiratory depression. High concentrations result in narcosis.”

- “The Link Between Carbon Dioxide Retention and Sleep…Carbon dioxide intoxication or carbon dioxide poisoning, known, respectively, as hypercapnia or hypercarbia, occurs when a person has too much of the gas in the body. This usually happens when someone is exposed to elevated levels of carbon dioxide for a long period of time...Many people have no symptoms of hypercapnia, but if they do, they're likely to feel drowsy or find it hard to think straight. Severe hypercapnia, on the other hand, can cause noticeable symptoms, such as increased heart rate, blood pressure or muscle twitches. It can lead to respiratory failure if untreated.”

- “Sleeping in a Closed Room – Indoor CO2 Analyze...Time-Graph of CO2 PPM Level while sleeping in a closed room. What you can clearly see on the chart is how each change in the rooms occupation affects the CO2 Level quite quickly. Also what is astonishing is that we passed 2000 ppm at ~1 am. This is just 2 hours after we went to sleep in a relatively fresh air. At
4.30am i woke up (i usually wake up then) and the air felt quite stuffy (maybe also because i Knew the PPM). But then i decided to open the door wide and give my wife and baby some fresh air. If i had left the door shut, the level would have easily reached 4500 ppm until 7am.”


- “Continued CO2 emissions will impair cognition...They found that if the outdoor CO2 concentrations do rise to 930 ppm, that would nudge the indoor concentrations to a harmful level of 1400 ppm."At this level, some studies have demonstrated compelling evidence for significant cognitive impairmment,” said Anna Schapiro, assistant professor of psychology at the University of Pennsylvania and a coauthor on the study. “Though the literature contains some conflicting findings and much more research is needed, it appears that high level cognitive domains like decision-making and planning are especially susceptible to increasing CO2 concentrations.””

https://neurosciencenews.com/co2-emission-cognition-16245/

- In fact, at 1400 ppm, CO2 concentrations may cut our basic decision-making ability by 25 percent, and complex strategic thinking by around 50 percent, the authors found.

- “Carbon Dioxide, Hypoxia, Epinephrine Cardiac "Sensitization" Tests...With high and prolonged exposures to carbon dioxide, or prolonged strenuous exercise while breathing carbon dioxide, the frequency of cardiac arrhythmias increases.”

http://archive.rubicon-foundation.org/xmlui/handle/123456789/10579

- “Carbon Dioxide “Alarm System” Might Help Explain Anxiety Disorders...For most people, a little stale air isn’t much of a problem—a lot of carbon dioxide has to build up before they start to panic. But for some, inhaling even a whiff or two of CO2 can provoke an immediate sense of dread. In fact, a prominent psychiatric theory holds that an overly sensitive detection mechanism for the gas, or “suffocation false alarm,” makes these folks particularly susceptible to panic disorders and other anxiety problems.”


- “Carbon dioxide hypersensitivity, hyperventilation, and panic disorder...RESULTS: Some panic patients have a chronic, subtle respiratory disturbance. Acute hyperventilation is neither necessary nor sufficient for panic to occur. Respiratory abnormalities in panic patients may adaptively aim at coping with a hypersensitive CO2 chemoreceptor system. Pharmacologic panicogens also stimulate the respiratory system, causing hyperventilation. Triggering this hypersensitive respiratory control mechanism may incite panic. Antipanic medications may reset the receptor threshold. Misattribution and catastrophic interpretation of somatic symptoms or the sense of loss of control may contribute to panic symptoms. Behavioral interventions such as desensitization or breathing retraining may block the full-blown attack. Cognitive strategies through cognitive control of respiration may supplement and accentuate these interventions.”


- “Panic Attacks as a Problem of pH. Study casts new light on the brain mechanisms behind recurrent bouts of intense anxiety...Carbon dioxide acts like an acid in the body and the brain. Several of the experiments described in the Iowa paper showed that inhaling elevated concentrations of carbon dioxide triggered strong fear reactions in normal mice, and that some of these fear reactions required the presence of the acid-sensing protein in the amygdala. These experiments are especially relevant to understanding panic disorder. One of the most consistent findings in patients with panic disorder is that they are unusually sensitive to carbon dioxide inhalation and other laboratory procedures that increase brain acidity. Most patients with panic disorder will experience a panic attack when they inhale air containing 35% carbon dioxide, while most healthy volunteers will not.”

https://www.scientificamerican.com/article/panic-
**The Relationship between Central Carbon Dioxide Sensitivity and Clinical Features in Patients with Chronic Airways Obstruction**...A technique has been developed which enables respiratory motor output to be measured independently of lung mechanics. The maximum rate of change of pressure at the mouth during initial transient occlusion of the airway, \((dP/dt)\) max., represents the rate of isometric force development by the inspiratory muscles. This technique was used to study central CO2 sensitivity in 40 patients with chronic airways obstruction. Subnormal CO2 sensitivity was associated with chronic cough and sputum production, relatively mild dyspnoea, raised arterial CO2 tension, hypoxaemia, poly-cythaemia and cor pulmonale. Normal CO2 sensitivity was associated with severe dyspnoea, normal blood gas tensions, and allergic features.”

**Genetic differences may alter carbon dioxide sensitivity, contribute to changes in astronauts' eyes**...Genetic variation may increase susceptibility of some astronauts to develop higher-than-normal carbon dioxide levels in the blood, which may contribute to eye abnormalities, including grooved bands on the retina and swelling of the optic nerve, new research indicates.”

**Decreased Carbon Dioxide Sensitivity in Infants of Substance-Abusing Mothers**...Results. The gestational ages by obstetrical dating and examination of the infants were not different, although birth weights and birth lengths were lower in the group of ISAMs. Other demographic data were not different, and there were no differences in the infants' median ages at the time of study or in maternal use of tobacco and alcohol. The two groups had comparable baseline (room air) ET-CO2 levels, respiratory rates, tidal volumes, and minute ventilation. When compared with the group of ISAMs, the drug-free group had markedly increased tidal volume and minute ventilation on exposure to 4% carbon dioxide. These increases accounted for the difference in sensitivity to carbon dioxide, calculated as the change in minute ventilation per unit change in ET-CO2 (milliliters per kg/min per mm Hg). The sensitivity to carbon dioxide of control infants was 48.66 ± 7.14 (mean ± SE), whereas that of ISAMs was 16.28 ± 3.14.”

**Carbon dioxide sensitivity and personality**...Abstract. 33 U.S. Army enlisted men underwent 3 or 4 trials of a rebreathing test for CO2 sensitivity. During each trial the increase in the S's ventilation was related to increase in alveolar CO2. Ss were also administered the MMPI. Elevations were noted on nearly all standard MMPI scales for low responders to CO2, with differences between high and low responders reaching statistical significance on several scales. Differences in personality traits between high and low responders to CO2 suggest that this test may be useful for psychosomatic investigations. The interpretation of CO2 sensitivity as an index of the excitatory level of the respiratory center in the medulla is discussed.”

**Scientists differ on climate’s carbon dioxide sensitivity**...Scientists have yet to settle one of the biggest questions of warming: the climate’s carbon dioxide sensitivity. How much more carbon dioxide can the atmosphere absorb – and how will life on Earth respond – before the global temperature ticks past the political milestones of 1.5 °C and 2 °C above the average levels for most of human history?”

**Carbon Dioxide Inside Can Be Harmful Too.** New studies show that CO2 inside buildings could be just as harmful as outside... scientists found impairments in cognitive function test
scores at CO2 concentrations in the 950-1,000 ppm range, and significantly worse performance when CO2 rose to 1500 and 2,500 ppm. The researchers stressed that carbon dioxide levels in indoor environments, especially schools, frequently rise above 1,000 ppm.”
**Industrial Gas Use In Chemical Weapons**

- “A chemical weapon (CW) is a specialized munition that uses chemicals formulated to inflict death or harm on humans.” [https://en.wikipedia.org/wiki/Chemical_weapon](https://en.wikipedia.org/wiki/Chemical_weapon)
- “During World War II, naval personnel who were exposed to mustard gas during military action were found to have toxic changes in the bone marrow cells that develop into blood cells. During that same period, the US Army was studying a number of chemicals related to mustard gas to develop more effective agents for war and also develop protective measures. In the course of that work, a compound called nitrogen mustard was studied and found to work against a cancer of the lymph nodes called lymphoma. This agent served as the model for a long series of similar but more effective agents (called alkylating agents) that killed rapidly growing cancer cells by damaging their DNA.” [https://www.cancer.org/cancer/cancer-basics/history-of-cancer/cancer-treatment-chemo.html](https://www.cancer.org/cancer/cancer-basics/history-of-cancer/cancer-treatment-chemo.html)
- “Choking agents injure an individual mainly in the respiratory tract, i.e. in the nose, throat, and particularly, the lungs. In extreme cases, membranes swell, the lungs become filled with liquid and death results from lack of oxygen; thus, these agents “choke” the unprotected individuals. Fatalities of this type are referred to as ‘dry-land drownings.’” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3148621/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3148621/)
Cryogenic & Industrial Gas Safety Courses

- “I never met anyone in astronomy that stated that they had been sent on an industry recognized training course for the safe handling and use of cryogenic liquids & industrial gas.” Steven Magee CEng MIET - Q
- “BOC Cryogenic Gas Safety Courses. All users of cryogenic gases should be fully aware of the associated risks and how they can be safely used. BOC offers workshops and online training options suitable for anyone using, handling, storing, or responsible for the safety of cryogenic gases...A half-day, instructor-led workshop at your own site. Delegates will be made aware of the hazards of cryogenic gases so they can identify the risks and adopt safe working practices.” [https://www.boconline.co.uk/en/services/safety-training/cryogenic-gas-workshop/cryogenic-gas-safety-courses.html](https://www.boconline.co.uk/en/services/safety-training/cryogenic-gas-workshop/cryogenic-gas-safety-courses.html)
- “Cryogenics Safety Solutions, Inc. LN2 Safety Course. Cryogenic Gas Safety Awareness Training workshop. The hazards of handling and storing cryogenic gases are well known – from nasty cases of frostbite, to the problems of leaks and spills. If you could safeguard your organization and employees from unnecessary harm in just three hours – wouldn’t you?” [http://cryogenicsafetytraining.com/training/](http://cryogenicsafetytraining.com/training/)
- “PGS Training Compressed & Cryogenic Gases Safety Open Workshops...This training ensures your organisation complies with obligations to train all staff exposed to risk. Attendance gives staff information to understand the specific hazards associated with compressed gases and cryogens such as cold, oxygen deficiency & enrichment and those encountered during decanting procedures, resulting in an assured workforce and a safer workplace.” [https://pgstraining.com/safety-training/compressed-cryogenic-gases-open-workshops/](https://pgstraining.com/safety-training/compressed-cryogenic-gases-open-workshops/)
- “Taylor & Taylor Consultants are a leading international supplier of compressed and cryogenic gas safety solutions and training services to end-users in a broad spectrum of different industries, processes and applications. We are acutely aware of the hazards and risks associated with gases, gas cylinders, supply systems, equipment and processes.” [http://www.taylorandtaylorconsultants.com/index.php/services/compressed-cryogenic-gas-safety-training.html](http://www.taylorandtaylorconsultants.com/index.php/services/compressed-cryogenic-gas-safety-training.html)
Professions That Breath Gas

- **Actors & Performers**
  - "Voices Fading in the Fog / Performers say chemicals in synthetic mists on stage are health risk...The citation concludes that opera employees suffered "adverse physical symptoms as a result of theatrical smoke and fog" including "coughing, sore throat, chest tightness and shortness of breath."” [https://www.sfgate.com/health/article/Voices-Fading-in-the-Fog-Performers-say-2969831.php](https://www.sfgate.com/health/article/Voices-Fading-in-the-Fog-Performers-say-2969831.php)
  - "Theatrical Haze Health Concerns and the Effect on Actors... I've often been sickened by the use of both water- and oil-based fog and want to see if there's a way to convince producers that its use is not in the best interest of either the cast or audience members.” [https://www.backstage.com/advice-for-actors/the-working-actor/theatrical-haze-health-concerns-and-the-effect-on-actors/](https://www.backstage.com/advice-for-actors/the-working-actor/theatrical-haze-health-concerns-and-the-effect-on-actors/)
  - "U2 tour: Berlin show cancelled due to Bono voice issues...She told BBC News that Bono "complained his voice had gone due to smoke from smoke machines". He said he would either cancel or take a short break, but after 30 minutes it was announced the concert was cancelled." [https://www.bbc.com/news/entertainment-arts-45386145](https://www.bbc.com/news/entertainment-arts-45386145)

- **Air Conditioning Workers**
  - "Side Effects of Breathing Freon or Other Refrigerants...Refrigerant poisoning can result from exposure, according to UMMC. Symptoms include throat swelling, difficulty breathing, severe throat pain, loss of vision, burning of the eyes, nose, lips and tongue, burns of the esophagus, vomiting blood, blood in the stool, severe abdominal pain, abnormal heart rhythm and circulatory collapse. Death is possible. Emergency medical care is required. Outcome after refrigerant poisoning depends on how severe the poisoning was, and how fast medical help began. Irreversible brain damage and severe lung damage can result.” [https://www.livestrong.com/article/174753-side-effects-of-breathing-freon-or-other-refrigerants/](https://www.livestrong.com/article/174753-side-effects-of-breathing-freon-or-other-refrigerants/)

- **Automobile Workers**
  - “5 Most Dangerous Automotive Chemicals in the Workshop...Almost all forms of solvents are toxic and this poses a great health risk to the workers in the automotive industry who use these solvents daily. Diesel fumes can also cause severe health challenges to mechanics; they can suffer from breathing problems like asthma, allergic reactions, and compromised immune systems. Brain damage has also been identified as one of the potential effects of these poisons.” [https://www.alsco.com.au/2017/06/dangerous-chemicals-automotive-workshop/](https://www.alsco.com.au/2017/06/dangerous-chemicals-automotive-workshop/)

- **Gas Workers**
  - “Threats from Fracking-Related Air Pollution...A growing body of evidence shows that people both near and far from oil and gas drilling are exposed to fracking-related air pollution that can cause at least five major types of health impacts, according to a new comprehensive analysis of scientific studies to-date by the Natural Resources Defense Council. The health impacts include respiratory problems, birth defects, blood disorders, cancer and nervous system impacts, raising serious concerns for workers and people living closest to wells, as well as entire regions with high volumes of oil and gas activity.” [https://www.nrdc.org/media/2014/141216](https://www.nrdc.org/media/2014/141216)

- **Medical Professionals**
“Environmental Hazards for the Nurse as a Worker...Exposure to waste anesthetic gases may occur in operating rooms, labor and delivery, and recovery rooms. Long-term exposure to these agents have been associated with an increased risk of renal (methoxyflurane) and hepatic (halothane) disorders and have also been correlated with an increased risk of spontaneous abortions and congenital abnormalities (nitrous oxide) in exposed workers.”

https://www.ncbi.nlm.nih.gov/books/NBK232400/

Firefighters

“After the Fire – Are You Protected From Deadly Gases?...Smoke contains many toxic gases, such as carbon monoxide (CO) and hydrogen cyanide (HCN), which are silent killers. These two compounds are known as the “Toxic Twins” because they attack the body in poisonous ways.”

http://www.indsci.com/the-monitor-blog/fire-gases/

Researchers

“Physical Hazards in the Laboratory... Commonly used cryogenic materials include the liquids nitrogen, argon, oxygen, and helium...Oxygen deficiency: If kept in an enclosed, poorly ventilated space (like a car with closed windows) the carbon dioxide evolved from dry ice can displace oxygen resulting in a suffocation hazard. Dry ice must only be kept in well ventilated areas.”


Restaurant Workers

“Dry ice – a useful form of carbon dioxide, but still dangerous...The woman was providing catering services and she had stored boxes and coolers of ice cream packed with dry ice in the back of her SUV. During her journey, the dry ice had started to turn to CO2 gas and she had failed to roll down her windows, meaning her car was not well ventilated. The CO2 displaced the oxygen in her car, causing her to pass out, and she was found in the middle of an intersection with her foot still on the gas pedal and the SUV in drive. Unconsciousness is just one of the physiological effects of CO2, as it can also cause drowsiness, reduced hearing, increased heart rate and blood pressure, headaches, tremors and dizziness, to name a few. Luckily the woman recovered from CO2 poisoning, however an increased concentration of the gas could have resulted in her death.”

https://www.analoxsensortechnology.com/blog/2016/03/10/dry-ice-co2/

“CO2 A Silent Killer...a restaurant employee was found unconscious at the top of a stairwell that leads to the basement storage area. A Firefighter and an Engineer went into the basement to see if the patient had tripped or slipped on something. After entering the basement both men became lightheaded and exited the basement. Upon exiting the basement, the Engineer fell and both members reported dizziness and a bitter taste in their mouths.”


Pilots, Air Cabin Crew & Frequent Fliers

“Former pilot says contaminated air on planes is 'like breathing car exhaust fumes'...Dr Susan Michaelis said air crew and frequent fliers are being let down by gaps in health and safety regulation which allow the regulators to “turn a blind eye” to the hazard of chronic exposure to low doses of poisonous chemicals in cabin air, as well as high-dose “fume events” which can leave pilots disoriented.”

http://www.heraldscotland.com/news/15540477.Former_pilot_says_contaminated_air_on_p lanes_is_like_breathing_car_exhaust_fumes/
○ “Sewer Gas...Symptoms of headache, nausea, dizziness, or drowsiness may indicate exposure to an odorless gas like methane or carbon monoxide, or to hydrogen sulfide, which smells of rotten eggs. Anyone experiencing severe symptoms should seek immediate medical care.” [https://www.dhs.wisconsin.gov/air/sewergas.htm](https://www.dhs.wisconsin.gov/air/sewergas.htm)

- Welders
  ○ “Are There Links Between Hazardous Welding Fumes and Brain Damage?...It is a well known fact that gases and fumes in welding smoke are toxic and can harm many different organs of the body. Multiple research studies show that welders have increased risk of many long-term diseases and chronic health problems, including cancer, and there definitely is evidence that brain damage is a danger.” [http://kemperamerica.com/welding-fumes-brain-damage/](http://kemperamerica.com/welding-fumes-brain-damage/)
  ○ “Welding Fume Exposure Health Effects – Acute and Chronic...There is a variety of components of welded materials and welding methods that may have chronic detrimental effects, including permanent disability, to welders. They include Lead (Pb), Cadmium (Cd), Beryllium (Be), Mercury (Hg), fluorides from fluxes, Iron (Fe), Nickel (Ni), Copper (Cu), Aluminum (Al), and of course Carbon Monoxide (CO) and Carbon Dioxide (CO2). Chronic effects of exposure to the variety of welding elements can take the form of many serious illnesses.” [https://www.atlenv.com/welding-fume-testing-and-hazard-assessment/](https://www.atlenv.com/welding-fume-testing-and-hazard-assessment/)
Multiple Chemical Sensitivity (MCS) From Breathing Abnormal Or Polluted Air

- “In 2019, it had emerged that I had a hypersensitivity to polluted indoor air that would cause daytime sleepiness, chronic fatigue and malaise. Thoroughly ventilating the indoor environment with fresh outdoor air daily would reduce the symptoms. The medical profession calls this Multiple Chemical Sensitivity (MCS).” Steven Magee CEng MIET - Q
- “Chemical Sensitivity Foundation” http://www.chemicalsensitivityfoundation.org/index.html
- “MULTIPLE CHEMICAL SENSITIVITY. People with multiple chemical sensitivity (MCS) are made sick by exposures to low levels of many common chemicals – such as perfume, pesticides, tobacco smoke, fresh paint, new carpets, air “fresheners,” new building materials, vehicle exhaust, solvents, industrial fumes, and many cleaning products. Many of these chemicals can make anyone sick at high levels, but chemically sensitive people can become extremely ill after exposures to even minute amounts of these substances. Reactions can occur after chemicals are inhaled, ingested, or absorbed through the skin. Chemically sensitive people also frequently react to foods, drugs, mold, pollen, and electromagnetic fields.” http://annmccampbell.com/multiple-chemical-sensitivity/
- “Multiple Chemical Sensitivity & Indoor Air Quality...Mutliple Chemical Sensitivity (MCS), once widely regarded with skepticism, is a growing health concern for many Americans. The October 2006 issue of National Geographic magazine features an in-depth article about the chemical pollution within our bodies and the increasing prevalence of MCS. Most of the problematic chemicals did not exist until after World War II, when petrochemicals (petroleum-based chemicals) were synthesized. Many pesticides, synthetic fragrances, cleaning products, and detergents are made from toxic petrochemicals. These chemicals can be found all around us, especially inside the tightly sealed walls of homes, offices, and automobiles.” https://www.achooallergy.com/learning/multiple-chemical-sensitivity-indoor-air-quality/
- “Why Air Quality Testing for VOCs Usually Isn't Helpful for People with MCS... testing to determine airborne chemical exposure levels is only useful when one's goal is to compare these values with health and safety guidelines that have been established based upon known health risk. These exposure guidelines do not take into account, however, the potential for various chemical compounds to trigger an individual hypersensitivity reaction and cannot be used to determine the acceptability of an environment for a sensitized person.” http://www.chemicalsensitivityfoundation.org/air-quality-testing.html
- “Diagnostic Markers of Multiple Chemical Sensitivity...Patients who present with complaints of MCS deserve a comprehensive objective evaluation. If this is performed, a high percentage will
be shown to have abnormal test results. This is true if the central and peripheral nervous systems as well as pulmonary and immune functions are tested. Also, anatomical changes are frequently found in the nasal passages on close inspection. By contrast, CBC and blood chemistry are usually within normal limits. So are findings on general physical examination.”

https://www.ncbi.nlm.nih.gov/books/NBK234795/

- “What Is Multiple Chemical Sensitivity (MCS)?...Symptoms can range from minor annoyances (headache, runny nose) to life-threatening reactions (seizures, anaphalaxis). They vary greatly for each patient regarding frequency, intensity, inhalation or dermal exposure. Symptoms are multi-system, have many overlaps with ME/CFS and FM, can be very debilitating and can include: Fatigue (chronic), feeling of weakness, hyperactivity, restlessness; nausea, vomiting, diarrhea, constipation, bloating; intestinal aches/pains; anxiety, irritability, depression; variable blurred vision; headaches, dizziness, insomnia, sleepiness; irregular, skipped, rapid, or slow heart beats, chest pain, high/low blood pressure; asthma; poor memory, comprehension, concentration or physical coordination, confusion; arthritic pain in joint/s, stiffness, muscle pain, muscular exercise intolerance; sinus problems, hay fever; acne, hives, rash, bruising easily, hair loss, flushing, hot flashes, excessive sweating; anaphylaxis, asthma, chronic cough, gagging, sore throat, hoarseness, voice loss; frequent urination, frequent ‘Urinary Tract Infections’; Aching testis/ovaries; Weight problems (under/overweight), water retention; and inflamed lymph glands, frequent unknown illness or infection.”

B12 Deficiencies From Breathing Abnormal Or Polluted Air

- “Impaired vitamin B12 metabolic status in healthcare workers...Previous studies demonstrated inactivation of vitamin B12 by nitrous oxide (N2O). The intraoperative exposure to N2O was shown to induce megaloblastic anaemia and myelopathy in subjects with subclinical vitamin B12 deficiency...Exposure to N2O in healthcare workers is associated with alterations of vitamin B12 metabolic status, the extent of which depends on the level of exposure.” [https://academic.oup.com/bja/article/99/6/812/247337]

- “Megaloblastic anemia (or megaloblastic anaemia) is an anemia (of macrocytic classification) that results from inhibition of DNA synthesis during red blood cell production. When DNA synthesis is impaired, the cell cycle cannot progress from the G2 growth stage to the mitosis (M) stage. This leads to continuing cell growth without division, which presents as macrocytosis. Megaloblastic anemia has a rather slow onset, especially when compared to that of other anemias. The defect in red cell DNA synthesis is most often due to hypovitaminosis, specifically a deficiency of vitamin B12 and/or folic acid.” [https://en.wikipedia.org/wiki/Megaloblastic_anemia]

- “Myelopathy describes any neurologic deficit related to the spinal cord. When due to trauma, it is known as (acute) spinal cord injury. When inflammatory, it is known as myelitis. Disease that is vascular in nature is known as vascular myelopathy. The most common form of myelopathy in human, cervical spondylotic myelopathy (CSM), is caused by arthritic changes (spondylosis) of the cervical spine, which result in narrowing of the spinal canal (spinal stenosis) ultimately causing compression of the spinal cord. In Asian populations, spinal cord compression often occurs due to a different, inflammatory process affecting the posterior longitudinal ligament.” [https://en.wikipedia.org/wiki/Myelopathy]

- “B12 the Antidote...Have you been exposed to carbon monoxide, hydrogen sulphide, cyanide, natural gas, chemical toxins, heavy metals or moulds? If so your health may improve enormously with correct vitamin B12 treatment, in the form of hydroxocobalamin injections. Hydroxocobalamin is a powerful toxin scavenger and could be your route to health.” [http://www.b12deficiency.info/b12-the-antidote/]

- “Vitamin B12 Deficiency due to Chlorofluorocarbon: A Case Report...In occupational medicine, vitamin B12 deficiency has been reported with exposure to nitrous oxide in health care workers. However, not much is known about exposure to Freons in other industries and vitamin B12 deficiency. We are reporting a case of vitamin B12 deficiency in the setting of exposure to chlorofluorocarbon (CFC) gases.” [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3065218/]

- “The air at very high altitude is different from the air at sea level that the sea level adapted human is accustomed to breathing.” Steven Magee CEng MIET - Q

- “Abnormally irradiated air may eventually be proven to present long term toxicity to the sea level adapted human.” Steven Magee CEng MIET - Q

- “We know that unnaturally irradiating the human makes it sick. Unnaturally irradiating the air and water seems to make them sick also.” Steven Magee CEng MIET - Q
B12 Deficiencies

- “Vitamin B12 Deficiency: Serious Consequences...there are numerous causes of deficiency. These include malabsorption syndromes, autoimmune disease, diet, drugs, chemotherapy, radiation, eating disorders, Helicobacter pylori, gastrointestinal surgeries, nitrous oxide, hepatic disease, and genetic defects.”

- “Vitamin B12 or folate deficiency anaemia can cause a wide range of symptoms. These usually develop gradually but can worsen if the condition goes untreated. Anaemia is where you have fewer red blood cells than normal or you have an abnormally low amount of a substance called haemoglobin in each red blood cell. General symptoms of anaemia may include: extreme tiredness (fatigue), lack of energy (lethargy), breathlessness, feeling faint, headaches, pale skin, noticeable heartbeats (palpitations), hearing sounds coming from inside the body, rather than from an outside source (tinnitus), loss of appetite and weight loss”
  https://www.nhs.uk/conditions/vitamin-b12-or-folate-deficiency-anaemia/symptoms/

- “B12 is involved in the metabolism of every cell in the human body. Deficiency of B12 is akin to going crazy, as it is linked to psychosis...Some researchers have even pinpointed obsessive-compulsive disorder as an early manifestation of B12 deficiency. People with OCD have dysregulation in the serotonergic system and in the efficacy of SRIs. This lends credence to the earlier point that adequate B12 levels are vital to normal physiologic function and mood, as well as sleeping patterns.”
  https://blog.paleohacks.com/vitamin-b12/

- “Vitamin B12 deficiency harms memory and nerves...Severe vitamin B12 deficiency has clear signs of fatigue and anemia, making it relatively easy to diagnose. However, symptoms of marginal deficiency are less obvious and might go unnoticed for a long time. Since B12 deficiency is known to damage the nervous system and cause permanent impairment of short-term memory if not treated in a timely fashion, medical researchers are seeking better methods to identify marginal (subclinical) B12 status before serious damage takes place.”
  http://www.nutritionate.hawaii.edu/HO/2012/498.htm

- “Vitamin B12 deficiency can be sneaky, harmful...a severe vitamin B12 deficiency can lead to deep depression, paranoia and delusions, memory loss, incontinence, loss of taste and smell, and more.”
  https://www.health.harvard.edu/blog/vitamin-b12-deficiency-can-be-sneaky-harmful-201301105780

- “B12-deficient individuals can develop confusion and depression, but the specific problems can vary from one person to another. Some of the symptoms are similar to those of Alzheimer's disease. Since older people are at greater risk of developing both B12 deficiency and Alzheimer's disease, it is important to be careful to distinguish between the two conditions. The symptoms of B12 deficiency can be reversible if treated within six to 12 months. However, if left untreated, B12 deficiency can cause irreversible damage.”

- “Reversible dementia, psychotic symptoms and epilepsy in a patient with vitamin B12 deficiency...Vitamin B12 deficiency is a common condition, typically associated with megaloblastic anaemia, glossitis and neuropsychiatric symptoms. We report the case of a patient presenting with progressive cognitive and functional deterioration, psychosis and seizures, later found to be secondary to pernicious anaemia. Importantly, the diagnosis of pernicious anaemia was only established 5 years after symptom onset and was overlooked even when the patient
was under medical care, in part due to the lack of classic neurological and haematological signs associated with the condition. The patient had a remarkable neuropsychiatric recovery after vitamin replacement and psychopharmacological management. We discuss similar presentations of vitamin B12 deficiency found in the literature, symptom reversibility and the importance of its early recognition and treatment.”

- “Woman Who Had Dementia For 5 Years Turned Out To Have A Common And Reversible Condition...They urge clinicians to consider vitamin B12 deficiencies when diagnosing patients with psychosis and seizures, especially when seen with cognitive decline. "Our case suggests that dementia associated with vitamin B12 deficiency can still be reversed with vitamin replacement therapy, even after a prolonged deficit status."”

- “Are Your Health Problems Actually Vitamin B 12 Deficiency Symptoms?...Classic Vitamin B12 Deficiency Symptoms...Fatigue...Macrocytic Anemia...Mental Changes...Chronic Pain...Infertility...Blood Disorders...Skin and Hair Problems”

- “How I treat cobalamin (vitamin B12) deficiency...The adult patient typically comes to medical attention because of symptoms related to anemia (such as fatigue), neurologic dysfunction (usually myelopathic or neuropathic, but occasionally also cerebral or autonomic), and, rarely today, glossitis. Macrocytic anemia is the most common clinical finding, with macrocytosis preceding the anemia by months, but 13% to 27% of patients with PA have little or no anemia, and unrelated microcytosis masks the macrocytosis in 7% of anemic cases. A roughly inverse relationship often exists between hematologic and neurologic deficits. Some medical encounters occur solely because of a known predisposing gastrointestinal disease or, increasingly, an abnormal biochemical finding.”

- “B12 deficiency leads to a long laundry list of symptoms that is almost all inclusive of any disease. In other words, if you have any chronic symptoms whether or not you have been diagnosed with a disease, you could be B12 deficient. B12 deficiency syndrome may be the most misdiagnosed illness in the United States because it’s symptoms mimic so many different illnesses and diseases.”

- “What Is Pernicious Anemia?...Without enough vitamin B12, your red blood cells don't divide normally and are too large. They may have trouble getting out of the bone marrow—a sponge-like tissue inside the bones where blood cells are made. Without enough red blood cells to carry oxygen to your body, you may feel tired and weak. Severe or long-lasting pernicious anemia can damage the heart, brain, and other organs in the body. Pernicious anemia also can cause other problems, such as nerve damage, neurological problems (such as memory loss), and digestive tract problems. People who have pernicious anemia also may be at higher risk for weakened bone strength and stomach cancer...The term “pernicious” means “deadly.” The condition is called pernicious anemia because it often was fatal in the past, before vitamin B12 treatments were available.”

- “If you think you may have pernicious anemia, see your physician for laboratory complete blood panel analysis. According to the National Library of Medicine, symptoms include: both diarrhea and constipation, fatigue, loss of appetite, pale skin, problems concentrating, shortness of breath especially during exercise, a swollen or particularly red tongue, bleeding gums, confusion, depression, poor balance, and numbness and/or tingling in hands and feet.”
- "Vitamin B12 – The Reference Range Level is Set too Low...B12 deficiency symptoms can be seen even when B12 level in blood is within the reference range, as 200 – 900 pg/mL in the United States;2 and 135-650 pmol/L in Australia.3 In clinical practice, signs and symptoms of B12 deficiency start when plasma B12 levels are ‘normal’, and long historical studies showed that neurological symptoms of deficiency occur in patients without sign of anaemia. As a matter of fact, Japan raised its B12 reference range to 500 – 1300 Pmol in 1980s.”
- "Routine evaluation of serum vitamin B12 after radiotherapy is recommended so that appropriate medication can be given, if possible before neurological symptoms appear.”
- "Vitamin B12: vitally important after radiotherapy. If you have radiotherapy on your abdomen, it is quite likely that you will get malabsorption. This means that you don't take up the vitamins and minerals which your body needs, however well you are eating.”
  https://www.jostrust.org.uk/node/11102
- “Adaptive response to ionizing radiation and the role of vitamin B12 in amelioration radiation protection standards...a modulatory effect was noted in Vit. B12 pre-treated irradiated groups, which suggest that Vit. B12 alone is likely to be one of the most important micronutrients which exert a vital protective role against gamma irradiation.”
  www.sciencedirect.com/science/article/pii/S1018364710000984
- "Pervasive B12 Deficiency Affects Millions – How About YOU?...Unfortunately, B12 deficiency is often unrecognized because the clinical manifestations can be very subtle. In fact, one of its manifestations -- mild memory loss -- can mimic the early stages of dementia.”
- “Seven Stages of Vitamin B12 Deficiency”
  http://b12patch.com/blog/seven-stages-of-vitamin-b12-deficiency/
- “Anemia and B12 Deficiency- Historically Fatal, Still Formidable...many of the symptoms of pernicious anemia are disabling, and often confused with other conditions like clinical depression, thyroid disorder, and diabetes.”
- “B12 deficiency Overview...Vitamin B12 deficiency can cause devastating neurologic disease and severe hematologic disorders....Dementia, peripheral neuropathy, depression, and other neuropsychiatric signs and symptoms may improve with vitamin B12 treatment, but treatment generally does not completely resolve the process.”
  https://online.epocrates.com/diseases/82251/Vitamin-B12-deficiency/Prognosis
- “One study entitled Vitamin B-12: Placebo or Neglected Therapeutic Tool had people who felt fatigued, but had NORMAL vitamin B12 blood levels and kept giving higher doses of supplements until they had a 'maximum feeling of well being'. And the AVERAGE dose that it took to do this was 9000 micrograms per day, that is 9 milligrams. And that was the AVERAGE dose, this means that some people needed even higher doses than this to feel well. And these were people without a diagnosed vitamin B12 deficiency! So, if you truly have Vitamin B12 deficiency, then you may need even more than these study participants!”
  https://www.easy-immune-health.com/vitamin-b12-deficiency-treatment.html
- “Vitamin B12 deficiency was reported to be the cause of seizures for adults and for infants.”
“I was diagnosed with seizures at age of forty five.” Steven Magee CEng MIET - Q

“Absence seizures are one of several kinds of seizures. These seizures are sometimes referred to as petit mal seizures (from the French for "little illness", a term dating from the late 18th century).[1] Absence seizures are characterized by a brief loss and return of consciousness, generally not followed by a period of lethargy (i.e. without a notable postictal state).”

https://en.wikipedia.org/wiki/Absence_seizure

“It was my experience with the medical profession that had years of experience treating me and knew that I was displaying symptoms that matched B12 deficiency, that they were unable to make that diagnosis.” Steven Magee CEng MIET - Q

“I discovered my B12 deficiency accidentally while experimenting with energy drinks, because I was fed up with being fatigued, sleepy and showing symptoms consistent with Dementia all the time. I bought a variety of energy drinks and the only one that I exhibited a positive response to was the one with a huge dose of vitamin B12.” Steven Magee CEng MIET - Q

“Experimentation with vitamin B12 showed that I needed to take 25,000 mcg daily, which was over a million times the recommended daily dose.”Steven Magee CEng MIET - Q

“A mental health professional stated this to me 'You are not crazy, but you may be losing your mind'. After many consultations, he unfortunately failed to diagnose the B12 deficiency that I had that is known to cause these adverse mental health symptoms.” Steven Magee CEng MIET - Q

“I had noticed the onset of sickness that was consistent with sleep disorders and B12 deficiency during working extreme nights shifts at very high altitude atop Mauna Kea in Hawaii.” Steven Magee CEng MIET - Q

“It was unfortunate that every time my vitamin B12 levels were tested that they showed values that were in the USA normal range and prevented the B12 deficiency from being diagnosed and treated.” Steven Magee CEng MIET - Q
Leukemia Hazards

- “Leukemia risk factors...Exposure to high levels of radiation: Exposure to high-energy radiation (e.g., atomic bomb explosions) and intense exposure to low-energy radiation from electromagnetic fields (e.g., power lines). Chemical exposure: Long-term exposure to certain pesticides or industrial chemicals like benzene is considered to be a risk for leukemia.”
https://www.cancercenter.com/leukemia/risk-factors/

- “Leukemia symptoms vary, depending on the type of leukemia. Common leukemia signs and symptoms include: Fever or chills; Persistent fatigue, weakness; Frequent or severe infections; Losing weight without trying; Swollen lymph nodes, enlarged liver or spleen; Easy bleeding or bruising; Recurrent nosebleeds; Tiny red spots in your skin (petechiae); Excessive sweating, especially at night; Bone pain or tenderness”
https://www.mayoclinic.org/diseases-conditions/leukemia/symptoms-causes/syc-20374373

- “Leukemia begins in a cell in the bone marrow. The cell undergoes a change and becomes a type of leukemia cell. Once the marrow cell undergoes a leukemic change, the leukemia cells may grow and survive better than normal cells. Over time, the leukemia cells crowd out or suppress the development of normal cells. The rate at which leukemia progresses and how the cells replace the normal blood and marrow cells are different with each type of leukemia.”
https://www.lls.org/leukemia

- “Radiation...Large doses of Sr-90 emission from nuclear reactors, nicknamed bone seeker increases the risk of bone cancer and leukemia in animals, and is presumed to do so in people.”
https://en.wikipedia.org/wiki/Leukemia
Radiation Researcher Sickness

- “Marie Skłodowska Curie...was a Polish and naturalized-French physicist and chemist who conducted pioneering research on radioactivity. She was the first woman to win a Nobel Prize, the first person and only woman to win twice, the only person to win a Nobel Prize in two different sciences, and was part of the Curie family legacy of five Nobel Prizes... she died at the Sancellemoz sanatorium in Passy, Haute-Savoie, from aplastic anemia believed to have been contracted from her long-term exposure to radiation. The damaging effects of ionising radiation were not known at the time of her work, which had been carried out without the safety measures later developed. She had carried test tubes containing radioactive isotopes in her pocket, and she stored them in her desk drawer, remarking on the faint light that the substances gave off in the dark. Curie was also exposed to X-rays from unshielded equipment while serving as a radiologist in field hospitals during the war. Although her many decades of exposure to radiation caused chronic illnesses (including near-blindness due to cataracts) and ultimately her death, she never really acknowledged the health risks of radiation exposure.”

- “Aplastic anemia can be caused by exposure to certain chemicals, drugs, radiation, infection, immune disease; in about half the cases, yet a definitive cause is unknown. It is not a familial line hereditary condition, nor is it contagious. It can be acquired due to exposure to other conditions but if a person develops the condition, their offspring would not develop it by virtue of their gene connection. Aplastic anemia is also sometimes associated with exposure to toxins such as benzene, or with the use of certain drugs, including chloramphenicol, carbamazepine, felbamate, phenytoin, quinine, and phenylbutazone. Many drugs are associated with aplasia mainly according to case reports, but at a very low probability. As an example, chloramphenicol treatment is followed by aplasia in less than one in 40,000 treatment courses, and carbamazepine aplasia is even rarer. Exposure to ionizing radiation from radioactive materials or radiation-producing devices is also associated with the development of aplastic anemia. Marie Curie, famous for her pioneering work in the field of radioactivity, died of aplastic anemia after working unprotected with radioactive materials for a long period of time; the damaging effects of ionizing radiation were not then known.”

- “Pierre Curie...was a French physicist, a pioneer in crystallography, magnetism, piezoelectricity and radioactivity. In 1903 he received the Nobel Prize in Physics with his wife, Marie Skłodowska-Curie, and Henri Becquerel...Pierre Curie died in a street accident in Paris on 19 April 1906. Crossing the busy Rue Dauphine in the rain at the Quai de Conti, he slipped and fell under a heavy horse-drawn cart. He died instantly when one of the wheels ran over his head, fracturing his skull. Statements made by his father and lab assistant imply that Pierre Curie's characteristic absent-minded preoccupation with his thoughts contributed to his death. Both the Curies experienced radium burns, both accidentally and voluntarily, and were exposed to extensive doses of radiation while conducting their research. They experienced radiation sickness and Marie Curie died of leukaemia in 1934. Even now, all their papers from the 1890's, even her cookbooks, are too dangerous to touch. Their laboratory books are kept in special lead boxes and people who want to see them have to wear protective clothing. Had Pierre Curie not been killed as he was, it is likely that he would have eventually died of the effects of radiation, as did his wife, their daughter, Irène, and her husband, Frédéric Joliot.”
“Irène Joliot-Curie...was a French scientist, the daughter of Marie Curie and Pierre Curie and
the wife of Frédéric Joliot-Curie. Jointly with her husband, Joliot-Curie was awarded the Nobel
Prize in Chemistry in 1935 for their discovery of artificial radioactivity...In 1956, after a final
convalescent period in the French Alps, Joliot-Curie was admitted to the Curie hospital in Paris,
where she died on 17 March at the age of 58 from leukaemia.”

“Leukemia, also spelled leukaemia, is a group of cancers that usually begin in the bone marrow
and result in high numbers of abnormal white blood cells. These white blood cells are not fully
developed and are called blasts or leukemia cells. Symptoms may include bleeding and bruising
problems, feeling tired, fever, and an increased risk of infections. These symptoms occur due to
a lack of normal blood cells. Diagnosis is typically made by blood tests or bone marrow biopsy.
The exact cause of leukemia is unknown. Different kinds of leukemia are believed to have
different causes. Both inherited and environmental (non-inherited) factors are believed to be
involved. Risk factors include smoking, ionizing radiation, some chemicals (such as benzene),
prior chemotherapy, and Down syndrome. People with a family history of leukemia are also at
higher risk. There are four main types of leukemia — acute lymphoblastic leukemia (ALL),
acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL) and chronic myeloid
leukemia (CML) — as well as a number of less common types.”

“Frederic Joliot Curie was a French physicist and Nobel laureate who along with his wife Irene
Joliot-Curie is credited with the discovery of artificial radioactivity...He died on August 14,
1958, at the age of 58, in Paris, France”

“Henri Becquerel was a French physicist best known for his work on radioactivity, for which he
won a Nobel Prize in 1903...His work with radioactive materials, leaving him burned and
scarred, may have contributed to his death.”

“Enrico Fermi was an Italian-American physicist and the creator of the world's first nuclear
reactor, the Chicago Pile-1. He has been called the "architect of the nuclear age" and the
"architect of the atomic bomb". He was one of the very few physicists in history to excel both
theoretically and experimentally. Fermi held several patents related to the use of nuclear power,
and was awarded the 1938 Nobel Prize in Physics for his work on induced radioactivity by
neutron bombardment and the discovery of transuranic elements. He made significant
contributions to the development of quantum theory, nuclear and particle physics, and statistical
mechanics...Fermi underwent an exploratory operation in Billings Memorial Hospital on 9
October 1954, after which he returned home. Several weeks later, Fermi died at age 53 of
stomach cancer in his home in Chicago, and was interred at Oak Woods Cemetery”

“Stomach cancer, also known as gastric cancer, is cancer developing from the lining of the
stomach.[9] Early symptoms may include heartburn, upper abdominal pain, nausea and loss of
appetite.[1] Later signs and symptoms may include weight loss, yellowing of the skin and
whites of the eyes, vomiting, difficulty swallowing, and blood in the stool among others.[1] The
cancer may spread from the stomach to other parts of the body, particularly the liver, lungs,
bones, lining of the abdomen and lymph nodes.[10] The most common cause is infection by the
bacterium Helicobacter pylori, which accounts for more than 60% of cases.[11][2][3] Certain
types of H. pylori have greater risks than others.[2] Smoking, dietary factors such as pickled vegetables, and obesity are other risk factors.[2][4] About 10% of cases run in families and between 1% and 3% of cases are due to genetic syndromes inherited from a person's parents such as hereditary diffuse gastric cancer.” [https://en.wikipedia.org/wiki/Stomach_cancer

• “Pernicious Anemia and Vitamin B-12 Deficiency...People with pernicious anemia have a slightly increased risk of stomach cancer when compared to the normal population. The incidence of stomach cancer in people with pernicious anemia is 2-3 times higher than in the general population of the same age.” [https://www.medicinenet.com/pernicious_anemia/article.htm#pernicious_anemia_definition_and_facts

• “Maria Goeppert Mayer (June 28, 1906 – February 20, 1972) was a German-born American theoretical physicist, and Nobel laureate in Physics for proposing the nuclear shell model of the atomic nucleus. She was the second woman to win a Nobel Prize in physics, after Marie Curie....In 1960, Goeppert Mayer was appointed full professor of physics at the University of California, San Diego. Although she suffered from a stroke shortly after arriving there, she continued to teach and conduct research for a number of years.[43][44] She was elected a Fellow of the American Academy of Arts and Sciences in 1965.[45] Goeppert Mayer died in San Diego, California, on February 20, 1972, after a heart attack that had struck her the previous year left her comatose. She was buried at El Camino Memorial Park in San Diego. [36]” [https://en.m.wikipedia.org/wiki/Maria_Goeppert-Mayer

• “A stroke is a medical condition in which poor blood flow to the brain results in cell death.[5] There are two main types of stroke: ischemic, due to lack of blood flow, and hemorrhagic, due to bleeding.[5] They result in part of the brain not functioning properly.[5] Signs and symptoms of a stroke may include an inability to move or feel on one side of the body, problems understanding or speaking, dizziness, or loss of vision to one side.[2][3] Signs and symptoms often appear soon after the stroke has occurred.[3] If symptoms last less than one or two hours it is known as a transient ischemic attack (TIA) or mini-stroke.[3] A hemorrhagic stroke may also be associated with a severe headache.[3] The symptoms of a stroke can be permanent.[5] Long-term complications may include pneumonia or loss of bladder control.[3]” [https://en.wikipedia.org/wiki/Stroke


• “Sir Humphry Davy, 1st Baronet PRS MRIA FRS FGS FRS (17 December 1778 – 29 May 1829) was a Cornish chemist and inventor,[1] who is best remembered today for isolating, using electricity, a series of elements for the first time: potassium and sodium in 1807 and calcium, strontium, barium, magnesium and boron the following year, as well as discovering the elemental nature of chlorine and iodine. He also studied the forces involved in these separations, inventing the new field of electrochemistry. In 1799 Davy experimented with nitrous oxide and became astonished that it made him laugh, so he nicknamed it "laughing gas", and wrote about its potential anaesthetic properties in relieving pain during surgery.[2]...Of a sanguine, somewhat irritable temperament...Davy spent the winter in Rome, hunting in the Campagna on his fiftieth birthday. But on 20 February 1829 he had another stroke. After spending many months attempting to recuperate, Davy died in a hotel room in Geneva, Switzerland, on 29 May 1829.” [https://en.m.wikipedia.org/wiki/Humphry_Davy

• “James Clerk Maxwell FRS FRSE (13 June 1831 – 5 November 1879) was a Scottish[2][3] scientist in the field of mathematical physics.[4] His most notable achievement was to formulate
the classical theory of electromagnetic radiation, bringing together for the first time electricity, magnetism, and light as different manifestations of the same phenomenon. Maxwell died in Cambridge of abdominal cancer on 5 November 1879 at the age of 48."

- "Stomach cancer, also known as gastric cancer, is a cancer that develops from the lining of the stomach. Early symptoms may include heartburn, upper abdominal pain, nausea and loss of appetite. Later signs and symptoms may include weight loss, yellowing of the skin and whites of the eyes, vomiting, difficulty swallowing and blood in the stool among others. The cancer may spread from the stomach to other parts of the body, particularly the liver, lungs, bones, lining of the abdomen and lymph nodes...risks include...pernicious anemia"

- "Michael Faraday...English physicist and chemist whose many experiments contributed greatly to the understanding of electromagnetism...in 1839 his health broke down. For the next six years he did little creative science...About 1855, Faraday’s mind began to fail...He died in 1867."

- "It is not disputed that electromagnetic fields above certain levels can trigger biological effects. Experiments with healthy volunteers indicate that short-term exposure at the levels present in the environment or in the home do not cause any apparent detrimental effects. Exposures to higher levels that might be harmful are restricted by national and international guidelines. The current debate is centred on whether long-term low level exposure can evoke biological responses and influence people's well being."

- Heinrich Rudolf Hertz was a German physicist who first conclusively proved the existence of the electromagnetic waves theorized by James Clerk Maxwell's electromagnetic theory of light. The unit of frequency — cycle per second — was named the "hertz" in his honor...In 1892, Hertz was diagnosed with an infection (after a bout of severe migraines) and underwent operations to treat the illness. He died of granulomatosis with polyangiitis at the age of 36 in Bonn, Germany in 1894, and was buried in the Ohlsdorf Cemetery in Hamburg."

- "Granulomatosis with polyangiitis (GPA), formerly known as Wegener's granulomatosis (WG), is a systemic disorder that involves both granulomatosis and polyangiitis. It is a form of vasculitis (inflammation of blood vessels) that affects small- and medium-size vessels in many organs. Damage to the lungs and kidneys can be fatal. Treatment requires long-term immunosuppression."

- "Nikola Tesla...was a Serbian-American inventor, electrical engineer, mechanical engineer, physicist, and futurist who is best known for his contributions to the design of the modern alternating current (AC) electricity supply system...Tesla began investigating what he referred to as radiant energy of "invisible" kinds after he had noticed damaged film in his laboratory in previous experiments (later identified as "Roentgen rays" or "X-Rays")...Tesla claimed never to sleep more than two hours per night. However, he did admit to "dozing" from time to time "to recharge his batteries."...On 7 January 1943, at the age of 86, Tesla died alone in Room 3327 of the New Yorker Hotel. His body was later found by maid Alice Monaghan after she had entered Tesla's room, ignoring the "do not disturb" sign that Tesla had placed on his door two days earlier. Assistant medical examiner H.W. Wembley examined the body and ruled that the cause of death had been coronary thrombosis."

- "Coronary thrombosis is the formation of a blood clot inside a blood vessel of the heart. This
blood clot restricts blood flow within the heart. It is associated with narrowing of blood vessels subsequent to clotting. The condition is considered as a type of ischaemic heart disease, also known as a heart attack or myocardial infarction... The main causes of coronary thrombosis are stress, smoking, high blood pressure, and lack of exercise. Symptoms are sharp pains around the chest area, breathing difficulties, dizziness, and fainting. This is treated by taking Aspirin, Nitrates, or Beta Blockers.”

- “A meta-analysis of eight randomized trials found a 62% increase in cardiac deaths among women who were treated with radiation therapy [10]. Even at lower radiation doses, there appears to be an excess risk of cardiovascular disease as shown in the Japanese atomic bomb survivors [11]...in patients treated as lately as between 1979 and 1986 the risk congestive heart failure and valvular dysfunction remained increased [12]. Radiation damage to the heart can involve the pericardium, myocardium, valves, and coronary vessels with pericardium being most frequently involved [13, 14]. Radiation damages the vascular endothelium, and hence radiation-induced vascular injury occurs in the field of radiation exposure. Damage to the capillary vessels manifests as telangiectasia, whereas thrombotic, inflammatory, and fibrogenic complications in larger vessels can result in peripheral, coronary and carotid artery disease.”

- “Nikola Tesla has become something of an Internet hero. According to legend, he was a mad genius who almost never got the credit he deserved in the money-hungry world of science. It’s easy to argue that Tesla didn’t make it further because of his eccentricities: He hated everything, suffered from severe obsessive-compulsive disorder, and might have been autistic.”

- “Guglielmo Marconi, 1st Marquis of Marconi (/mɑːˈrkoʊni/;[1] Italian: [ɡuˈʎɛlmo marˈkoːni]; 25 April 1874 – 20 July 1937) was an Italian[2][3][4][5] inventor and electrical engineer known for his pioneering work on long-distance radio transmission[6] and for his development of Marconi's law and a radio telegraph system. He is credited as the inventor of radio,[7] and he shared the 1909 Nobel Prize in Physics with Karl Ferdinand Braun "in recognition of their contributions to the development of wireless telegraphy"...Marconi died in Rome on 20 July 1937 at age 63, following a series of heart attacks.”

- “'MythBusters' Host Grant Imahara Experienced Painful Headaches Days Before Fatal Aneurysm...the accomplished electrical engineer, roboticist and beloved Discovery host's sudden death, at just 49 years old, was a severe shock to his friends and longtime coworkers.”

- “MEET GRANT IMAHARA...Before becoming a Mythbuster, Grant worked in movie special effects as an animatronics engineer and modelmaker for George Lucas' Industrial Light & Magic in Marin County, California. He specialized in electronics and radio control at the ILM Model Shop”

- “21 Negative Health Symptoms from RF Radiation...RF radiation is basically microwave radiation. You know the radiation we use to cook food? We surround our kids with this radiation and they have developing minds and bodies which are affected more dramatically even than adults. For one thing they have thinner skulls. Yet we let our kids use cell phones, tablets and laptops. At the same time their minds and bodies are bombarded with radiation from smart meters, cordless phone stations and 5G WiFi routers which exceed by 60 times the already massively inflated US safety limits for this radiation exposure. Very scary.”
“Brain disease, heart disease, gastrointestinal disease and blood disorders were common in the radiation pioneers.” Steven Magee CEng MIET - Q
Fall Hazards

- “I ventured up onto the domes of the world’s largest telescopes a few times. The view was impressive! The curvature of the domes means that you can only walk around on about twenty feet of the domes before developing a fear of sliding off them on the rapidly sloping surface. What amazes me today was that I was not required to wear a safety harness during the fun activity while breathing very high altitude air that was 40% deficient of oxygen that was known to make people faint. A strenuous climb up ladders was required to get to the top of the domes and a fall from that height would likely be fatal.” Steven Magee CEng MIET - Q

- “Fall protection, for activities not in the construction industry, is addressed in specific standards for the general industry, shipyard employment, marine terminals and longshoring industry. This section highlights OSHA standards, Federal Register notices (rules and proposed rules), the Regulatory Agenda (a list of actions being taken with regard to OSHA standards), preambles to final rules (background to final rules), directives (instruction to OSHA staff), letters of interpretation, example cases, and national consensus standards related to fall protection.”

Extreme Night Shift Hazards

- “Can High Altitude Influence Cytokines and Sleep?..around 60% of persons subjected to altitudes of 3500 m or higher experience various sleep complaints. Recurring wakefulness is the most common characteristic due to the decreased O2 saturation, which leads to sleep fragmentation [45, 64, 65]. In addition, hypoxia can cause poor sleep quality due to slight reductions in delta sleep, relative reductions in REM sleep, and agitation during the night [63]; however, overall total sleep time (TST) is not reduced. Therefore, the reduced subjective sleep quality is due to a higher arousal frequency. Despite previous studies suggesting that the impairment of sleep persists even after a season of acclimatization [64, 65], partial recovery of the damage during sleep can occur after spending some days at high altitude [26]. This finding has been shown in animal studies in which several days were spent in hypoxic conditions but not after a sudden ascent.” [https://www.hindawi.com/journals/mi/2013/279365/]

- "The Mauna Kea night shift was an 18 hour night in wintertime at the 13,796 feet summit (before sunset to after sunrise) with insufficient time for adequate sleep before the next night shift. Night shift was between 5 and 8 nights long and we slept at 9,200 feet. We sat at a desk staring at four large computer monitors and a large cathode ray tube television. I would also use my Wi-Fi laptop computer. I would have extreme fatigue by the end of every night shift and have chapped lips which I now associate with exposure to the artificial light from the computer screens. A good day of sleep between shifts was rare and starting the next shift fatigued was normal." Steven Magee CEng MIET - Q

- "Both shift work and long work hours have been associated with health and safety risks." [http://www.cdc.gov/niosh/topics/workschedules/default.html]

- "Shift work is classified as Class 2A carcinogen by the WHO" [http://iohsad.org/12/10/women/shift-work-classified-class-2a-carcinogen-who]

- "A long-running study found that women who work overnight have as much as a 60 percent greater risk of developing type 2 diabetes due to irregular sleep patterns and poor dieting." [http://www.theatlantic.com/health/archive/2012/01/the-health-hazards-of-shift-work/251499/]

- “Overall, long-term night shift work among women increased the risk of cancer by 19 percent. When analyzing specific cancers, the researchers found that this population had an increased risk of skin (41 percent), breast (32 percent), and gastrointestinal cancer (18 percent) compared with women who did not perform long-term night shift work. After stratifying the participants by location, Ma found that an increased risk of breast cancer was only found among female night shift workers in North America and Europe.” [https://www.sciencedaily.com/releases/2018/01/180108090118.htm]


- “The graveyard shift, it turns out, is aptly named,” it says. “Those who regularly endure it are also at higher risk for depression, obesity, diabetes, and cancer. In fact, the correlation is so strong that in 2010, the World Health Organization went so far as to classify late-night work as a probable carcinogen.” [http://time.com/money/4942543/time-wake-up-productive-sleep/]

- “Make efforts, whenever feasible, to ensure that unavoidable extended work shifts and shift changes allow affected employees time for adequate rest and recovery. Extended shifts should
not be maintained for more than a few days, especially if they require heavy physical or mental exertion.” [https://www.osha.gov/OshDoc/data_Hurricane_Facts/faq_longhours.html]

- “By planning for adequate rest after every night shift, you can avoid some serious complications of chronic sleep deprivation, such as high blood pressure, cardiac disease, and depression.” [https://cna.plus/surviving-night-shift-9-tips/]

- “The risks of night work...Millions of American workers fight against their circadian clocks every day, putting them — and others in their paths — in danger. Psychologists are looking for solutions.” [http://www.apa.org/monitor/2011/01/night-work.aspx]

- “Doctors have warned for years that Americans are not getting enough sleep, with health consequences ranging from drowsy driving and irritability to an increased risk of dementia, heart disease and early death.” [http://time.com/4970767/rem-sleep-dreams-health/]

- “There is now abundant evidence that poor sleep can have devastating consequences for physical, mental and psychological health.” [http://www.bbc.com/future/story/20171031-why-we-still-dont-understand-sleep-and-why-it-matters]

- “There's No Substitute for a Good Night's Sleep, UA Expert Says...lack of sleep affected emotional processing, judgment and decision making.” [https://uaatwork.arizona.edu/lqp/theres-no-substitute-good-nights-sleep-ua-expert-says]

- “2018 Goals: Get more sleep. Sleep deprivation is toxic to your health...It turns out you can only live about 11 days without sleep. You can give it a try if you don’t believe me, but, just like the other essentials, after day 11 you will probably die.” [https://www.usatoday.com/story/money/columnist/2017/12/22/heres-why-sleep-deprivation-toxic-and-eventually-kill-you/967151001/]

- “the Centers for Disease Control and Prevention (in the US) has looked at this and has actually proclaimed insufficient sleep a public health epidemic, so there’s increasing awareness of lack of sleep being a public health problem.” [http://www.bbc.com/capital/story/20171208-what-working-through-the-dead-of-night-does-to-your-body]

- “Surviving the Night Shift...What working nights does to your health...he warns that companies whose employees do night shift work could be setting themselves up for lawsuits in the future if they don’t demonstrate they are taking all reasonable measures to try and mitigate some of the problems associated with working at night.” [http://www.bbc.co.uk/programmes/w3cs8g7]

- “6 Ways to Make Working the Night Shift Less Hazardous to Your Health...A lack of sleep and disruption to your biological clock can have harmful effects.” [https://health.usnews.com/health-news/family-health/sleep/articles/2009/12/04/6-ways-to-make-working-the-night-shift-less-hazardous-to-your-health]

- “With regard to employer training, OSHA does not train employers on hazards related to late night and extended unusual shifts. However, OSHA encourages employers to perform a hazard analysis of its jobsite...Can OSHA train and regulate employers about the basics of minimizing light pollution from the workplace, especially with the use of blue-rich/bright white LEDs, light trespass, skyglow, glare, etc? Response: No. With respect to training, OSHA does not train employers on light pollution.” [https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=29306]

- “Shift changes where you have only a shift (8-12 hours) between your old and new shift are especially bad.” [http://www.canmybossdothat.com/category.php?id=169]

- “Impact of Sleep Deprivation on Police Performance. Sleep deprivation is comparable to
excessive drinking. A sleep deprivation study found that not sleeping for 17 hours impaired a person's motor skills to an extent equivalent to having an alcohol toxicity of 0.05 percent. Not sleeping for 24 hours was equivalent to a toxicity level of 0.10 percent.[1] This level of deprivation would impair speech, balance, coordination and mental judgment.”

- “OSHA has no regulation for sleep deprivation – but you must know who is fit for duty” http://www.ishn.com/blogs/16-thought-leadership/post/98415-osha-has-no-regulation-for-sleep-deprivation-but-you-must-know-who-is-fit-for-duty
- “Sleepy and unsafe. Why aren't workers getting enough rest? Research has shown that inadequate sleep can affect workers’ ability to remain healthy and perform their work safely – and in safety-sensitive positions, can even put others in harm’s way.” http://www.safetyandhealthmagazine.com/articles/10412-sleepy-and-unsafe-worker-fatigue
- “Shift work sleep disorder (SWSD) is a circadian rhythm sleep disorder characterized by insomnia and excessive sleepiness affecting people whose work hours overlap with the typical sleep period. There are numerous shift work schedules, and they may be permanent, intermittent, or rotating; consequently, the manifestations of SWSD are quite variable.” https://en.wikipedia.org/wiki/Shift_work_sleep_disorder
- “Do you know the signs of shift work disorder?” http://scrubsmag.com/shift-work-disorder/view-all/
- “Very high altitude extreme night shift work is a class 2A carcinogen that may result in lifelong disabling sleep disorders, high cholesterol, radiation sickness, and heart, lung and brain damage.” Steven Magee CEng MIET - Q
- “One can only wonder what the motivation is for Mauna Kea astronomers to subject their nighttime support staff to extremely long and fatiguing night shifts when they are easily avoidable.” Steven Magee CEng MIET - Q
- “Extreme night shift work in high altitude astronomy is easily avoidable by using a split night shift where the first night shift starts before sunset and finishes at midnight and the second night shift starts with a new fresh person working through to after sunrise.” Steven Magee CEng MIET - Q
- “Night shift workers typically suffer from solar radiation deficiency sickness.” Steven Magee CEng MIET - Q
Sleep Disorder Hazards

- “Polysomnography is used to diagnose, or rule out, many types of sleep disorders including narcolepsy, idiopathic hypersomnia, periodic limb movement disorder (PLMD), REM behavior disorder, parasomnias, and sleep apnea. Although it is not directly useful in diagnosing circadian rhythm sleep disorders, it may be used to rule out other sleep disorders.” [https://en.wikipedia.org/wiki/Polysomnography](https://en.wikipedia.org/wiki/Polysomnography)

- “Risk factors for sleep apnea include a family history of apnea, snoring, smoking, obesity, sleeping on the back rather than on the side, and medical conditions such as heart failure and gastroesophageal reflux disease (GERD). Blacks are at higher risk than other ethnic groups in the US. Risk factors for narcolepsy have a genetic component, and the condition typically starts in the second or third decade of life. The risk factors for hypersomnia are obesity, night-shift work, major depression, and long-haul truck driving. For forms of hypersomnia other than sleep apnea, women are more at risk than men.” [http://www.mdguidelines.com/hypersomnia](http://www.mdguidelines.com/hypersomnia)

- “Obstructive sleep apnea (OSA) is the most common category of sleep-disordered breathing...It has been revealed that people with OSA show tissue loss in brain regions that help store memory, thus linking OSA with memory loss. Using magnetic resonance imaging (MRI), the scientists discovered that people with sleep apnea have mammillary bodies that are about 20 percent smaller, particularly on the left side. One of the key investigators hypothesized that repeated drops in oxygen lead to the brain injury.” [https://en.wikipedia.org/wiki/Sleep_apnea](https://en.wikipedia.org/wiki/Sleep_apnea)

- “Sleep Apnea and Cancer: Here’s What We Know About How They’re Related...Now, researchers also believe there is a link between OSA and the development of cancer—especially in women. In the new study, an international team of researchers analyzed data on nearly 20,000 Europeans who’d been diagnosed with sleep apnea. About 5,800 of the patients studied were women, and about 14,000 were men. During the study period, 2.8% of women—but only 1.7% of men—developed a serious cancer. Breast cancer was the most common cancer among these women.” [https://www.health.com/condition/cancer/sleep-apnea-cancer](https://www.health.com/condition/cancer/sleep-apnea-cancer)

- “Behaviorally induced insufficient sleep syndrome must also be considered in the differential diagnosis of secondary hypersomnia. This disorder occurs in individuals who fail to get sufficient sleep for at least three months. In this case, the patient has chronic sleep deprivation although he or she is not necessarily aware of it. This situation is becoming more prevalent in western society due to the modern demands and expectations placed upon the individual.” [https://en.wikipedia.org/wiki/Hypersomnia](https://en.wikipedia.org/wiki/Hypersomnia)

- “Sleep Disorders – ICD-10 Codes and Names” [https://www.sleepassociation.org/sleep-disorders-icd-10-codes-names/](https://www.sleepassociation.org/sleep-disorders-icd-10-codes-names/)

- “Sleep disorders are a known occupational hazard for astronomers and their nighttime support staff.” Steven Magee CEng MIET - Q

- “Astronomers do not disclose to their nighttime support staff that they are at significant risk of developing shift work sleep disorder (SWSD) and the associated range of other sleep disorders.” Steven Magee CEng MIET - Q

- “Sleep studies are tests that record the body activity during sleep. They are helpful in identification of sleep disorders.” [https://en.wikipedia.org/wiki/Sleep_study](https://en.wikipedia.org/wiki/Sleep_study)

- “A routine annual sleep study should really be required as part of their job description for astronomers and their nighttime support staff for early detection of sleep disorders and blood
oxygenation issues.” Steven Magee CEng MIET - Q

- “I was sent for a sleep study in 2015 and they found that I have 9.9 arousals per hour and I stop breathing 31.9 times per hour during sleeping. They diagnosed Insomnia and Obstructive Sleep Apnea (OSA).” Steven Magee CEng MIET - Q

- “A sleep disorder, or somniphathy, is a medical disorder of the sleep patterns of a person or animal. Some sleep disorders are serious enough to interfere with normal physical, mental, social and emotional functioning.” [https://en.wikipedia.org/wiki/Sleep_disorder](https://en.wikipedia.org/wiki/Sleep_disorder)

- “The term "sleep-disordered breathing" is commonly used in the U.S. to describe the full range of breathing problems during sleep in which not enough air reaches the lungs (hypopnea and apnea). Sleep-disordered breathing is associated with an increased risk of cardiovascular disease, stroke, high blood pressure, arrhythmias, diabetes, and sleep deprived driving accidents.” [https://en.wikipedia.org/wiki/Sleep_apnea](https://en.wikipedia.org/wiki/Sleep_apnea)

- “Hypersomnia' means excessive sleep or sleepiness that interferes with everyday life. It can have many possible causes, including conditions such as narcolepsy, sleep apnoea or restless legs syndrome; severe sleep deprivation; depression; certain medications (such as tranquillisers); or drug and alcohol misuse.” [http://www.nhs.uk/Conditions/hypersomnia/Pages/Introduction.aspx](http://www.nhs.uk/Conditions/hypersomnia/Pages/Introduction.aspx)

- “In 2017 at the age of 47 I was diagnosed with a rare and disabling sleep disorder called Ideopathic Hypersomnia. I had noticed the onset of the condition during extreme night shift work from 2003 to 2006 on the 13,796 feet very high altitude summit of Mauna Kea. After a few years of doctors visits for insomnia, fatigue, sleepiness and falling asleep at work, it was initially diagnosed as Shift Work Sleep Disorder in 2009 before being correctly diagnosed by a Multiple Sleep Latency Test several years later.” Steven Magee CEng MIET - Q

- “Idiopathic hypersomnia is a condition, thought to be a neurological disorder, which is characterized primarily by excessive daytime sleepiness (EDS). It has historically been rarely diagnosed and is often very difficult to diagnose at an early stage; it is usually a lifelong chronic disease, which is often debilitating.” [https://en.wikipedia.org/wiki/Idiopathic_hypersomnia](https://en.wikipedia.org/wiki/Idiopathic_hypersomnia)


- “Idiopathic hypersomnia (IH) is a rare sleep disorder that can affect many aspects of a person's life. People with IH have a hard time staying awake during the day (chronic excessive daytime sleepiness or EDS) even though they seem to sleep well at night. They need to take long naps, but usually do not feel refreshed upon waking. The immediate need for sleep may come at anytime during the day, including while working, in class, or driving a car. Many people with IH may feel very drowsy and confused when waking up (sleep drunkeness). Other symptoms may include anxiety, feeling irritated, low energy, restlessness, slow thinking or speech, loss of appetite, and memory difficulties.” [https://rarediseases.info.nih.gov/diseases/8737/hypersomnolence-idiopathic/cases/27225](https://rarediseases.info.nih.gov/diseases/8737/hypersomnolence-idiopathic/cases/27225)

- “The Multiple Sleep Latency Test (MSLT) is a sleep disorder diagnostic tool. It is used to measure the time elapsed from the start of a daytime nap period to the first signs of sleep, called sleep latency. The test is based on the idea that the sleepier people are, the faster they will fall asleep. The MSLT is used extensively to test for narcolepsy, to distinguish between physical tiredness and true excessive daytime sleepiness, or to assess whether treatments for breathing disorders are working. Its main purpose is to discover how readily a person will fall asleep in a conducive setting, how consistent or variable this is, and the way they fall asleep in terms of REM sleep and other brain patterns. This can be used to identify and differentiate between
Environmental Radiation LLC - https://www.environmentalradiation.com

various sleep problems.” https://en.wikipedia.org/wiki/Multiple_Sleep_Latency_Test

- “Sleep disorders are commonly misdiagnosed as mental health disorders.” Steven Magee CEng MIET - Q
- “You might already know how important sleep is, and how sleep deprivation can cause a slew of health problems. But have you thought about your dreams? Do you dream? And can you remember your dreams from last night? Whether you can or not, if you're not dreaming—and more and more people aren’t, according to new research—you're putting yourself at higher risk for obesity, memory loss, and inflammation throughout your body, which can lead to autoimmune troubles.” https://www.rd.com/health/wellness/dream-sleep-deprivation/
- “Sex-related effects of sleep deprivation on depressive- and anxiety-like behaviors in mice...In conclusion, male mice showed a significant trend to depressive-like behaviors late after sleep deprivation. Conversely, female have a strong tendency to display anxiety- and depressive-like behaviors immediately after sleep deprivation.” https://www.ncbi.nlm.nih.gov/pubmed/26548630
- “How Men and Women Respond Differently to Sleep Deprivation...Men were more likely to engage in risky behavior when sleep deprived, while women actually became more risk averse...Women, for example, became more altruistic when sleep deprived while men did not...While men are more susceptible to hypertension and cardiovascular disease in general, women are more likely to develop high blood pressure as a result of chronic sleep deprivation.” https://www.chronobiology.com/how-men-and-women-respond-differently-to-sleep-deprivation/
- “12 Shocking Effects Of Sleep Deprivation That Will Make You Want to Go to Bed Immediately” https://www.nestmaven.com/sleep/sleep-deprivation-effects/
- “The shorter your sleep, the shorter your life: the new sleep science...Leading neuroscientist Matthew Walker on why sleep deprivation is increasing our risk of cancer, heart attack and Alzheimer’s – and what you can do about it” https://www.theguardian.com/lifeandstyle/2017/sep/24/why-lack-of-sleep-health-worst-enemy-matthew-walker-why-we-sleep
- “With exquisite precision, our inner clock adapts our physiology to the dramatically different phases of the day. The clock regulates critical functions such as behavior, hormone levels, sleep, body temperature and metabolism. Our wellbeing is affected when there is a temporary mismatch between our external environment and this internal biological clock, for example when we travel across several time zones and experience "jet lag". There are also indications that chronic misalignment between our lifestyle and the rhythm dictated by our inner timekeeper is associated with increased risk for various diseases.” https://www.nobelprize.org/nobel_prizes/medicine/laureates/2017/press.html
- “Jean-Jacques d'Ortous de Mairan....His observations and experiments also inspired the beginning of what is now known as the study of biological circadian rhythms.” https://en.wikipedia.org/wiki/Jean-Jacques_d%27Ortous_de_Mairan

601
“A circadian rhythm /sɜːrˈkeɪdiən/ is any biological process that displays an endogenous, entrainable oscillation of about 24 hours. These 24-hour rhythms are driven by a circadian clock, and they have been widely observed in plants, animals, fungi, and cyanobacteria. The term circadian comes from the Latin circa, meaning "around" (or "approximately"), and diēm, meaning "day". The formal study of biological temporal rhythms, such as daily, tidal, weekly, seasonal, and annual rhythms, is called chronobiology. Processes with 24-hour oscillations are more generally called diurnal rhythms; strictly speaking, they should not be called circadian rhythms unless their endogenous nature is confirmed. Although circadian rhythms are endogenous ("built-in", self-sustained), they are adjusted (entrained) to the local environment by external cues called zeitgebers (from German, "time giver"), which include light, temperature and redox cycles.”

“Chronobiology is a field of biology that examines periodic (cyclic) phenomena in living organisms and their adaptation to solar- and lunar-related rhythms. These cycles are known as biological rhythms. Chronobiology comes from the ancient Greek χρόνος (chrónos, meaning "time"), and biology, which pertains to the study, or science, of life...Chronobiological studies include but are not limited to comparative anatomy, physiology, genetics, molecular biology and behavior of organisms within biological rhythms mechanics. Other aspects include epigenetics, development, reproduction, ecology and evolution.”

“Circadian rhythm sleep disorders (CRSD) are a family of sleep disorders affecting (among other bodily processes) the timing of sleep. People with circadian rhythm sleep disorders are unable to go to sleep and awaken at the times commonly required for work and school as well as social needs. They are generally able to get enough sleep if allowed to sleep and wake at the times dictated by their "body clocks". The quality of their sleep is usually normal unless they also have another sleep disorder. Humans, like most living organisms, have various biological rhythms. Circadian rhythms, often referred to as the body clock or the biological clock, control processes that re-occur daily, e.g. body temperature, alertness, and hormone secretion as well as sleep timing. Due to the circadian clock, sleepiness does not continuously increase throughout the day; a person's desire and ability to fall asleep is influenced both by the length of time since the person woke from an adequate sleep and by internal circadian rhythms. Thus, a person's body is ready for sleep and for wakefulness at relatively specific times of the day. Sleep researcher Yaron Dagan states that "[t]hese disorders can lead to harmful psychological and functional difficulties and are often misdiagnosed and incorrectly treated due to the fact that doctors are unaware of their existence."

“Abnormal Sleep Causes Neurological Problems...What was making their sleep abnormal? In 2009 I accidentally discovered that all of the patients who had abnormal sleep also had vitamin D deficiency. Over time I realized that nearly everyone with abnormal sleep had a combination of both vitamin D and B vitamin deficiencies.”

“Vitamins Can Hurt You!...For my patients the Vitamin D blood level that brought “great sleep” was 60-80 ng/ml. The majority of my patients could eventually tell when their D level “wasn’t right”. But, it was still hard to know whether “not right” meant below 60 or above 80. It is keeping the vitamin D blood level in the “level to thrive” (60-80 ng/ml) AND using every other tool available to keep the sleep as perfect as possible that reverses disease. In other words it took you a long time to get here and depending on what’s wrong with you it may take a long time to get better.”
time to fix everything.”

- “Sleep — Why You Need It and 50 Ways to Improve It”
- “Are Hormones To Blame For Your Lack Of Sleep?...hormonal imbalances are a big reason for sleep disturbance. Hormone imbalances create vicious cycles—often triggered by underlying issues and then circling around to make those very same issues even worse. "The first thing I always check is the adrenal glands (which produce cortisol, DHEA, and adrenaline)," says New York Tri-State Area doctor of naturopathic medicine Dr. Doni Wilson. "And then I check the gut, because stress causes leaky gut, and leaky gut causes inflammation that affects the nervous system."”
  https://www.mindbodygreen.com/0-28953/are-hormones-to-blame-for-your-lack-of-sleep.html
- “Effects of a 3-week dehydroepiandrosterone administration on sleep, sex steroids and multiple 24-h hormonal profiles in postmenopausal women: a pilot study...As DHEA-induced elevations in testosterone and estradiol levels varied widely between individuals and were largely unpredictable, DHEA administration might not be the most appropriate approach to compensate for the reduction observed in androgen and oestrogen production in postmenopausal women. DHEA supplementation may result either in sleep stimulation or in inhibition, depending on the ratio between DHEA-induced increments in testosterone vs estradiol.”
Detecting Sleep Apnea

- "Guide to Sleep Study Tests...The first step to treating any form of sleep apnea is getting diagnosed. After consulting with your doctor, the first plan of action may be to get tested. There are a variety of sleep study tests that can be done either at home or in a lab. Learn more about what these tests entail, how to prepare for them, and more." [https://www.sleepassociation.org/sleep-apnea/testing/]

- "A sleep study is a test that records the activity of the body during sleep. There are five main types of sleep studies that use different methods to test for different sleep characteristics and disorders. These include simple sleep studies, polysomnography, multiple sleep latency tests (MSLTs), maintenance of wakefulness tests (MWTs), and home sleep tests (HSTs). In medicine, sleep studies have been useful in identifying and ruling out various sleep disorders. Sleep studies have also been valuable to psychology, in which they have provided insight into brain activity and the other physiological factors of both sleep disorders and normal sleep. This has allowed further research to be done on the relationship between sleep and behavioral and psychological factors." [https://en.wikipedia.org/wiki/Sleep_study]

- "How Does a Sleep Study Work?...A sleep study is a non-invasive, overnight exam that allows doctors to monitor you while you sleep to see what’s happening in your brain and body. For this test, you will go to a sleep lab that is set up for overnight stays—usually in a hospital or sleep center. While you sleep, an EEG monitors your sleep stages and the cycles of REM and nonREM or NREM sleep you go through during the night, to identify possible disruptions in the pattern of your sleep. A sleep study will also measure things such as eye movements, oxygen levels in your blood (through a sensor—there are no needles involved), heart and breathing rates, snoring, and body movements." [https://www.sleepfoundation.org/excessive-sleepiness/diagnosis/how-does-sleep-study-work]

- "Home Sleep Apnea Test Diagnostic Machine (HSAT): Watchpat One at Home Sleep Study Kit by Itamar Medical. Tests The Need for A CPAP Or Other Sleep Solution" [https://www.amazon.com/dp/B07XKWC1TL/ref=sr_1_1?dchild=1&keywords=home+sleep+study&qid=1592247691&sr=8-1]

- "Introducing WatchPAT™ ONE from Lunella. Undiagnosed Sleep Apnea can shorten your lifespan and dramatically increase your risk of a heart attack, stroke and a whole host of other diseases. Are you at risk?" [https://www.lunella.com/]

- "We use the Alice NightOne, which meets the American Academy of Sleep Medicine (AASM) recommended criteria for home sleep test devices (type 3) and is superior to type 4 devices like the Watch-PAT because it allows our sleep doctor to review the raw data from your study and more accurately determine the type and severity of sleep apnea. The Watch-PAT simply generates a report that the doctor signs; sleep doctors cannot review the data directly from the Watch-PAT. The Watch-PAT is not good at distinguishing obstructive from central sleep apnea which is important to determine the best treatment for you." [https://singularsleep.com/pages/sleep-apnea-test?msclid=16475aaf176a1b89b6680448cb6fc4d6]

- "Alice NightOne. Designed to provide it all – ease, confidence, and reliability. The Alice NightOne home sleep testing (HST) device is designed to help patients get their study done right the first night." [https://www.usa.philips.com/healthcare/product/HC1109289/alice-nightone-home-sleep-testing-device]
Sleep Apnea: CPAP Insomnia

- "The worst insomnia I have experienced in life occurred during using a CPAP machine." Steven Magee CEng MIET – Q
- "Testing with a CPAP machine in June 2020 revealed that it would produce insomnia whenever the pressure was 6 cmH2O or above." Steven Magee CEng MIET – Q
- "I had two prescriptions for CPAP: 7 cmH2O and 13 cmH2O. Both made me feel lousy and the higher pressure caused Aerophagia. I eventually had to abandon the treatment as it was making me so sick." Steven Magee CEng MIET – Q
- "Why You May Not Feel Better After Using CPAP Therapy for Sleep Apnea...Your Sleep Is Worsened by CPAP Problems...Unfortunately, CPAP can introduce its own set of problems. Without adequate support and interventions, these issues can quickly undermine your efforts to acclimate to the therapy. At first, it feels uncomfortable to breathe against the pressure, but this can be improved with some practice. Most people who encounter difficulties struggle with the fit of their CPAP mask. If it is not properly sized or adjusted, it can cause pain, marks on the face, ulcers or sores, and lead to air leak. Finding the right mask takes a little guidance from the equipment supplier. There are a lot of options: nasal pillows, nasal masks, and full-face masks. Beyond the mask, the humidity and temperature of the air may need to be adjusted to improve comfort. Nasal congestion or obstruction may lead to mouth breathing and a dry mouth. Excessive pressure can cause air swallowing (aerophagia). These issues may worsen sleep and exacerbate insomnia. If you get upset or frustrated, sleep becomes even more elusive. Reach out to your providers to get all your concerns addressed early so that you can get on the right track." [https://www.verywellhealth.com/why-cpap-may-not-provide-relief-4083010](https://www.verywellhealth.com/why-cpap-may-not-provide-relief-4083010)
- "'We Stopped Using CPAP with Complex Insomnia Patients—We Use More Advanced Devices'...A study finds ASV superior in patients with comorbid insomnia and sleep apnea. Insomnia, one of the most common sleep disorders, is often thought of as a psychiatric problem treated with therapy or medications. But emerging research shows many cases of insomnia have a physical cause—specifically, obstructive sleep apnea (OSA) or upper airway resistance syndrome (UARS). This phenomenon is referred to as “complex insomnia,” COMISA, or comorbid insomnia. A new study, published in The Lancet’s EClinicalMedicine and funded by ResMed Science Center, looked at both the prevalence and treatment of complex insomnia. The results revealed OSA frequently disrupts sleep brainwaves among people with insomnia—who are completely unaware of this underlying process. Moreover, their physicians and therapists rarely suspect a sleep breathing etiology. The prospective randomized control trial also revealed the superiority of adaptive servoventilation (ASV) in these patients. ASV attained insomnia remission rates measured on the well-known Insomnia Severity Index in nearly 70% of cases compared to only one-quarter of fixed CPAP users."
- "How & When To Have CPAP Pressure Settings Adjusted...When your pressure is too low, you can experience more apnea events than the normal 5 per hour as well as other symptoms like snoring or waking up gasping for air. But, if the pressure is too high you can experience other side effects like uncomfortable therapy, problems with your CPAP mask, nasal congestion, and fitful, interrupted sleep." [https://www.apneamed.org/blogs/info/how-when-to-have-cpap-pressure-settings-adjusted](https://www.apneamed.org/blogs/info/how-when-to-have-cpap-pressure-settings-adjusted)
- "Is Your CPAP Pressure Too High? How to Tell and How to Fix It...The average pressure for treating sleep apnea is 10 cm/H2O. Average pressure levels for treating Obstructive Sleep
Apnea range from 6 to 15 cm/H2O...What happens if your CPAP setting is too high? If your CPAP pressure is too high, your symptoms and side effects can include: Uncomfortable CPAP Therapy. Significant Air Leaks From Your Mask. Dry Mouth and Throat, Even When You Are Using Heated Humidification. Swallowing Air. An Apnea-Hypopnea Index (AHI) Above the Normal Five Events per Hour. Feeling Tired or Fatigued During the Day. Additionally, some experts worry that setting your CPAP pressure too high can lead to pressure-induced Central Sleep Apnea. In contrast to Obstructive Sleep Apnea, which is caused by your airways being blocked, Central Sleep Apnea is the result of breathing signals failing to be sent from your brain." [https://www.cpap.com/blog/cpap-pressure-high-tell-fix/](https://www.cpap.com/blog/cpap-pressure-high-tell-fix/)

- "APAP does not work as well as CPAP...The human body also adjusts to things that are constant (like CPAP), and gets used to such things. We have more difficulty adjusting to anything that is constantly changing, such as APAP. Many insurance companies require that APAP be tried unsuccessfully before switching to CPAP. If APAP seems to work, the patient stays on it. But, it is not unusual for patients to have difficulty tolerating APAP or continue to have symptoms on APAP. Other patients have increased awakenings and arousals from APAP. In that case, these insurance companies will allow us to bring you in at night and find the right pressure (CPAP) for you. Your APAP machine can then be set to CPAP mode." [https://www.sleepandattentiondisorders.com/blog/apap-not-work-well-cpap/](https://www.sleepandattentiondisorders.com/blog/apap-not-work-well-cpap/)
Sleep Apnea: CPAP Conclusion Induced Fatigue

- "CPAP never really worked for me and it was a few years later that the medical profession discovered I had positional sleep apnea that needed treatment with a positional device, not a CPAP machine." Steven Magee CEng MIET – Q
- "Testing with the CPAP machine in June 2020 revealed that it was triggering altitude sickness symptoms after waking, specifically Descent Fatigue during the daytime." Steven Magee CEng MIET – Q
- "I call daytime fatigue that occurs after waking up and turning off a CPAP machine: CPAP Conclusion Induced Fatigue." Steven Magee CEng MIET – Q
- "Still sleepy using cpap...I've been using my cpap every night for months and still feel sleepy and fatigued all day...I too wear my mask every night for 5yrs now and can see no change in my daily activities...Interestingly enough, I was tired a lot too even tho I faithfully used my cpap. It was not until I had my doctor switch me from a beta blocker to a regular blood pressure medicine, that my body feels great. However, I have seen an increase of morning migraines...Some patients report that it takes weeks or months before they start to feel like they have more energy or feel refreshed...Even with low AHI and acceptable mask leak, there are, unfortunately, many patients who still complain of fatigue." [https://myapnea.org/forum/still-sleepy-using-cpap](https://myapnea.org/forum/still-sleepy-using-cpap)
- "Persistent morning fatigue...I have been 100% compliant with CPAP for three months. My machine shows AHI of 1-2 most nights. I still have persistent fatigue in the AM despite 9-10 hours of sleep. However I am not sleepy during the day...it took me over 3 months to come out of my fog, I even went to the doctor to get some narcolepsy medication but decided not to take it because of the side effects. I was sleeping good sleep 8 to 8 1/2 hours a night. then one day I just felt better. for a few months after that I was on the machine 9+ hours of sleep. Now I am doing 8 months compliant and I am doing 7-8 hours and feeling good. All I know is that I never thought I had SA, never had any symptoms. Now I am feeling better, more energy and I am not drinking 3 bottles of water a night...Been on 2 months myself, my pressure currently is only 6cm, but the first few days were awesome. Now I am worse than I was before starting...Almost 10 month with AHI = 0.5. Except for sleepiness (a bit reduced) then all my problems remain (fatigue, short term memory, thinking speed, decision making, concentration)." [http://www.cpaptalk.com/viewtopic/t115447/Persistent-morning-fatigue.html](http://www.cpaptalk.com/viewtopic/t115447/Persistent-morning-fatigue.html)
- "symptoms - hangover feeling next day...I have now been on CPAP for 14 months -three different machines now have ResMed S9 Elite. The longer I use machine the worse the headache is in the morning but my biggest problem is a lousy head - hangover in the morning sometimes lasting all day. I have tortured myself for 14 months for no gain. Using tennis balls in T shirt is slightly better than CPAP pressure now 10 my specialist is increasing to 11. Headaches can use panadeine but the lousy head makes life a misery - had to stop golf because with hangover and concentration problems playing like a novice. Does anyone else suffer this lousy head like being in a vice in the morning...I have had every test available including a brain scan. I see my specialist every month with the reports from the CPAP machine and follow up after with a visit to my Doctor, who also has sleep apnoea, but it has been 15 months with the CPAP and almost 2 years since I reported the problems to my Doctor which led to all the tests I have had...After two weeks of CPAP therapy I now wake feeling hung over too. I just had a consultation with my DME technician this week and mentioned I wake with minor headaches that last all day and feel hung-over. Technician offered no council. I have six to ten beers a year
over the course of as many months otherwise no alcohol whatsoever. I also feel flush in my cheeks beneath my eyes." [http://www.apneaboard.com/forums/Thread-Symptoms-symptoms-hangover-feeling-next-day](http://www.apneaboard.com/forums/Thread-Symptoms-symptoms-hangover-feeling-next-day)

- "CPAP hangover ??...just curious if anyone is having the same issue with SUPER gogginess after overnight usage? The kind where it takes about 15-20 minutes after you wake up in order to start your day?...Exactly as you describe. The mask comes off, I suddenly feel flat and limp and don't want to move. Which causes problems because then, I just want to stay curled up with the mask on and let it keep doing its' magic." [https://www.reddit.com/r/CPAP/comments/8wpnhs/cpap_hangover/?ampcid=1*19ekoeh*cid*YW1wLVdLUnRvYzdVcDlJvdUdTJBRk44eHc](https://www.reddit.com/r/CPAP/comments/8wpnhs/cpap_hangover/?ampcid=1*19ekoeh*cid*YW1wLVdLUnRvYzdVcDlJvdUdTJBRk44eHc)

- "CPAP gives me 7 hours of continuous sleep, but....... after a night of CPAP sleep I wake to quite a heavy head, almost like a mini hangover which can last for several hours into the day. If I then spend the next night without CPAP, I might wake up more times during the night, but I can feel a lot more 'with it' in the morning. Consequently if I have a really important day at work coming up, I need to make sure the previous night is without CPAP but that night needs to be proceeded by 2 or 3 nights WITH CPAP. The answer for me seems to be CPAP, but not every night." [https://forums.cpap.co.uk/forum/cpap-therapy/cpap-machines/1633-cpap-gives-me-7-hours-of-continuous-sleep-but](https://forums.cpap.co.uk/forum/cpap-therapy/cpap-machines/1633-cpap-gives-me-7-hours-of-continuous-sleep-but)

- "Using CPAP but still tired?...It is not uncommon to start feeling daytime sleepiness, headaches, irritability, snoring or other sleep apnea symptoms months or years after a period of successful CPAP therapy. This is often a sign that something is not quite right with your CPAP therapy. Different factors can cause this gradual change including: Wear and tear of your CPAP equipment. Your physique: weight, allergies, facial features and overall health. Your sleep habits. Side effects from other medication. Your changing pressure needs or a drift of your CPAP pressure." [https://www.vitalaire.ca/blog/using-cpap-still-tired](https://www.vitalaire.ca/blog/using-cpap-still-tired)
Sleep Apnea: CPAP Aerophagia Hazards

- "A CPAP machine produced the worst gastrointestinal problems and the most putrid farts I have experienced in life!" Steven Magee CEng MIET - Q
- "CPAP-Related Aerophagia: Awareness First!...Aerophagia—or air swallowing—results in burping, abdominal distention, and discomfort, and oh my—flatulence! Aerophagia can develop during continuous positive airway pressure (CPAP) use. But most CPAP patients do not openly complain of aerophagia symptoms, and clinicians may not specifically ask about it. Furthermore, there is minimal literature available concerning CPAP-related aerophagia and its consequences. To examine CPAP-related aerophagia prevalence, Shepherd et al. examined consecutive OSA patients currently on CPAP undergoing polysomnography for optimal CPAP pressure determination. Note that this CPAP population may have been enriched with patients having difficulty tolerating CPAP.1 Using a validated gastroesophageal reflux (GER) questionnaire that was altered to examine sleep-related GER symptoms and aerophagia, they noted that of 259 patients, 130 (50%) had at least one aerophagia symptom during the previous period of CPAP use (median CPAP use of 1 to 6 months). Aerophagia was defined by the presence of one symptom during CPAP use. Since some symptoms are not specific for aerophagia (diarrhea), this study may have overestimated aerophagia prevalence. Nevertheless, the presence of aerophagia needs to be assessed in our CPAP patients, especially in those with difficulty tolerating or adhering to CPAP."

- "Swallowing Air with CPAP (Aerophagia): Causes and Solutions...Some causes of aerophagia may include: Pressure is set too high: Your CPAP pressure could be set too high or higher than you need. The extra air you get has no place else to go, but to your esophagus and then belly. Pressure is set too low: You may have your pressure set too low where it’s too inadequate to resolve your apnea episodes. As you’re trying to obtain more air in your lungs, you end up quickly gulping air which is forced into your esophagus instead. Nasal congestion: You could have nasal congestion from allergies, a cold or the flu. When you have a stuffy nose, you might not be able to get the right CPAP air pressure you require, therefore you gulp the air by mouth and there it goes, down into your esophagus. Mouth breathing: You might be a mouth breather and wears a traditional nasal mask. When your mouth opens up while you’re sleeping, the CPAP machine may not be able to deliver the air to your lungs, but rather the air escapes through your mouth. Your apnea episodes aren’t being corrected, therefore in your unconscious panic; you could suddenly experience a choking sensation and gulp the air in rapidly, forcing it into your esophagus. Exhalation problems: You might be having trouble exhaling over the consistent air pressure CPAP delivers. This is particularly hard for individuals using mid- to high-CPAP pressures. When you inhale high pressures, it might be simple, but exhaling might cause panic, anxiety and a feeling of choking or suffocation. When this occurs, you might fall out of your natural breathing rhythm and start hyperventilating. This may lead to quickly gulping or sucking in air, forcing it into your esophagus instead of your lungs."

- "Aerophagia Causes and Resolutions...CPAP users who experience excessive belching, stomach bloating, stomach distension and agonizing gas pains may be suffering from aerophagia. It’s the medical term for the phenomenon when air enters the esophagus, goes into the belly and causes bloating. Aerophagia can be caused by eating, drinking or even talking too fast. It can occur
with hyperventilation from anxiety, from chewing gum, smoking cigarettes and even during strenuous exercising. For the CPAP patient, aerophagia and stomach bloating is much more prevalent than you might think. It’s not a subject many feel comfortable talking about, but this side effect of CPAP use is an important issue to discuss and with proper changes to therapy, it can be resolved. Aerophagia occurs when air from a CPAP enters the esophagus and goes into the belly, rather than the airway and into the lungs. This can cause gas pains and distension of the stomach. It is common and can happen to anyone who uses CPAP. But when it becomes chronic, it’s a red flag, a symptom that can be overcome when the cause is properly determined"https://www.sleepapnea.org/treat/cpap-therapy/troubleshooting-guide-for-cpap-problems/aerophagia-causes-and-resolutions/
Sleep Apnea: BiPAP Machine

- "Non-invasive ventilation (NIV) is the use of breathing support administered through a face mask, nasal mask, or a helmet. Air, usually with added oxygen, is given through the mask under positive pressure; generally the amount of pressure is alternated depending on whether someone is breathing in or out. It is termed "non-invasive" because it is delivered with a mask that is tightly fitted to the face or around the head, but without a need for tracheal intubation (a tube through the mouth into the windpipe). While there are similarities with regards to the interface, NIV is not the same as continuous positive airway pressure (CPAP), which applies a single level of positive airway pressure throughout the whole respiratory cycle;[1] CPAP does not deliver ventilation but is occasionally used in conditions also treated with NIV.[2] Non-invasive ventilation is used in acute respiratory failure caused by a number of medical conditions, most prominently chronic obstructive pulmonary disease (COPD); numerous studies have shown that appropriate use of NIV reduces the need for invasive ventilation and its complications. Furthermore, it may be used on a long-term basis in people who cannot breathe independently as a result of a chronic condition." [https://en.wikipedia.org/wiki/Non-invasive_ventilation](https://en.wikipedia.org/wiki/Non-invasive_ventilation)

- "BiPAP May Offer Relief for Aerophagia Sufferers...After using your CPAP machine overnight, do you sometimes feel bloated? The cause may be aerophagia, a condition that happens from swallowing air while getting your CPAP therapy. Did you know that BiPAP machines can be used to help relieve the symptoms of aerophagia? This article will show you how some people are having success with BiPAP machines as a way to prevent aerophagia, creating a more restful sleep...Aerophagia is a condition that occurs when air enters the gastrointestinal tract, including the stomach and intestines. As air builds up, it can cause considerable discomfort in the belly and bowels. The most common symptoms of aerophagia include: belly bloating, stomachache, burping, flatulence, an uncomfortable feeling of being distended or “full”, acid reflux and “heartburn”...When these patients were “switched” from CPAP to BiPAP, nearly all of them – roughly three-quarters – experienced resolution of their aerophagia symptoms. What’s more, the mean number of apnea events (designated by AHI or apnea-hypopnea index) also decreased, from 7.25 (indicating mild apnea) to 2.71 (indicating normal)." [https://www.cpap.com/blog/bipap-aerophagia/](https://www.cpap.com/blog/bipap-aerophagia/)

- "In June 2020 the sleep doctor was evaluating me for a BiPAP machine, as the CPAP machine was triggering altitude sickness, chronic fatigue, sleepiness and gastrointestinal problems." Steven Magee CEng MIET – Q

- "BiPAP machines are used to treat breathing problems during sleep that are caused by neurological problems in the brain." Steven Magee CEng MIET – Q

- "After years of unsuccessful CPAP treatment and a wide range of unpleasant side effects, I was prescribed BiPAP treatment in July 2020" Steven Magee CEng MIET – Q

- "I found that I could not tolerate the BiPAP machine at the prescribed pressure setting of 4cmH20 to 12cmH20 and I had to reduce it to 4cmH20 to 9cmH20. Anything higher would increase daytime fatigue levels to the point I would have to go to bed, as I would have no daytime energy. It is consistent with what I saw with the CPAP machine that my high altitude damaged lungs are now pressure intolerant." Steven Magee CEng MIET – Q
Oxygen Administration During Sleep

- "Most doctors that I have spoken to about using oxygen during sleep to treat low oxygen levels have warned me not to. They say oxygen makes the lungs become lazy." Steven Magee CEng MIET – Q
- "What Should Your Oxygen Level Be When You Sleep?...Blood oxygen levels during sleep should be at a 95 percent saturation, which is considered normal, according to the American Sleep Apnea Association. A saturation of 86 percent rates as mild, while 80 to 85 percent is moderate, and 79 percent or less rates as severe. Sleep apnea occurs when airflow reduces by 80 percent. An airflow reduction to 50 to 80 percent qualifies as a hypopnea episode." [https://www.reference.com/world-view/should-oxygen-level-sleep-5ee0c816045c5747](https://www.reference.com/world-view/should-oxygen-level-sleep-5ee0c816045c5747)
- "When is oxygen therapy performed in a sleep lab?...Healthy people maintain an oxygen saturation of 90 percent or higher at any time of day or night. When blood oxygen drops, it indicates an imbalance in blood gases (that is, there may be too little oxygen hypoxemia or too much carbon dioxide hypercapnia or both). If these conditions are sustained, a lot of chronic health problems can and will develop...people with obstructive sleep apnea (OSA) may have healthy lung function and enjoy normal blood oxygen while they are awake, but severe obstructions at night may lead to these dangerous and sustained drops in their blood oxygen...Remember those COPD patients we mentioned earlier? Their lung dysfunction makes it even more challenging if they also have sleep apnea. This combination of chronic conditions is referred to as Overlap Syndrome...Breathing patterns for those who are already struggling, but who are using oxygen therapy, may be further disrupted, and the severity of episodes of apneas may actually increase, leading to cardiovascular stress over the long haul. In addition, daytime sleepiness one of the main side effects of OSA will not be addressed by using oxygen therapy alone." [https://www.soundsleephealth.com/when-is-oxygen-therapy-performed-in-a-sleep-lab/](https://www.soundsleephealth.com/when-is-oxygen-therapy-performed-in-a-sleep-lab/)
- "The Signs of Low Oxygen When Sleeping...Symptoms of low oxygen levels include blue-colored toes and fingers and swollen ankles. Other symptoms that you aren’t getting enough oxygen at night include being extremely tired during the day, feeling as though you are choking while you sleep, heavy snoring, extreme restlessness during sleep and waking up in the middle of the night gasping for breath...Lack of oxygen can change a person’s behavior during the day. He may not respond to stimulus or has bouts of fainting. If a person is suddenly no longer interested in things he previously enjoyed, this may be an indication of oxygen deprivation, or a number of other ailments." [https://healthfully.com/signs-low-oxygen-sleeping-8400103.html](https://healthfully.com/signs-low-oxygen-sleeping-8400103.html)
- "Home Oxygen Therapy for Sleep Apnea...A Case for CPAP + Oxygen? Because OSA is associated with high blood pressure, researchers have looked into the role of supplemental oxygen in addition to CPAP. A study published in 2019 sought to establish the role of intermittent hypoxia (a state of low oxygen in the tissues) in the morning high blood pressure (hypertension) that's common in people with OSA. They found that supplemental oxygen virtually eliminated they typical rise in morning blood pressure but didn't address other symptoms of OSA, such as morning heart rate or daytime sleepiness. They concluded that hypertension linked to OSA is the result of hypoxia and not sleep interruption. On the surface, that conclusion appears to be at odds with the findings of a 2014 study that investigated the impact of supplemental oxygen and CPAP together on markers of cardiovascular risk. This paper concluded that, in people with heart disease or multiple risk factors of heart disease,
CPAP did reduce blood pressure while supplemental oxygen at night did not. However, an important difference between the studies is that the 2014 one looked at overall blood pressure, while the later one focused only on morning blood pressure. There is much the experts still don't know about the link between OSA and hypertension and how best to deal with it, so more research needs to be done."  

Effect of Oxygen Administration During Sleep on Skin Surface Oxygen and Carbon Dioxide Tensions in Patients With Chronic Lung Disease...Hypoxemia, hypercarbia, and cor pulmonale ultimately occur in most patients with chronic lung disease. Although oxygen therapy may reduce or delay the development of pulmonary hypertension and myocardial failure in these patients, its use is thought to lead to CO2 narcosis and apnea. The effect of O2 administration during sleep has been examined in 12 patients (seven with cystic fibrosis, three with bronchopulmonary dysplasia, one with bronchiolitis obliterans, and one with severe hypersensitivity pneumonitis) using skin surface O2 (Roche) and CO2 (Radiometer) electrodes. Both electrodes were calibrated over wet gas and applied at 44 C. Ten patients had chronic hypercarbia (PaCO2 62 +/- 19 torr; range 46 to 103 torr) when awake. Humidified oxygen was administered by nasal cannula, Venturi mask, or head hood. Oxygen flow was increased every 20 minutes from 80 minutes or until the patient awoke. In eight of ten patients with hypercarbia and in the two normocarbic patients, skin surface carbon dioxide tension (PsCO2) increased by 10% or less as the skin surface oxygen tension (PsO2) was increased. In the remaining two patients with hypercarbia (both had cystic fibrosis) PsCO2 increased 18% and 24% as PsO2 was increased. These last two patients with depressed responsiveness to CO2 could not be separated from the other patients by clinical or laboratory criteria. It is concluded that the skin surface blood gas tensions are a simple and reproducible method for adjusting oxygen therapy in patients with chronic lung disease, and although the response to oxygen varies from patient to patient, most patients with chronic hypercarbia retain their central responsiveness to CO2 during sleep and for them O2 therapy is probably safe."  

Boost your body's oxygen saturation for maximum sleep recovery...How to increase your oxygen levels while sleeping...1. Practice taking deep breaths...2. Sleep on your side...3. Decrease and manage your stress...4. Exercise...5. Avoid alcohol before bed...When you need extra help. Sometimes, low oxygen levels are a problem you can’t solve on your own, so you visit a sleep dentist or sleep doctor who specializes in sleep health. It’s possible that you’ll come away from your appointment with a diagnosis of sleep apnea...Sleep apnea has been linked to many health issues, including irregular heartbeat, high blood pressure, heart attack, and stroke. A lack of deep, restorative sleep can also impair cognitive functioning and may contribute to dementia."
Stimulant Hazards

- “The most stimulants that I have taken in life were during my extreme night shifts to keep me awake.” Steven Magee CEng MIET - Q
- “It was normal to drink two pots of coffee during an extreme night shift.” Steven Magee CEng MIET - Q
- “CAFFEINE...EFFECTS OF SHORT-TERM EXPOSURE: The substance may cause effects on the central nervous system and cardiovascular system, resulting in insomnia, excitement, tachycardia, polyuria...EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Animal tests show that this substance possibly causes toxic effects upon human reproduction.” https://www.cdc.gov/niosh/ipcsneng/neng0405.html
- “Caffeine MSDS...MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: heart, gastrointestinal tract, central nervous system (CNS).” http://www.sciencelab.com/msds.php?msdslId=9927475
- “Coffee Drinkers Need Cancer Warning, Judge Rules, Giving Sellers the Jitters...“Since defendants failed to prove that coffee confers any human health benefits, defendants have failed to satisfy their burden of proving that sound considerations of public health support an alternate risk level for acrylamide in coffee,” the judge wrote.” https://www.nytimes.com/2018/03/30/business/coffee-cancer-warning.html
- “The longer I worked extreme night shifts, the less effective energy drinks became. Eventually I stopped drinking them as they would have no effect on me. I would drink one and go to sleep when home during the daytime.” Steven Magee CEng MIET - Q
- “Woman Shares What Energy Drinks Did To Her Husband While She Was 9 Months Pregnant” https://www.boredpanda.com/energy-drinks-caution-story-parents-brianna-austin/?utm_source=facebook&utm_medium=link&utm_campaign=BPFacebook
- “Energy drinks: Getting wings but at what health cost?” https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4320741/
- “The Buzz on Energy Drinks” https://www.cdc.gov/healthyschools/nutrition/energy.htm
- “Energy drinks are killing young people. It’s time to stop that.” http://blogs.berkeley.edu/2017/06/07/energy-drinks-are-killing-young-people-its-time-to-stop-that/
- “‘For lots of people who do shift work, it would be really useful if they could take a pill that would help them go to sleep or stay awake at the right time,” Liira said. Unfortunately, the results of this review suggest some may have serious side effects, while others should only be used for a short period. There’s no short cuts when trying to break from your natural rhythm.” http://www.medicaldaily.com/shift-work-disorder-motivates-use-modafinil-and-other-pills-may-cause-harm-297774
Sleeping Tablet Hazards

- “Trying to get a good sleep at high altitude during the daytime between extreme night shifts generally required sleeping tablets.” Steven Magee CEng MIET - Q
- "Yes, they're a quick fix to help you get a good night’s sleep temporarily, but they're not a long-term solution to sleep problems in general—and they can be dangerous if used incorrectly," [https://www.womenshealthmag.com/health/sleeping-pill-dangers](https://www.womenshealthmag.com/health/sleeping-pill-dangers)
- “Shift workers often rely on sleeping pills to help them fall asleep during the day. These pills are also known as hypnotics or sedatives.” [http://sleepcenter.ucla.edu/coping-with-shift-work](http://sleepcenter.ucla.edu/coping-with-shift-work)
- “regular use of sleeping pills and other sedatives to aid sleep are not recommended because they can lead to dependency and addiction.” [http://www.hse.gov.uk/humanfactors/topics/shift-workers.htm](http://www.hse.gov.uk/humanfactors/topics/shift-workers.htm)
- “Sleeping pills and unwanted sex...While I was married to my ex I was on sleeping pills. I told him not to have sex with me while I was taking them because I could not remember having sex a few times when we did, while I was on the pills. It felt strange and even wrong to have sex when I couldnt remember it.” [https://www.dailystrength.org/group/sexual-abuse/discussion/sleeping-pills-and-unwanted-sex](https://www.dailystrength.org/group/sexual-abuse/discussion/sleeping-pills-and-unwanted-sex)
- “Side Effects and Potential Dangers of Sleeping Pills...Low Sexual Drive: Diminished libido is counterproductive for most insomnia patients as most of them do suffer from anxiety or depression as well. And satisfactory sexual activity is always linked to relaxed body, peaceful mind and a good sleep.” [http://blog.snoozester.com/side-effects-and-potential-dangers-of-sleeping-pills/](http://blog.snoozester.com/side-effects-and-potential-dangers-of-sleeping-pills/)
- “some users of the most widely prescribed drug, Ambien, started complaining online and to their doctors about unusual reactions ranging from fairly benign sleepwalking episodes to hallucinations, violent outbursts, nocturnal binge eating and — most troubling of all — driving while asleep.” [http://www.nytimes.com/2007/03/15/business/15drug.ready.html](http://www.nytimes.com/2007/03/15/business/15drug.ready.html)
- “Ambien Side Effects” [https://www.drugs.com/sfx/ambien-side-effects.html](https://www.drugs.com/sfx/ambien-side-effects.html)
Mauna Kea Hazards

• “If all of your past employees were to honestly write about their experiences in your company, what would they write?” Steven Magee CEng MIET – Q

• High Altitude Health Hazards of Mauna Kea, Hawaii http://www.environmentalradiation.com/Altitude%20chapter%20of%20health%20forensics.pdf

• Mauna Kea, Hawaii, USA – A very high altitude worker's experiences http://www.environmentalradiation.com/Hawaii%20Chapter.pdf

• Anoynymous worker review 1 of the summit of Mauna Kea: "...Keck is run for the benefit for 3 or 4 key individuals who have a long history of mistreating staff. In some instances the mistreatment led to suicide. Expect to work with angry explosive hair trigger co-workers...In one incident it was necessary to post guards at headquarters to protect the hq workers from a disgruntled mountain worker...Working at altitude can have profound effects on one's health and relationships with others." https://www.glassdoor.com/Reviews/W-M-Keck-Observatory-Reviews-E783404.htm

• Annoynymous worker review 2 of the summit of Mauna Kea: "...Don't be the next victim of this toxic organization. This isn't a collegial scientific organization, its an Apartheid style old Hawaii Sugar Plantation on top of a volcano..." https://www.glassdoor.com/Reviews/W-M-Keck-Observatory-Reviews-E783404.htm

• Annoynymous worker review 3 of the summit of Mauna Kea: “Science First, Equipment Second, Safety Third, People Fouth...The entire summit facility is an OSHA nightmare with fall dangers that will one day kill people, toxic work environment, cutthroat work culture, poor commitment to competitive pay, poor documentation, ineffective standard operational procedures....Kecks hiring goal is to get people in the door as cheaply as possible, with an empty promise of later increasing pay. This will never happen. The pay you receive upon hiring will be about what you make for your term of employment at Keck. Typically after 5 years, you'll be making less than you were when you started based on inflation.  Kecks project managers are some of the worst that I have ever seen. They seem to rely on everyone else to get it done. Some call this a hands-off approach that when the reality is that its purely lazy…you'd be better off working anywhere else for half the pay.” https://www.glassdoor.com/Reviews/W-M-Keck-Observatory-Reviews-E783404.htm

• “I almost fell through the deck railings at the W. M. Keck Observatory which would have resulted in a high fall from the telescope instrument deck that probably would have been fatal at very high altitude.  It was only years later that that I realized the deck railings did not meet the building construction code for Hawaii Island that required 4 inch spacing to prevent falls.  My ‘near miss’ fall that sent me to the hospital was reported to the W. M. Keck Observatory management team in 2002.” Steven Magee CEng MIET – Q

• “U.S. Building Codes for Deck Railing...A deck with no or inadequate railings is an accident waiting to happen. To ensure safety, individual communities in the United States regulate certain aspects of construction. Most regulations come from the International Residential Code, although local building authorities often add additional restrictions for their specific communities...Baluster Spacing.  Balusters, the vertical guards that support the handrail, must be installed close enough that the space between them is no greater than 4 inches. Most city inspectors carry a 4-inch ball with them to test the spacing. Installed balusters should withstand 50 lbs. of pressure exerted over a 1-square-foot area.” https://homeguides.sfgate.com/us-
“It is important to remember that blatant harassment of male workers by toxic female managers is also prevalent in the USA.” #MeToo  Steven Magee CEng MIET - Q

“The #MeToo movement has done an excellent job of highlighting workplace harassment of females. It is now time to expand it to represent the unwarranted workplace harassment of workers by the opposite gender.”  Steven Magee CEng MIET - Q

"The summit of Mauna Kea was definitely a place where it was better to be a hard to replace skilled engineer than an easy to replace technician. It was my experience that once you had developed Mauna Kea Sickness (MKS) that the management team would blatantly harass you out of your job using nasty inhumane human resources techniques." Steven Magee CEng MIET #MeToo - Q

“Two aggressive female astronomy managers would take me into numerous surprise closed door meetings and jointly attempt to harass me out of my job. It was the worst experience that I have ever had in the workplace.”  Steven Magee CEng MIET #MeToo - Q

“I WANT YOUR RESIGNATION!” W. M. Keck Observatory #MeToo

“The toxic female managers clearly stated the reason why they were harassing me for my resignation was because I had the audacity to use my earned sick time for essential surgery. It all seemed very illegal to me to harass a worker that was working while recovering from essential surgery.” Steven Magee CEng MIET #MeToo - Q

“I found it strange that I had a large benign tumor on the tendon sheaths of the knee joint. As the tumor grows in the joint, it damages the surrounding bone and tissues if not removed promptly. I later researched the toxicity of very high altitude facilities and realized that I was working in a very abnormal biological environment that was clearly doing strange things to workers health.”  Steven Magee CEng MIET - Q

“Radiation Effects Research Foundation...Benign tumors. Information about the influence of A-bomb radiation on non-malignant, or benign, tumors comes mostly from research in the clinical Adult Health Study (AHS). Studies have been conducted with respect to benign thyroid, parathyroid, salivary gland and uterine tumors, and gastric polyps. In each case, a relationship to radiation dose was seen.”  https://www.rerf.or.jp/radefx/late_e/benign.html

“In 2017 I became extremely ill with flu-like symptoms and was confined to bed for a week, 2018 was filled with colon issues that resulted in a colonoscopy removing a 5mm polyp from the sigmoid colon. Intestinal pains were a feature of high altitude workplaces and I had previously seen a gastroenterologist in 2006 for extreme intestinal pains that were so severe that I was falling over with them. The removed polyp was causing malnutrition to occur and I had been high dosing with nutritional supplements to offset it. My very high altitude coworker had died from fatal colon cancer.”  Steven Magee CEng MIET - Q

“Hypoxia is when a portion of the body doesn't have adequate oxygen supply. Hypoxia-inducible factor 1-alpha, (HIF-1-alpha,) is a protein that is encoded by the HIF1A gene, playing an essential role in cellular and systemic responses to hypoxia. Cancer cells use this protein to grow their blood supply and spread.”  https://www.envita.com/cancer/the-important-role-oxygen-plays-in-cancer-treatment

“Being harassed out of my job by the W. M. Keck Observatory removed me from the abnormal environmental conditions that exist at very high altitudes, which was clearly beneficial for my long term health.”  Steven Magee CEng MIET #MeToo - Q

“I found the numerous surprise meetings with the female harassers to be very unprofessional,
possibly illegal, and aimed to make sure that you had no legal support in the meetings from an employment lawyer.” Steven Magee CEng MIET #MeToo - Q

• “Not content with harassing me numerous times in a private office, an aggressive female manager started extending my extreme night shifts which would make me really sick with shift work disorder, very high altitude sickness and workplace drug use.” Steven Magee CEng MIET #MeToo - Q

• “I was placed onto time off against my will by the harassing female managers.” Steven Magee CEng MIET #MeToo

• “The harassing female managers unexpectedly terminated my employment while I was away on forced time off that they initiated.” Steven Magee CEng MIET #MeToo - Q

• “The reason why I had earned so much night shift time bank was because the harassing female managers had overworked me, causing me to accumulate lots of excess work hours.” Steven Magee CEng MIET #MeToo

• “I was owed a very large sum of vacation and night shift time bank pay when I was terminated and I have no recollection of ever receiving it.” Steven Magee CEng MIET #MeToo

• “The W. M. Keck Observatory is the only employer that has surprised me during my employment with urine tests for illegal drugs.” Steven Magee CEng MIET #MeToo - Q

• “I never felt so relieved to leave a job as I did the day I left the toxic W. M. Keck Observatory.” Steven Magee CEng MIET #MeToo - Q

• “From the point that I returned to work from essential surgery to the point of being terminated, it was clear that the toxic W. M. Keck Observatory had declared war on me.” Steven Magee CEng MIET #MeToo - Q

• “It was clear to me that using your earned sick time for essential surgery would put a target on your back at the toxic W. M. Keck Observatory.” Steven Magee CEng MIET #MeToo - Q

• "I posted a truthful review of the toxic W. M. Keck Observatory on Glassdoor and got the following message back from them: ...We determined your review does not meet these guidelines because it contains an accusation of a specific criminal activity that we don't allow on our site...Best Regards, Glassdoor" Steven Magee CEng MIET #MeToo - Q http://www.environmentalradiation.com/Glassdoor%20w%20m%20keck%20observatory%20review%20rejection%20captioned.jpg


• “Constructive Discharge: Were You Forced to Resign? If you were forced to quit your job because of intolerable working conditions, you may be able to sue.” https://www.nolo.com/legal-encyclopedia/constructive-discharge-were-you-forced-resign.html

• “Key Facts to Know When You’ve Been Forced to Resign...Being forced to resign can be a serious blow to one’s career and self-esteem, but it doesn’t have to mean forfeiting your rights. In some instances, being forced to resign is illegal, and employees should be aware that employment discrimination laws can protect them when the circumstances signal unfairness. A resignation is a voluntary act which results in formally giving up a position of employment. However a forced resignation is often involuntary and comes as a result of some form of pressure or intimidation from supervisors, managers or even fellow members of an organizational board. A forced resignation has certain legal implications that a voluntary resignation does not have. For instance, a forced resignation based on discrimination or retaliation could trigger employment discrimination law.” https://www.shegerianlaw.com/key-
Forced to resign: What are your options?...Dear Evil HR Lady, My employer asked me to resign. I had no early warnings nor complaints about my work performance. They won't tell me the reason. Should I sign the termination letter on the spot? Can I ask them if I can review it first? What questions should I ask? The first rule of signatures is you never, ever - not in a million years - sign something you don't understand. If someone shoves a resignation letter under your nose and tells you to sign it, do not sign until you not only understand it, but are willing to accept the consequences of signing it.”

After refusing numerous hostile demands for my resignation, the toxic management team changed my job description multiple times to be distinctly different from the rest of the team. I regarded it as a form of harassment and discrimination.”

To be considered a constructive discharge, the employer (or someone employed by the employer) must create intolerable working conditions. This often includes things like: Demotions, forced retirement, or job responsibility removal without reason, Pay or hour decreases without justification, Reassignment to menial work. Consistent bullying or badgering, humiliation or harassment as in the case of a hostile work environment”

Discrimination...In human social affairs, discrimination is treatment or consideration of, or making a distinction in favor of or against, a person based on the group, class, or category to which the person is perceived to belong rather than on individual attributes. This includes treatment of an individual or group, based on their actual or perceived membership in a certain group or social category, "in a way that is worse than the way people are usually treated".[1] It involves the group's initial reaction or interaction going on to influence the individual's actual behavior towards the group leader or the group, restricting members of one group from opportunities or privileges that are available to another group, leading to the exclusion of the individual or entities based on logical or irrational decision making.”

Discrimination by Type. Learn about the various types of discrimination prohibited by the laws enforced by EEOC. We also provide links to the relevant laws, regulations and policy guidance, and also fact sheets, Q&As, best practices, and other information. Age; Disability; Equal Pay/Compensation; Genetic Information; Harassment; National Origin; Pregnancy; Race/Color; Religion; Retaliation; Sex; Sexual Harassment”

Harassment is unwelcome conduct that is based on race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability or genetic information. Harassment becomes unlawful where 1) enduring the offensive conduct becomes a condition of continued employment, or 2) the conduct is severe or pervasive enough to create a work environment that a reasonable person would consider intimidating, hostile, or abusive. Anti-discrimination laws also prohibit harassment against individuals in retaliation for filing a discrimination charge, testifying, or participating in any way in an investigation, proceeding, or lawsuit under these laws; or opposing employment practices that they reasonably believe discriminate against individuals, in violation of these laws. Petty slights, annoyances, and isolated incidents (unless extremely serious) will not rise to the level of illegality. To be unlawful, the conduct must create a work environment that would be intimidating, hostile, or offensive to reasonable people. Offensive conduct may include, but is not limited to, offensive jokes, slurs, epithets or name
calling, physical assaults or threats, intimidation, ridicule or mockery, insults or put-downs, offensive objects or pictures, and interference with work performance. Harassment can occur in a variety of circumstances, including, but not limited to, the following: The harasser can be the victim's supervisor, a supervisor in another area, an agent of the employer, a co-worker, or a non-employee. The victim does not have to be the person harassed, but can be anyone affected by the offensive conduct. Unlawful harassment may occur without economic injury to, or discharge of, the victim.” https://www.eeoc.gov/laws/types/harassment.cfm

- “Based on what I experienced at the toxic W. M. Keck Observatory, this is the Mauna Kea workplace harassing procedure: 1. Hit the worker with multiple nasty surprise resignation meetings. 2. If they do not voluntary resign, make their working conditions intolerable by repeatedly changing their working conditions on a regular basis and extend their working hours. 3. If still present, put them on leave against their will and fire them while they are away from the workplace.” Steven Magee CEng MIET #MeToo - Q
- “It is unfortunate for the toxic W. M. Keck Observatory that it failed to see that blatantly harassing a sickened worker out of their job would have long term repercussions for its ability to operate its current and future facilities atop Mauna Kea as their victim told their horror story to the world.” Steven Magee CEng MIET #MeToo - Q
- “Never harass a sickened manager out of their position that has a complete understanding of how the biologically toxic facility operates.” Steven Magee CEng MIET #MeToo - Q
- “This was my Mauna Kea experience: 1. Hire worker and do not disclose the full range of the biological toxicity of the very high altitude facility to them. 2. Let the worker get sick and start using their earned sick time. 3. Harass the sickened worker out of the company. 4. Hire an unsuspecting healthy worker to replace them.” Steven Magee CEng MIET #MeToo - Q
- “I have never had any complaints about the quality of your work, or the effort you have put in to making Keck function better - I think you have been a good & valuable employee, and done good work for Keck.” Email by senior coworker at the W. M. Keck Observatory months after the workplace harassment started.
- “The W. M. Keck Foundation would be wise to establish how profound the health, safety, worker sickness and harassment issues are at the toxic W. M. Keck Observatory.” Steven Magee CEng MIET #MeToo - Q
- “Five years of working at the toxic W. M. Keck Observatory was the point where I ceased to be healthy and started a daily struggle with sickness. That sickness has plagued me ever since.” Steven Magee CEng MIET - Q
- "The following information really should be placed on all very high altitude job adverts and company contracts: WARNING – Very high altitude commuting presents many known health risks to sea level adapted humans. Some of the documented conditions are headaches, forgetfulness, confusion, irritability, aggression, hallucinations, visions, light headedness, fatigue, fainting, sore throats, runny noses, digestive disturbances, changed personality and panic attacks. Development of cancer, anemia, high cholesterol, heart, lung, brain, and blood oxygenation issues have occurred in very high altitude workers that have resulted in disability and premature death. The nearest fully equipped hospital accident and emergency facility is typically one to two hours away. Numerous very high altitude workers have been killed due to fatal mistakes on the job. Workers are expected to use a variety of company supplied drugs to offset the daily very high altitude sickness including "RX-Only" prescription medical oxygen."
Daily long term self medication is known to damage human health. The work environment is comparable to a Faraday cage and Faraday Cage Sickness (FCS) may occur in long term workers. Radiation levels are abnormally high and long term radiation sickness may result. Blood oxygen levels are typically in the region of 80% and the medical profession regards this as a health risk. Extreme night shifts are associated with causing poor health and lifelong sleep disorders. Low oxygen environments are associated with the onset of irritability, fatigue and Sleep Apnea. Repeatedly reporting observations of abnormal behaviors in workers to upper management may result in your contract not being renewed or termination without notice. Permanently sickened workers are unlikely to qualify for corporate government disability payments, which may lead to a lifetime of extreme poverty." Steven Magee CEng MIET - Q

- "If you are looking for a career that may induce a myriad of health conditions into you, I can recommend working at the 13,796 feet very high altitude summit of Mauna Kea, Hawaii, USA." Steven Magee CEng MIET - Q
- “Very high altitude observatories are a known worker health hazard.” Steven Magee CEng MIET - Q
- “Given that science has proven that the very high altitude summit of Mauna Kea is biologically toxic to the sea level adapted human, the only correct course of action is to bulldoze all manned facilities as soon as possible.” Steven Magee CEng MIET - Q
- “I am proud to be a civil rights advocate.” Steven Magee CEng MIET - Q
Harassment

- “Workplace harassment was a feature of USA professional astronomy.” Steven Magee CEng MIET - Q
Statement by Finnish Astronomers and Astrophysicists on Harassment

- “We, astronomers and astrophysicists from Finland and in Finland, strongly condemn harassment and discrimination. This includes but is not limited to harassment or discrimination based on sex, gender, sexual orientation, race, or disability. Harassment can take the form of unwanted sexual attention, bullying, coercion, or the creation of an unsafe or hostile work environment, especially in the presence of imbalances of power. Our own academic community is no exception. Harassment is a serious offence that too often goes unreported and unchallenged. When victims come forward, they must be able to rely on our support. We must address the issue head-on. Otherwise, we not only enable harassers, but also send a devastating message to the individuals who have been harassed - and whose careers are often destroyed or seriously disrupted - as well as to the whole community. Our concern and solidarity is first with victims of harassment, and with the right of all staff and students to work in a healthy and safe environment. And while we also recognise the possibility of rehabilitation, it can only be at the end of a process that begins with an acknowledgement of the offense, and taking responsibility for the harm caused. The Finnish astronomical and astrophysical community is diverse and international, and it is also deeply connected. It strives on principles of fairness and equal opportunities. Harassment or discrimination threaten our community and our way of working together. They have no place here.”

https://docs.google.com/document/d/e/2PACX-1vQSkR8OSHbqC9tEFjum3RkHbk-IEXYbv422el3bTILMeTRY1XtcDY9lKRadQnyffree1hp1Fs2pqKYMc/pub
Sonic Boom Hazards

- “When I was hired to work at the Kitt Peak National Observatory (KPNO), it was not disclosed to me that the site was being hit by powerful sonic booms from military supersonic aircraft that would shake the buildings. I had noticed that there seemed to be a significant number of staff that were having heart issues and some appeared to have had heart attacks and died prematurely. I later discovered during researching my own heart issues that it was a suspected effect of exposure to sonic booms. Regular exposure to sonic booms from military supersonic jet aircraft is suspected of increasing the incidence of vibroacoustic disease, a thickening of heart tissue which may lead to heart arrhythmia or premature death.” Steven Magee CEng MIET

- “48 of the 50 Vieques residents tested were diagnosed as suffering from vibroacoustic disease—a thickening of heart tissue caused by exposure to sonic booms. Simultaneously, the Ponce School of Medicine conducted an independent study and found other data to confirm the presence of vibroacoustic disease: 79% of Viequenses fishermen have thickened heart tissue, which is the main symptom of vibroacoustic disease. This disease is said to lead to heart arrhythmia, or even death.”

- “Aircraft noise linked with heart problems...The results showed that the highest levels of aircraft noise had the strongest association with cardiovascular disease hospitalizations. Overall, 2.3% of hospitalizations for cardiovascular disease among older people living near airports were attributable to aircraft noise.”

- “The mission of Quiet Tucson Skies Inc. is to protect and enhance the livability of the Tucson metropolitan area by promoting limited flights of quiet, safe military aircraft and by opposing the increase of military air traffic, expanded flight paths or the introduction of aircraft that generate increased noise and air pollution, especially the F-35. Quiet Tucson Skies Inc. will educate residents and decision-makers about the dangers of military flights over our community and the threats created by the noise and air pollution they generate. Quiet Tucson Skies Inc. may work with the public and other organizations to restore the safety and serenity of our Sonoran Desert community.”

- “Aircraft noise is noise pollution produced by aircraft during the various phases of a flight...Health consequences include sleep disturbance, hearing impairment and heart disease, as well as workplace accidents caused by stress. Memory and recall can also be affected.”
Radio Frequency Hazards

- “High altitude astronomical sites are commonly also used as Radio Frequency (RF) radiation antenna parks.” Steven Magee CEng MIET - Q
  http://www.environmentalradiation.com/RF_Steward_Observatory_captioned.jpg
- “RF Readings At Kitt Peak National Observatory (KPNO)” https://youtu.be/HBTljT8dANs
- “Tuning in to Microwave Sickness From Wireless Radiation. How wireless technology can trigger a devastating illness...scientists have documented evidence of an illness from sub-thermal microwave exposure for decades. The condition used to be known as “microwave sickness” or “radio frequency sickness,” but today, it’s usually called electromagnetic sensitivity (ES).” https://www.theepochtimes.com/tuning-in-to-microwave-sickness_2925499.html
- “After almost a decade in high altitude astronomy, I went on to develop Electromagnetic Hyper-Sensitivity (EHS).” Steven Magee CEng MIET http://www.es-uk.info/ - Q
- “The Robert C. Byrd Green Bank Telescope, which opened in 2001 and is operated by the National Radio Astronomy Observatory, is used to detect electromagnetic signals in deep space....Between 50 and 60 of Green Bank’s residents suffer from electromagnetic hypersensitivity (EHS), a condition purported to be a debilitating sensitivity to the electromagnetic waves emitted by Wi-Fi routers and cellphone towers. Its sufferers report experiencing headaches, nausea, nosebleeds, sleep problems and other symptoms they believe are connected to exposure to such waves.” http://www.newsweek.com/seeking-radio-silence-west-virginias-quiet-zone-475589
- “Cell phone radiation and electromagnetic fields (EMF’s) are the most important under-reported story of our generation. Autism and obesity is exploding, child diabetes is on an unexplainable rise, children are being medicated as never before. Does this need to be? Is this normal? No it’s not. EMFs and cell phones have got a lot to answer for, and I am not the only one saying this.” https://www.electricsense.com/about/
- “Seven ways EMF technology seriously threatens entire populations” https://nexusnewsfeed.com/article/health-healing/seven-ways-emf-technology-seriously-threatens-entire-populations/#.Wd2CH6lllKg.facebook
- “The Shocking Truth About Electricity & EMFs with Arthur Firstenberg...The electromagnetic field affects electrons. It interferes with it with electron transport and interferes with metabolism. Effectively, makes metabolism less efficient and starves us of oxygen effectively because the electrons from your food can combine with the oxygen you breathe. Sugars, fats
and amino acids back up into your bloodstream. There’s the backup, you get diabetes. It gets deposited in coronary arteries and you get heart disease. Cancer thrives in aerobic environments. If you are effectively starved of oxygen, cancer cells thrive. The modern epidemics of cancer, heart disease and diabetes, exactly those three diseases are due in large part to the expanding sea of radiation that we’re all swimming in.”

https://www.westonaprice.org/podcast/272-the-shocking-truth-about-electricity-emfs-with-arthur-firstenberg/?fbclid=IwAR3joYHctal96o_iYkNKoxurSsElpLqwZFoLNOVz47BHVHlgN5mFCFxICv30

- “Cell Tower Health Effects” https://mdsafetech.org/cell-tower-health-effects/
- "Cockpit Electromagnetic Fields May Be Harming Pilots, The U.S. Military Fears...There have long been fears that pilots are being exposed to harmful environmental hazards. Some are natural radiation effects, such as ultraviolet rays from the sun piercing cockpit windows. Some U.S. fighter pilots also believe that radiation from the powerful radars on their aircraft have also contributed to a surge in cancer cases among their ranks. But what’s significant about DARPA's new project is that the suspected culprit isn’t just high-powered radar anymore. Pilots of cutting-edge aircraft, such as the F-35 stealth fighter, are encased in an electronic cocoon of powerful sensors, audiovisual displays, and special high-tech helmets. And it’s not just U.S. pilots: European, Russia, Israeli and other pilots of advanced aircraft also use this technology – and faced potential exposure to hazardous radiation. Equally significant is that the Pentagon is admitting a disturbing possibility: that cockpit radiation may be affecting the mental judgment of pilots so badly that it’s causing them to crash their aircraft." https://www.forbes.com/sites/michaelpeck/2020/09/14/cockpit-electromagnetic-fields-are-harming-pilots-the-us-military-fears/?sh=32cb63c43d57

- “Electromagnetic interference (EMI), also called radio-frequency interference (RFI) when in the radio frequency spectrum, is a disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, or conduction.[1] The disturbance may degrade the performance of the circuit or even stop it from functioning. In the case of a data path, these effects can range from an increase in error rate to a total loss of the data.[2] Both man-made and natural sources generate changing electrical currents and voltages that can cause EMI: ignition systems, cellular network of mobile phones, lightning, solar flares, and auroras (Northern/Southern Lights). EMI frequently affects AM radios. It can also affect mobile phones, FM radios, and televisions, as well as observations for radio astronomy.” https://en.wikipedia.org/wiki/Electromagnetic_interference
Environmental Radiation LLC - https://www.environmentalradiation.com

It is a part of Title 47 of the Code of Federal Regulations (CFR), and regulates everything from spurious emissions to unlicensed low-power broadcasting. Nearly every electronics device sold inside the United States radiates unintentional emissions, and must be reviewed to comply with Part 15 before it can be advertised or sold in the US market.”


- “There was a lot of observatory fabricated electronic circuitry used in astronomy that had never been tested to Federal Communications Commission (FCC) standards for electromagnetic interference (EMI).” Steven Magee CEng MIET - Q

- “Steven Magee Discovers That Kelp & Vitamin B12 Offset Radiation Induced Damage In Plants” Steven Magee CEng MIET https://youtu.be/nb4mSk06eGw

- "Increased Release of Mercury from Dental Amalgam Fillings due to Maternal Exposure to Electromagnetic Fields as a Possible Mechanism for the High Rates of Autism in the Offspring: Introducing a Hypothesis...According to the World Health Organization (WHO), factors such as growing electricity demand, ever-advancing technologies and changes in social behaviour have led to steadily increasing exposure to man-made electromagnetic fields. Dental amalgam fillings are among the major sources of exposure to elemental mercury vapour in the general population. Although it was previously believed that low levels are mercury (i.g. release of mercury from dental amalgam) is not hazardous, now numerous data indicate that even very low doses of mercury cause toxicity. There are some evidence indicating that perinatal exposure to mercury is significantly associated with an increased risk of developmental disorders such as autism spectrum disorders (ASD) and attention-deficit hyperactivity disorder (ADHD). Furthermore, mercury can decrease the levels of neurotransmitters dopamine, serotonin, norepinephrine, and acetylcholine in the brain and cause neurological problems. On the other hand, a strong positive correlation between maternal and cord blood mercury levels is found in some studies. We have previously shown that exposure to MRI or microwave radiation emitted by common mobile phones can lead to increased release of mercury from dental amalgam fillings. Moreover, when we investigated the effects of MRI machines with stronger magnetic fields, our previous findings were confirmed. As a strong association between exposure to electromagnetic fields and mercury level has been found in our previous studies, our findings can lead us to this conclusion that maternal exposure to electromagnetic fields in mothers with dental amalgam fillings may cause elevated levels of mercury and trigger the increase in autism rates. Further studies are needed to have a better understanding of the possible role of the increased mercury level after exposure to electromagnetic fields and the rate of autism spectrum disorders in the offspring." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4795328/
Dirty Electricity Hazards

- “The most deformed AC voltage sine wave that I have seen in my career was at a high altitude astronomical observatory where I worked for almost three years. I eventually became so sick sitting next to the electrical room daily that I had no option but to leave.” Steven Magee CEng MIET
- “The State of Arizona warns about the toxicity of sitting near to electrical rooms.” Steven Magee CEng MIET
- “Dirty Electricity tells the story of Dr. Samuel Milham, the scientist who first alerted the world about the frightening link between occupational exposure to electromagnetic fields, electromagnetic pollution, and human disease. Milham takes readers through his early years and education, following the twisting path that led to his discovery that most of the twentieth century diseases of civilization, including cancer, cardiovascular disease, diabetes, and suicide, are caused by electromagnetic field exposure. “
- “‘Dirty’ Electricity is a National Problem Affecting Everyone’s Health in the United States”
- “Here you will find an ever-expanding list of research on the subjects of electrical pollution, dirty electricity, ground currents and voltages (“stray voltage”), and studies on the application of STETZERiZER® products to remediate these electrical problems. Research is also available on how electrical pollution, dirty electricity, and ground currents and voltages affect the health of human beings and animals.”
- “Welcome to the PSC Stray Voltage website. The stray voltage documents listed below are a compilation of papers and other documents that relate to the topic of stray voltage.”
- "It's a slow, painful torturous death, is what it is for them...It's like watching someone die of AIDS."
Faraday Cage Sickness

- “Metal astronomical observatory domes and metal buildings are a form of the Faraday cage.” Steven Magee CEng MIET - Q
- “A Faraday cage or Faraday shield is an enclosure used to block electromagnetic fields. A Faraday shield may be formed by a continuous covering of conductive material or in the case of a Faraday cage, by a mesh of such materials. Faraday cages are named after the English scientist Michael Faraday, who invented them in 1836.” https://en.wikipedia.org/wiki/Faraday_cage
- “An emerging body of research is suggesting that soaring 35,000ft (10km) above the ground inside a sealed metal tube can do strange things to our minds, altering our mood, changing how our senses work and even making us itch more.” http://www.bbc.com/future/story/20170919-how-flying-seriously-messes-with-your-mind
- “There have been a few studies that have shown that plants can have a difficult time surviving when grown under a form of electro-magnetic shielding known as a Faraday’s Cage...They discovered that shielding plants from the Earth’s electric field using a grounded wire net had a detrimental effect on plant health, stating that the plants looked “feebly”...It turned out that the uncovered plants grew 50 to 60 percent better than the shielded plants. Furthermore, they found that flowering and fruiting processes were adversely affected by the lack of electric field exposure.” http://electricfertilizer.com/2014/07/natural-earth-currents-and-plant-health/
- “Cars are a form of the Faraday cage.” Steven Magee CEng MIET - Q
- “An absence of natural radiation may be as harmful as an abnormally large exposure of radiation.” Steven Magee CEng MIET - Q
Travel Hazards

- “The most dangerous roads that I have driven on are those leading to high altitude astronomical observatories.” Steven Magee CEng MIET - Q
- “The most dangerous roads are those that provide sea level adapted humans rapid ascent to very high altitudes.” Steven Magee CEng MIET - Q
- “I lost control of the sport utility vehicle (SUV) many times at astronomical observatories. Driving up the road on two wheels like a stunt car driver after taking a corner too fast and almost rolling over at Roque De Los Muchachos, sliding fast and uncontrollably down Kitt Peak backwards on a dangerous snowy road, and hallucinating on Mauna Kea while driving, to name just a few of the dangerous occurrences.” Steven Magee CEng MIET - Q
- “Driving judgment is compromised in the sea level adapted human when at high altitudes.” Steven Magee CEng MIET - Q
- “Workers on the 13,796' oxygen deficient summit of Mauna Kea did not use medical oxygen when driving cars to treat the potentially dangerous adverse mental effects of Cerebral Hypoxia.” Steven Magee CEng MIET - Q
- “Falling asleep at the wheel was always a danger when working extreme night shifts.” Steven Magee CEng MIET - Q
- “There were times I would drive home after an extreme set of night shifts and have no recollection of the journey.” Steven Magee CEng MIET - Q
- “How did I get home without killing myself in a car accident was a question that I asked myself many times during working extreme night shifts.” Steven Magee CEng MIET - Q
- “Drowsy Driving: Asleep at the Wheel...Drowsy driving is a major problem in the United States. The risk, danger, and often tragic results of drowsy driving are alarming. Drowsy driving is the dangerous combination of driving and sleepiness or fatigue. This usually happens when a driver has not slept enough, but it can also happen due to untreated sleep disorders, medications, drinking alcohol, or shift work.” [https://www.cdc.gov/features/dsdrowsydriving/index.html](https://www.cdc.gov/features/dsdrowsydriving/index.html)
- “Insufficient Sleep Is a Public Health Problem...The National Department of Transportation estimates drowsy driving to be responsible for 1,550 fatalities and 40,000 nonfatal injuries annually in the United States.” [https://www.cdc.gov/features/dssleep/index.html](https://www.cdc.gov/features/dssleep/index.html)
- “Sleep-deprived driving (commonly known as tired driving, drowsy driving, or fatigued driving) is the operation of a motor vehicle while being cognitively impaired by a lack of sleep. Sleep deprivation is a major cause of motor vehicle accidents, and it can impair the human brain as much as alcohol can. According to a 1998 survey, 23% of adults have fallen asleep while driving. According to the United States Department of Transportation, male drivers admit to have fallen asleep while driving twice as much as female drivers. In the United States, 250,000 drivers fall asleep at the wheel every day, according to the Division of Sleep Medicine at Harvard Medical School and in a national poll by the National Sleep Foundation, 54% of adult drivers said they had driven while drowsy during the past year with 28% saying they had actually fallen asleep while driving. According to the National Highway Traffic Safety Administration, drowsy driving is a factor in more than 100,000 crashes, resulting in 6550 deaths and 80,000 injuries annually in the USA. When a person does not get an adequate
amount of sleep, his or her ability to function is affected. As listed below, their coordination is impaired, have longer reaction time, impairs judgment, and memory is impaired.”

https://en.wikipedia.org/wiki/Sleep-deprived_driving

- “Fatigue – You're More Than Just Tired...We wouldn't allow a friend to drive drunk, but we rarely take the keys away from our tired friends or insist that they take a nap before heading out on the road. Drowsy driving is impaired driving. NSC has gathered research that shows: You are three times more likely to be in a car crash if you are fatigued. More than 5,000 people died in drowsy-driving related crashes in 2014. Losing even two hours of sleep is similar to the effect of having three beers. Being awake for more than 20 hours is the equivalent of being legally drunk.” http://www.nsc.org/learn/NSC-Initiatives/Pages/Fatigue.aspx

- “Extreme weather in conjunction with Cerebral Hypoxia makes for a very dangerous driving experience when at high altitudes.” Steven Magee CEng MIET - Q

- “Neurologic Conditions: Assessing Medical Fitness to Drive...Wisconsin laws require that drivers “retain consciousness and the ability to have bodily control of a motor vehicle.” Factors affecting consciousness (e.g., seizures, syncope, hypoglycemia and sleepiness), perception (e.g., visual acuity and field of vision), mental functioning (e.g., dementia), neuromuscular and musculoskeletal function (e.g., adequate manipulation of vehicle controls), and behavior (e.g., self and impulse control) may limit safe driving.”

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1069044/

- “New info in Kitt Peak wreckage, human remains”


- “A cable car taking staff, cleaners and maintenance workers to an international astronomical observatory fell 80 metres (260ft) to the valley below...20 workers on board a cable car plunged to their deaths.” http://unofficialnetworks.com/2013/04/19/the-worst-cable-car-disasters-in-history/

- “Initially, the state prosecutor demanded a six month prison sentence for eight maintenance workers at the observatory, for their contributing roles in the accident....Three maintenance workers at the observatory were convicted on negligence charges”

https://en.wikipedia.org/wiki/Saint-%C3%89tienne-en-D%C3%A9voluy_cable_car_disaster


- “Great drive for those with a death wish”

https://www.tripadvisor.com/ShowUserReviews-g60583-d3140479-r192779874-Maunakea_Visitor_Information_Station-Hilo_Island_of_Hawaii_Hawaii.html

- “Woman dies after car lost control, tumbled down Mauna Kea”


- “Take A Drive On The Most Dangerous Road In Hawaii… If You Dare”

http://www.onlyinyourstate.com/hawaii/saddle-road-hi/

- “Route 200, known locally as Saddle Road, traverses the width of the Island of Hawai’i, from downtown Hilo to its junction with Hawaii Route 190 near Waimea. The road was considered one of the most dangerous paved roads in the state, with many one-lane bridges and areas of marginally maintained pavement. Most of the road has now been repaved, and major parts have
new re-alignments to modern standards. The highway reaches a maximum elevation of 6,632 feet (2,021 m) and is subject to fog and low visibility.” 

https://en.wikipedia.org/wiki/Hawaii_Route_200

- “10 Things Your Commute Does to Your Body” http://time.com/9912/10-things-your-commute-does-to-your-body/
- “For some workers in very high altitude astronomy, their daily round trip commute from home to the mountain summit was approximately six hours.” Steven Magee CEng MIET - Q
- “The health and well-being of remote and mobile workers...Health effects identified included musculoskeletal symptoms associated with higher mileage and more time in a vehicle but a number of vehicle design issues were found to improve symptoms.”
- “Motion sickness is a condition in which a disagreement exists between visually perceived movement and the vestibular system's sense of movement. Depending on the cause, it can also be referred to as seasickness, car sickness, simulation sickness or airsickness.[1] Dizziness, fatigue and nausea are the most common symptoms of motion sickness.[2] Sopite syndrome, in which a person feels fatigue or tiredness, is also associated with motion sickness. "Nausea" in Greek means seasickness (naus means ship).[3][4] If the motion causing nausea is not resolved, the sufferer will usually vomit. Vomiting often will not relieve the feeling of weakness and nausea, which means the person might continue to vomit until the cause of the nausea is treated.”
  https://en.wikipedia.org/wiki/Motion_sickness
- “Motion sickness” https://www.sciencedirect.com/topics/medicine-and-dentistry/motion-sickness
Recommended High Altitude Road Signs

- “Roads that provide rapid ascent to high altitudes should be clearly marked with the appropriate warning signs detailing the altitude disease risks.” Steven Magee CEng MIET
- “8,000 feet (2,438 meters): 20% of people who ascend to 8,000 feet (2,438 meters) develop some form of altitude disease. Descent is the recommended treatment.” Steven Magee CEng MIET
- “10,000 feet (3,048 meters): 40% of people who ascend to 10,000 feet (3,048 meters) develop some form of altitude disease. Descent is the recommended treatment.” Steven Magee CEng MIET
- “12,000 feet (3,657 meters): 60% of people who ascend to 12,000 feet (3,657 meters) develop some form of altitude disease. Descent is the recommended treatment.” Steven Magee CEng MIET
- “14,000 feet (4,267 meters) and above: Most people who ascend above 14,000 feet (4,267 meters) develop some form of altitude disease. Descent is the recommended treatment.” Steven Magee CEng MIET
Extreme Weather Hazards

- “The most extreme weather I have experienced was on top of high altitude mountain summits at astronomical observatories.” Steven Magee CEng MIET - Q
- “Weather on Mauna Kea can be severe and may include winds over 100 miles per hour, freezing temperatures, and snow storms. "White outs" caused by blowing snow can reduce visibility to zero. Deep snow drifts, freezing fog, and ice on the road can prevent passage. In the winter, ice may form suddenly, without warning. The steep paved grades are dangerous with just a thin coat of ice or snow. Visitors trapped on the mountain under these circumstances are in a life-threatening situation--they are in danger of freezing to death. Extreme weather that prevents the rescue of trapped visitors can last for more than a week.”
  http://www.ifa.hawaii.edu/info/bulletins/Mauna_Kea_Hazards.html
- “The most dangerous weather condition that I experienced at high altitude was walking out of the observatory to check on astronomers in another building during a snow blizzard. When I was returning to the observatory the conditions progressed to white out, stranding me in a nighttime snow field. I was only able to return to the safety of the observatory by following my footprints in the snow with the flashlight.” Steven Magee CEng MIET - Q
- “The primary dangers caused by bad weather center on the changes it causes in snow and rock conditions, making movement suddenly much more arduous and hazardous than under normal circumstances. Whiteouts make it difficult to retrace a route while rain may prevent taking the easiest line only determined as such under dry conditions. In a storm the mountaineer who uses a compass for guidance has a great advantage over a merely empirical observer. In large snow-fields it is, of course, easier to go wrong than on rocks, but intelligence and experience are the best guides in safely navigating objective hazards. Summer thunderstorms may produce intense lightning. If a climber happens to be standing on or near the summit, they risk being struck. There are many cases where people have been struck by lightning while climbing mountains. In most mountainous regions, local storms develop by late morning and early afternoon. Many climbers will get an "alpine start", that is, before or by first light, so as to be on the way down when storms are intensifying in activity and lightning and other weather hazards are a distinct threat to safety. High winds can speed the onset of hypothermia, as well as damage equipment such as tents used for shelter. Under certain conditions, storms can also create waterfalls which can slow or stop climbing progress. A notable example is the Föhn wind acting upon the Eiger.”
  https://en.wikipedia.org/wiki/Mountaineering#Weather
- “Temperature Extremes and the Workplace”
Lightning Hazards

- “The most amazing lightning I have seen has been at high altitude astronomical observatories. Watching a nearby tree being hit by lightning is an impressive sight and the explosion of sound is awesome!” Steven Magee CEng MIET - Q
- “Lightning emits a high powered electromagnetic pulse (EMP) that induces energy into everything in the area.” Steven Magee CEng MIET - Q
- “Lightning produces afterglow of gamma radiation...Lightning can produce X-rays and gamma radiation. In the past, researchers thought that this phenomenon only lasted for a very short time, about one ten-thousandth of a second. However, the ionizing radiation of lightning appears to emit much longer than presumed. An afterglow of gamma radiation arises, which lasts up to 10,000 times longer.” [https://phys.org/news/2017-10-lightning-afterglow-gamma.html](https://phys.org/news/2017-10-lightning-afterglow-gamma.html)
- “Gamma rays from lightning found to create antimatter in the air...Lightning is one of Earth's most energetic events, but there's much more to it than just a flashing fork and the rumble of thunder. Lightning strikes have been known to generate gamma rays, and now a team of Japanese researchers has found that those bursts can create photonuclear reactions in the atmosphere, resulting in the production – and annihilation – of antimatter.” [https://newatlas.com/lightning-gamma-rays-antimatter/52312/](https://newatlas.com/lightning-gamma-rays-antimatter/52312/)
- “Long term exposure to abnormally high levels of lightning may trigger genetic adaptation processes in the human.” Steven Magee CEng MIET - Q
- “An electromagnetic pulse (EMP), also sometimes called a transient electromagnetic disturbance, is a short burst of electromagnetic radiation. Such a pulse's origination may be a natural occurrence or man-made and can occur as a radiated, electric, or magnetic field or a conducted electric current, depending on the source.” [https://en.wikipedia.org/wiki/Electromagnetic_pulse](https://en.wikipedia.org/wiki/Electromagnetic_pulse)
- “Lightning strikes the earth more than 8 million times per day. The risk of being struck is low but the consequences of lightning strike injuries are serious. During 2003–2012, lightning caused an average of 35 deaths per year in the United States.” [https://www.cdc.gov/disasters/lightning/index.html](https://www.cdc.gov/disasters/lightning/index.html)
- “Lightning tends to be a nervous system injury and may affect any or all parts of the nervous system: the brain, the autonomic nervous system, and the peripheral nervous system. When the brain is affected, the person often has difficulty with short-term memory, coding new information and accessing old information, multitasking, distractibility, irritability and personality change....Early on, survivors may complain of intense headaches, tinnitus (ringing in the ears), dizziness, nausea, vomiting and other 'post-concussion' types of symptoms. Survivors may also experience difficulty sleeping, sometimes sleeping excessively acutely after the injury but changing during the next few weeks to inability to sleep more than two or three hours at a time. A few may develop persistent seizure-like activity several weeks to months after the injury.” [http://lightninginjury.lab.uic.edu/overview.htm](http://lightninginjury.lab.uic.edu/overview.htm)
- “Atmospheric electricity is the study of electrical charges in the Earth's atmosphere (or that of another planet). The movement of charge between the Earth's surface, the atmosphere, and the
Ionosphere is known as the global atmospheric electrical circuit. Atmospheric electricity is an interdisciplinary topic, involving concepts from electrostatics, atmospheric physics, meteorology and Earth science.” [https://en.wikipedia.org/wiki/Atmospheric_electricity](https://en.wikipedia.org/wiki/Atmospheric_electricity)

- “I don't have problems with arthritis (yet) but those that I do know both here in Colorado Springs and in Denver do have problems with barometric pressure. Whether or not that really has a medical affect (or effect) on arthritis is still up in the air as to it's validity. The thing is, those I know with joint problems (me, it's allergies), can sense a thunderstorm coming on long before it's apparent.” [http://www.city-data.com/forum/denver/310811-how-arthritis-denver.html](http://www.city-data.com/forum/denver/310811-how-arthritis-denver.html)
Sick Building Syndrome

- “Sick building syndrome (SBS) is a medical condition where people in a building suffer from symptoms of illness or feel unwell for no apparent reason.[1] The symptoms tend to increase in severity with the time people spend in the building, and improve over time or even disappear when people are away from the building. The main identifying observation is an increased incidence of complaints of symptoms such as headache, eye, nose, and throat irritation, fatigue, and dizziness and nausea.[2] These symptoms appear to be linked to time spent in a building, though no specific illness or cause can be identified. SBS is also used interchangeably with "building-related symptoms", which orients the name of the condition around patients rather than a "sick" building. A 1984 World Health Organization (WHO) report suggested up to 30% of new and remodeled buildings worldwide may be subject of complaints related to poor indoor air quality. Sick building causes are frequently pinned down to flaws in the heating, ventilation, and air conditioning (HVAC) systems. However, there have been inconsistent findings on whether air conditioning systems result in SBS or not.[4] Other causes have been attributed to contaminants produced by outgassing of some types of building materials, volatile organic compounds (VOC), molds (see mold health issues), improper exhaust ventilation of ozone (byproduct of some office machinery), light industrial chemicals used within, or lack of adequate fresh-air intake/air filtration (see Minimum efficiency reporting value).”

- “Sick Building Syndrome... Introduction. The term "sick building syndrome" (SBS) is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified. The complaints may be localized in a particular room or zone, or may be widespread throughout the building. In contrast, the term "building related illness" (BRI) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants. A 1984 World Health Organization Committee report suggested that up to 30 percent of new and remodeled buildings worldwide may be the subject of excessive complaints related to indoor air quality (IAQ). Often this condition is temporary, but some buildings have long-term problems. Frequently, problems result when a building is operated or maintained in a manner that is inconsistent with its original design or prescribed operating procedures. Sometimes indoor air problems are a result of poor building design or occupant activities”

- “Sick Building Syndrome (Environmental Illness, Multiple Chemical Sensitivity or MCS)... Sick building syndrome is believed by some to be an illness caused by unknown agents in buildings.”

- “Although in many cases the exact mechanism by which a building, or substances within the building, are causing the occupants to become ill is unknown, the problem areas can usually be identified and remedial action taken. In many SBS cases poor building design, maintenance, and/or operation of the structure's ventilation system may be at fault... The important thing is to take action to have a suspected sick building investigated as soon as possible as it is likely that the problem will only get worse if not addressed.”
“Indoor air quality (IAQ) is a term which refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. IAQ can be affected by gases (including carbon monoxide, radon, volatile organic compounds), particulates, microbial contaminants (mold, bacteria), or any mass or energy stressor that can induce adverse health conditions. Source control, filtration and the use of ventilation to dilute contaminants are the primary methods for improving indoor air quality in most buildings. Residential units can further improve indoor air quality by routine cleaning of carpets and area rugs. Determination of IAQ involves the collection of air samples, monitoring human exposure to pollutants, collection of samples on building surfaces, and computer modelling of air flow inside buildings. IAQ is part of indoor environmental quality (IEQ), which includes IAQ as well as other physical and psychological aspects of life indoors (e.g., lighting, visual quality, acoustics, and thermal comfort).”

“Ventilation is the intentional introduction of ambient air into a space and is mainly used to control indoor air quality by diluting and displacing indoor pollutants; it can also be used for purposes of thermal comfort or dehumidification. The correct introduction of ambient air will help to achieve desired indoor comfort levels although the measure of an ideal comfort level varies from individual to individual...Ventilation Rate Procedure is rate based on standard and prescribes the rate at which ventilation air must be delivered to a space and various means to condition that air.[6] Air quality is assessed (through CO2 measurement) and ventilation rates are mathematically derived using constants. Indoor Air Quality Procedure uses one or more guidelines for the specification of acceptable concentrations of certain contaminants in indoor air but does not prescribe ventilation rates or air treatment methods.[6] This addresses both quantitative and subjective evaluations, and is based on the Ventilation Rate Procedure. It also accounts for potential contaminants that may have no measured limits, or for which no limits are not set (such as formaldehyde offgassing from carpet and furniture)...ASHRAE continues to publish space-by-space ventilation rate recommendations, which are decided by a consensus committee of industry experts. The modern descendants of ASHRAE standard 62-1975 are ASHRAE Standard 62.1, for non-residential spaces, and ASHRAE 62.2 for residences.”

“Air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction.” ASHRAE Air Quality Requirements.

“The Standards for Ventilation and Indoor Air Quality. ANSI/ASHRAE Standards 62.1 and 62.2 are the recognized standards for ventilation system design and acceptable IAQ.“

“Indoor Air Quality and the Workplace”

“Air-conditioning in all buildings causes me very bad problems with arthritis and other problems. It seems to me that businesses do not air-conditioned at such a severe cold level like the warmer states.”

“Sick building syndrome - the collection of symptoms office workers have traditionally blamed on air-conditioning, photocopiers and dusty carpets - may have another cause: the computers at which they work.”
“Dirty Electricity - An Invisible Pollutant in Schools...Abstract: Dr. Magda Havas studied a Wisconsin elementary school that had been classified as a "sick building" by the school district. The principal called in a power quality expert who discovered excessive dirty power in the building. After installing Graham/Stetzer microsurge filters in the school as part of the study, the results of the study were clear: dirty electricity is contributing to the ill health of staff and students; that elementary-aged students are the most sensitive; and that this form of pollution may be significantly compromising the learning and working environment in schools. This and other studies show that young children seem to be the most sensitive to dirty electricity and their behaviour in the classroom improves when this pollutant is removed. Many of the behavioural traits that disappear are those we associated with ADD and ADHD. Students with asthma and teachers with allergies also improve when dirty electricity is reduced in school. Sick building syndrome has been associated with poor indoor air quality but recent evidence suggests that dirty electricity may be a significant contributor to this phenomenon. Monitoring and mitigating electromagnetic pollution in schools improves the school environment and may reduce ill health and learning difficulties.”

“No, Your Patient Is Not Crazy. Radiofrequency Sickness: Symptoms, Causes, Mechanisms, Diagnosis, and Treatment...Radio frequency sickness results from overexposure to radio frequency radiation. Radio frequency sickness is not a disease. It is an environmentally induced functional impairment. Radio frequency sickness has real and disabling consequences. People with radio frequency sickness experience illness (or even death) upon exposure to radio frequency radiation. The most common sources are electrical pollution – high frequencies that travel on building wiring or through the ground– and transmitters – all wireless devices. Radio frequency sickness develops when the exposure overwhelms the body’s ability to compensate for the effects produced by the exposure, often within 3-5 years. Detrimental biological effects, distinct from tissue heating effects, have been extensively documented in studies at a range of different frequencies and at levels far below the current United States safety standard.”

Multiple chemical sensitivity (MCS), also known as idiopathic environmental intolerances (IEI), is a disputed chronic condition characterized by symptoms that the affected person attributes to low-level exposures to commonly used chemicals. Symptoms are typically vague and non-specific. They may include fatigue, headaches, nausea, and dizziness. Commonly attributed substances include scented products, pesticides, plastics, synthetic fabrics, smoke, petroleum products, and paint fumes.”

“The NASA Clean Air Study[1] was led by the National Aeronautics and Space Administration (NASA) in association with the Associated Landscape Contractors of America (ALCA). Its results suggest that certain common indoor plants may provide a natural way of removing toxic agents such as benzene, formaldehyde and trichloroethylene from the air, helping neutralize the effects of sick building syndrome. The first list of air-filtering plants was compiled by NASA as part of a clean air study published in 1989,[2][3][4] which researched ways to clean air in space stations. As well as absorbing carbon dioxide and releasing oxygen, as all plants do, these plants also eliminate significant amounts of benzene, formaldehyde and trichloroethylene. The second and third lists are from B. C. Wolverton's book[5] and paper[6] and focus on removal of specific chemicals. NASA researchers suggest efficient air cleaning is accomplished with at least one plant per 100 square feet of home or office space. Other more recent research has...
shown that micro-organisms in the potting mix (soil) of a potted plant remove benzene from the air, and that some plant species also contribute to removing benzene.[7]”

https://en.wikipedia.org/wiki/NASA_Clean_Air_Study
Acclimatization

- “Most healthy people can ascend rapidly to 5,000 feet without experiencing symptoms of Acute Mountain Sickness (AMS), and then proceed to 9,000 or 10,000 feet the next day without significant difficulties. Above this altitude the pace of ascent should be slowed to 1,000 feet per day.” Going Higher. Oxygen, Man, And Mountains.
- “We can cautiously suggest that a healthy young person can go, during the course of three days, to 12,000 feet and not experience more than minor symptoms. Above this, climbing 1,000 to 1,500 feet a day, with a rest every third day, seems appropriate. Above 22,000 feet, our data confirm the belief that one does not acclimatize.” Going Higher. Oxygen, Man, And Mountains.
Law Enforcement At Very High Altitudes

- “The last thing you want when you are willfully damaging your workers health is for your biologically toxic workplace to fill up with law enforcement officers!” Steven Magee CEng MIET – Q
- “Altitude sickness is known to develop in some people above 4,900 feet and armed police officers should be screened to see how low it is occurring in them. A police officer with altitude sickness should be removed from duty and returned to sea level for recovery, regardless of how low it is occurring. Police officers that are repeatedly experiencing altitude sickness should be reassigned to sea level duty.” Steven Magee CEng MIET – Q
- “’Unconscionable’: Altitude sickness in officers assigned to Mauna Kea draws concern at least four deputy sheriffs and one attorney general investigator assigned to the TMT protest were evacuated from Mauna Kea and hospitalized…” It's disturbing and it's concerning because it's been a while and they've been up there too long,” said Kelli Keawe, union steward in the Department of Public Safety…Their symptoms of altitude sickness included spiking blood pressure, vision problems and cognitive issues such as slurred speech and inability to complete sentences.” [https://www.hawaiinewsnow.com/2019/10/19/new-concerns-over-law-enforcement-altitude-sickness-shifts-mauna-kea/](https://www.hawaiinewsnow.com/2019/10/19/new-concerns-over-law-enforcement-altitude-sickness-shifts-mauna-kea/)
- “Altitude sickness challenges state officers and TMT protesters…Altitude sickness is a very real danger on Mauna Kea. And law enforcement officers assigned to the Thirty Meter Telescope protest on the mountain are quickly learning that. Hawaii News Now has learned that seven state law enforcement officers were forced off the mountain in September because of altitude sickness. Five were evacuated and hospitalized. “HGEA is extremely concerned with the health and safety of deputy sheriffs,” wrote HGEA executive director Randy Perreira. The state Attorney General’s office confirmed three deputy sheriffs and one attorney general investigator were transported in separate incidents in an ambulance, but did not release specific dates. Sources told Hawaii News Now the officers have filed for workers compensation.” [https://www.hawaiinewsnow.com/2019/10/18/handful-law-enforcement-officers-evacuated-mauna-kea-after-altitude-sickness/](https://www.hawaiinewsnow.com/2019/10/18/handful-law-enforcement-officers-evacuated-mauna-kea-after-altitude-sickness/)
- “A smart sea level adapted police officer would refuse to work above 10,000 feet on the grounds of their own health and safety.” Steven Magee CEng MIET
- “A sea level adapted armed police officer that has developed altitude sickness should excuse themselves from duty and leave to sea level to treat it.” Steven Magee CEng MIET – Q
- “A sea level adapted armed police officer can legally refuse to venture above 10,000 feet in altitude on the grounds of health and safety.” Steven Magee CEng MIET – Q
- “A sea level adapted police officer with a gun above 10,000 feet in altitude is a really bad idea.” Steven Magee CEng MIET – Q
- “A sea level adapted human is not mentally fit to fire a gun above 10,000 feet in altitude.” Steven Magee CEng MIET – Q
- “A sea level adapted police officer would be wise not to venture above Hale Pohaku at 9,300-foot (2,800 m) on Mauna Kea due to altitude sickness and the associated health and safety problems that it may cause.” Steven Magee CEng MIET – Q
- “A sea level adapted armed police officer should leave to sea level at the first signs of altitude sickness.” Steven Magee CEng MIET – Q
“A sea level adapted armed police officer can legally refuse to work at high altitude if they have pre-existing health conditions.” Steven Magee CEng MIET – Q

“A sea level adapted armed police officer at high altitude that has developed altitude sickness can legally return to sea level to treat the condition under health and safety law.” Steven Magee CEng MIET – Q

“As a sea level adapted law enforcement officer, you are at serious risk of developing High Altitude Observatory Disease (HAOD) working at the summit of Mauna Kea, Hawaii, and it is highly unlikely that you will receive disability or workers compensation payments in the future for it.” Steven Magee CEng MIET – Q

“I am interested to observe how severe the acute mountain sickness is in sea level adapted law enforcement officers when the Mauna Kea protectors push them up to the 13,797’ summit.” Steven Magee CEng MIET – Q

"The police would be wise to purchase some home sleep study machines to monitor the health of their sea level adapted police officers assigned to the very high altitude mountain of Mauna Kea in Hawaii." Steven Magee CEng MIET – Q

"Alice NightOne. Designed to provide it all – ease, confidence, and reliability. The Alice NightOne home sleep testing (HST) device is designed to help patients get their study done right the first night." [https://www.usa.philips.com/healthcare/product/HC1109289/alice-nightone-home-sleep-testing-device](https://www.usa.philips.com/healthcare/product/HC1109289/alice-nightone-home-sleep-testing-device)

"I am interested to see if the Hawaii law enforcement department is going to research the effects of Mauna Kea Sickness (MKS) in its officers." Steven Magee CEng MIET – Q

"Sea level adapted law enforcement officers assigned to very high altitude mountains would be wise to purchase disability and life insurance, as the toxic environment is well known to cause biological damage that may lead to disabiling illnesses and fatal diseases." Steven Magee CEng MIET – Q
Hiring Very High Altitude Workers

- At the W. M. Keck Observatory, this was the hiring process when I worked there:
  - Invite the potential worker for a day or two long interview.
  - Part of the interview process was to take the potential summit worker to the very high altitude summit of Mauna Kea.
  - The worker would be observed for a few hours on the summit to see how they react to the very high altitude of Mauna Kea.
  - If the worker showed bad physical or mental reactions to the very high altitude summit of Mauna Kea, they generally would not be offered a job.
  - Extend job offer to candidate, contingent on passing a medical stress test.

- Once working:
  - The stress test would never be performed again and no monitoring of the summit workers mental or physical health would be done.
  - The worker would be directed to use the company supplied drugs to treat their summit sicknesses. No records of worker company drug use were maintained.
  - Workers showing signs and symptoms of High Altitude Observatory Diseases (HAOD) would be targeted for their resignation.

- “Stress Test. Also known as Exercise Stress Test, Treadmill Test. A stress test measures how healthy your heart is and how well it works during physical stress. Some heart problems are easier to identify when your heart is working hard to pump blood throughout your body, such as when you exercise...You will slowly start to exercise on a treadmill or stationary bicycle, and then gradually increase the treadmill speed or bicycle resistance until your heart is working at the target heart rate for your age. Most often, a stress test includes an electrocardiogram to measure your heart’s electrical activity as you exercise on a treadmill or on a stationary bicycle. Your doctor may also measure your blood oxygen level, blood pressure, and heart rate. During the test, you will exercise for 10 to 15 minutes. Your doctor will stop the test if you show any sign of a heart problem, or if you are too tired to continue the test.”
  
Astronomical Incompetence

- “Astronomers messing up the construction of the Hubble Space Telescope was a very public declaration that there were serious problems within the astronomical industry” Steven Magee CEng MIET
- “NASA and the telescope became the butt of many jokes, and the project was popularly regarded as a white elephant. For instance, in the 1991 comedy The Naked Gun 2½: The Smell of Fear, Hubble was pictured with the Lusitania, the Hindenburg, and the Edsel.” https://en.wikipedia.org/wiki/Hubble_Space_Telescope#Flawed_mirror
- “Mauna Kea Observatories...In Honolulu, the governor and legislature, enthusiastic about the development, set aside an even larger area for the observatory after the initial project, causing opposition on the Big Island, in the city of Hilo. Native Hawaiians (kānaka ‘ōiwi) believed the entire site was sacred and that developing the mountain, even for science, would spoil the area. Environmentalists were concerned about rare native bird populations and other citizens of Hilo were concerned about the sight of the domes from the city. Using town hall meetings, Jefferies was able to overcome opposition by weighing the economic advantage and prestige the island would receive.[3] There has been substantial opposition to the Mauna Kea observatories that continues to grow.[23] Over the years, the opposition to the observatories may have become the most visible example of the conflict science has encountered over access and use of environmental and culturally significant sites.[24] Opposition to development grew shortly after expansion of the observatories commenced. Once access was opened up by the roadway to the summit, skiers began using it for recreation and objected when the road was closed as a precaution against vandalism when the telescopes were being built. Hunters voiced concerns, as did the Hawaiian Audubon Society who were supported by Governor George Ariyoshi.[7]:56 The Audubon Society objected to further development on Mauna kea over concerns to habitat of the endangered Palila, a species endemic to only specific parts of this mountain. The bird is the last of the finch billed honeycreeper existing on the island. Over 50% of native bird species had been killed off due to loss of habitat from early western settlers or the introduction of non-native species competing for resources. Hunters and sportsmen were concerned that the hunting of feral animals would be affected by the telescope operations.[25] A "Save Mauna Kea" movement was inspired by the proliferation of telescopes, with opposition believing development of the mountain to be sacrilegious.[26] Native Hawaiian non-profit groups, such as Kahea, whose goals are the protection of cultural heritage and the environment, oppose development on Mauna Kea as a sacred space to the Hawaiian religion.[27] Today, Mauna Kea hosts the world's largest location for telescope observations in infrared and submillimeter astronomy. The land is protected by the United States Historical Preservation Act due to its significance to Hawaiian culture, but still allowed development.[28]” https://en.wikipedia.org/wiki/Mauna_Kea_Observatories
- “The Thirty Meter Telescope (TMT) is a proposed astronomical observatory with an extremely large telescope (ELT) that has become the source of controversy over its planned location on Mauna Kea in the US state of Hawaii. Construction of the TMT on land which is sacred to Native Hawaiian culture and religion[5] attracted international coverage[6] after October 2014, when construction was temporarily halted due to protests. While construction of the telescope was set to resume on April 2 and later on June 24, 2015, it was blocked by further protests each time.[7] The Board of Land and Natural Resources approved the TMT project,[8][9] but the
Environmental Radiation LLC - https://www.environmentalradiation.com

State Supreme Court of Hawaii invalidated the building permits in December 2015, ruling that the board had not followed due process. Roque de los Muchachos Observatory, La Palma, Canary Islands, Spain is the alternative site if construction cannot go forward in Hawaii.[10][11][12] The TMT would become the last area on Mauna Kea on which any telescope will ever be built.” https://en.wikipedia.org/wiki/Thirty_Meter_Telescope

- “The TMT International Observatory LLC (TIO), a non-profit organization, was established in May 2014 to carry out the construction and operation phases of the TMT Project. The Members of TIO are Caltech, the University of California, the National Institutes of Natural Sciences of Japan, the National Astronomical Observatories of the Chinese Academy of Sciences, the Department of Science and Technology of India, and the National Research Council (Canada); the Association of Universities for Research in Astronomy (AURA) is a TIO Associate. Major funding has been provided by the Gordon & Betty Moore Foundation.“ https://www.tmt.org/

- “Gordon and Betty Moore established the foundation to create positive outcomes for future generations. In pursuit of that vision, we foster path-breaking scientific discovery, environmental conservation, patient care improvements and preservation of the special character of the San Francisco Bay Area.” https://www.moore.org/home


- “W. M. Keck Observatory...Today Keck Observatory is supported by both public funding sources and private philanthropy. As a 501(c)3, the organization is managed by the California Association for Research in Astronomy (CARA), whose Board of Directors includes representatives from the California Institute of Technology and the University of California, with liaisons to the board from NASA and the Keck Foundation.” http://www.keckobservatory.org/

- “W. M. Keck Foundation” http://wmkeck.org/

- “University of California” https://www.universityofcalifornia.edu/

- “California Institute of Technology” https://www.caltech.edu/

- “National Aeronautics and Space Administration (NASA)” https://www.nasa.gov/

- “Jerry Nelson (astronomer)...Jerry Earl Nelson (January 15, 1944 – June 10, 2017) was an American astronomer known for his pioneering work designing segmented mirror telescopes, which led to him receiving the 2010 Kavli Prize for Astrophysics. He was the principal designer and project scientist for the Keck telescopes.” https://en.wikipedia.org/wiki/Jerry_Nelson_(astronomer)

- “University of Hawaii” https://www.hawaii.edu/

- “Institute for Astronomy - University of Hawaii” http://www.ifa.hawaii.edu/


- “USA Federal Government” https://www.usa.gov/


- “County of Hawaii” http://www.hawaiicounty.gov/

- “Occupational Safety and Health Administration (OSHA)” https://www.osha.gov/

- “United States DEPARTMENT OF LABOR (DOL)” https://www.dol.gov/

- “U.S. Food and Drug Administration (FDA)” https://www.fda.gov/
Astronomical White Elephants

- “A white elephant is a possession which its owner cannot dispose of and whose cost, particularly that of maintenance, is out of proportion to its usefulness. In modern usage, it is an object, building project, scheme, business venture, facility, etc., considered expensive but without use or value.” [https://en.wikipedia.org/wiki/White_elephant](https://en.wikipedia.org/wiki/White_elephant)

- “So Far, NASA's Flying Telescope Is a Huge Waste of Money...A new report has raised some questions about NASA's “flying telescope” that costs tens of millions of dollars to operate each year. Nature discovered the agency's SOFIA observatory—which stands for Stratospheric Observatory for Infrared Astronomy and embodies a partnership of exploration between the U.S. and Germany—was funded to publish 150 papers a year, but has produced an average of just 21 annual papers.” [https://www.popularmechanics.com/science/a32155982/nasa-flying-telescope-sofia-cost/](https://www.popularmechanics.com/science/a32155982/nasa-flying-telescope-sofia-cost/)
Failure to Perform Adequate Maintenance

- “When I was hired into Kitt Peak National Observatory by Columbia University, I was shocked at how run down their two telescopes were!” Steven Magee CEng MIET
- “When I arrived on site at Kitt Peak National Observatory, it was obvious there were a wide range of OSHA violations at the facility.” Steven Magee CEng MIET
- “The management team made it clear to me that OSHA was not to be allowed on site.” Steven Magee CEng MIET
- “After advising the management team that a manager was not competent to run the observatory to legally required OSHA health and safety standards, they were placed back in charge of the facility after I left.” Steven Magee CEng MIET
- “Arecibo Observatory director quits after funding row. Departure of long-term advocate adds to woes of the financially troubled radio telescope…Physicist Robert Kerr uses irony to describe the first hint of trouble: “Radio quiet,” he calls it. After four years as director of the Arecibo Observatory, home to the world’s largest single-dish radio telescope, he says, he was suddenly out of the loop: contacts at both the US National Science Foundation (NSF), which owns the Arecibo Observatory, and SRI International, the contractor that runs it, stopped returning his e-mails and phone calls. After a month of silence, Kerr was stripped of his role as the observatory’s principal investigator. Shortly afterward he resigned from his other post, as operations director.” https://www.nature.com/news/arecibo-observatory-director-quits-after-funding-row-1.18745
- “Robert Kerr, who was the operations director at the Arecibo Observatory has quit, following his loss of position as the telescope's principal investigator. He says that after he criticized the National Science Foundation, which owns the observatory, for planning to cut funding if Arecibo accepted private funding to search for extraterrestrial life, that the NSF and SRI International—the contractor that runs it—cut off certain avenues of communication with him and that he was stripped of his position as Arecibo's principal investigator. The NSF denies both the plan to cut funding and that communications lapsed.” https://www.facebook.com/PhysicsToday/posts/1015625324805164
- “I had a similar experience at Kitt Peak National Observatory as Robert Kerr had at Arecibo Observatory. After reporting behavioral problems in all staff that I supervised to the Dartmouth College management team, I was silently removed from management team emails and put into the dark. They insisted observatory records of daily staff behavioral problems be destroyed. I was then given a final warning of dismissal, even though no previous warnings had been received. I was told to stop keeping maintenance records. The toxic Dartmouth College management team continued to give me warnings of dismissal on a regular basis until I left and I regarded this as blatant workplace harassment. I was ‘Observatory Director’ in name only. I was told I had no management authority over all staff I had previously supervised. The management team silently changed my job from ‘Observatory Director’ to project engineer at the facility and would routinely refuse to purchase items I needed to do the project work. My project work was cobbled together out of parts that were already at the observatory and I was personally embarrassed at how it turned out and that my name was associated with it. It was not compliant with electrical engineering standards. I left to my next position at the earliest possible opportunity to remove myself from the abusive Dartmouth College environment. By the time I left I was aware the observatory had an established history of staff behavioral
problems and I later discovered the facility had a variety of serious sick building syndrome issues that may still be present today. During my employment with Dartmouth College I was developing a myriad of very weird health conditions including a severe anxiety disorder and was losing my voice in stressful situations. I was routinely attending the hospital, looking for answers as to why my health was rapidly degrading. I discovered numerous OSHA health and safety violations years later as I was investigating why my physical and mental health mysteriously ran down at the biologically toxic facility, which included mercury poisoning from mishandling telescope mercury systems and nitrogen enriched environments. No one at the facility had been on an OSHA approved mercury handling training course or nitrogen gas and cryogenic liquids course, I know this as I had reviewed their training certificates when I was becoming aware of workplace incompetence. As the years have passed, I have concluded that my failing health that took me into disability came from the myriad of biologically toxic exposures received during a decade of high altitude astronomical observatory work. I was clearly retaliated against by trying to get toxic Dartmouth College to understand the staff behavioral problems at the observatory. I now advise people to not work in high altitude ‘professional’ astronomy, as it has extensive biological toxicity associated with it that no amount of health and safety equipment can prevent. The poorly funded facilities are run down OSHA health and safety hazards, and are demoralizing to work for. I was blatantly denied USA government disability payments and astronomy Workers Compensation for USA ‘professional’ astronomy induced occupational diseases. I have never been compensated in any way for the biological damage USA ‘professional’ astronomy inflicted onto me.”

Steven Magee CEng MIET

• “NSF puts Arecibo Observatory on chopping block. The telescope was battered in recent years by tight budgets, poor morale, natural disasters, and now broken cables. Engineers have deemed the site unsafe…. John Mathews, an emeritus professor at the Pennsylvania State University who visited and used Arecibo regularly from 1969 through 2019, says that “deferred maintenance has been a problem for decades, and it’s only gotten worse.” He points to visible corrosion of dish components and sagging smaller cables. Those are external features, he admits, “but many of us suspected that the structure was compromised.” He adds that “the ship was sinking, and the people who could get jobs elsewhere wisely did so” after the transition to the current UCF-led management team in 2018. In conversations with Physics Today, many Arecibo users and employees suggested that the morale among employees was as frayed as the cables that broke. Some people interviewed for this story requested anonymity for fear of retaliation….A scientist who left recently says that some observing time was awarded based on friendships rather than merit. “I was a loud voice against stupid decisions and the toxic environment that my colleagues and I faced since UCF took over managing the observatory,” she says. “Finding friends and colleagues crying on the stairs became routine.””


• “Time’s Up for Toxic Workplaces” https://hbr.org/2020/06/times-up-for-toxic-workplaces?

• “Arecibo radio telescope, an icon of astronomy, is lost. Arecibo Telescope's illustrious scientific career is over…The National Science Foundation (NSF) will decommission Arecibo Observatory's massive radio dish after damage has made the facility too dangerous to repair, the agency announced today (Nov. 19)….After considering three separate engineering reports, the NSF, which owns the property, has decided the facility is unstable enough that there is no way to repair the damage that does not put personnel at undue risk….the entire facility at risk of an
uncontrolled collapse, unnecessarily jeopardizing people and also the additional facilities.”

- “Corrosive effects of the electromagnetic induction caused by the high voltage power lines on buried X70 steel pipelines”
- “Most forms of man-made electromagnetic radiation cause accelerated corrosion.” Steven Magee CEng MIET
- “Arecibo Observatory, also known as the National Astronomy and Ionosphere Center (NAIC), is an observatory in Arecibo, Puerto Rico owned by the US National Science Foundation (NSF)...The observatory has four radar transmitters, with effective isotropic radiated powers of 20 TW (continuous) at 2380 MHz, 2.5 TW (pulse peak) at 430 MHz, 300 MW at 47 MHz, and 6 MW at 8 MHz.” (Note: This RADAR information has been removed from Wikipedia)
- “The #Arecibo Observatory in Puerto Rico Collapses...“It was not inevitable,” she said of the collapse. “If they had properly maintained it, it’s likely that wouldn’t have happened.”
- “Working Safely with Wire Rope...Recent OSHA investigations found several workplace incidents involving wire rope failures, often resulting in worker fatalities. These ropes consist of multiple strands of concentrically wound wire, and degradation in only one strand may result in an unexpected break of that strand and an abrupt release in rope tension. When rope tension is lost, the load it is holding or the machine it is controlling may fall or move. Because the movement is unpredictable, workers are at risk for crushing and struckby injuries.

Understanding how wire rope is structured, what causes degradation, what to look for when inspecting ropes, and how often to inspect them assists in the prevention of both wire rope failure and worker injuries and fatalities...All wire rope components degrade over time in service but the degradation rate depends on several variables. For example, the degradation rate depends on how often the load limit is exceeded, cyclic loading history, proper periodic maintenance and lubrication, abrasive service history, core/rope design and weather/chemical exposure. When a wire rope’s structural components degrade, the rope may fail under load...Wire rope has a finite service life and therefore requires consistent, thorough, and documented inspections to identify component degradation before a failure. Conducting periodic inspections, as recommended by the manufacturers, is the most effective way to detect, monitor, and respond to wire fatigue failures...Detailed inspection requirements are described in the OSHA standards, industry consensus standards, and the manufacturer’s instructions. Wire ropes in general industry service must comply with 29 CFR 1910.179, 29 CFR 1910.180, and 29 CFR 1910.184, as applicable.”

- “Wire Rope Replacement Criteria...8.6.3.2 Replacement of a Single Suspension Rope. If one rope of a set is worn or damaged and requires replacement, the entire set of ropes shall be replaced, except, where one rope has been damaged during installation or acceptance testing prior to being subjected to elevator service, it shall be permissible to replace a single damaged rope with a new rope, provided that the requirements of 8.6.3.2.1 through 8.6.3.2.6 are met.”
- “Number of Broken Wire Discard Tables”
“Aerial footage of the fallen ARECIBO OBSERVATORY” [https://www.youtube.com/watch?v=tkFuz13dYE&feature=youtu.be&fbclid=IwAR09hBMrRQulGK1O4_LDctR9bJ65ekCTMvH8NX6aTBullOMfBeNsCfiNuUQ](https://www.youtube.com/watch?v=tkFuz13dYE&feature=youtu.be&fbclid=IwAR09hBMrRQulGK1O4_LDctR9bJ65ekCTMvH8NX6aTBullOMfBeNsCfiNuUQ)


“I was not surprised when the Arecibo Observatory collapsed.” Steven Magee CEng MIET

“It's a sad reflection on 'professional' astronomy that Arecibo Observatory reached the point of collapsing. Unfortunately, it is not alone in being a poorly maintained telescope. The huge RADAR system probably did not help the cause. I do wonder how many of the staff there have electromagnetic hypersensitivity, neurological and physical health issues? Hopefully they will be screened by the medical profession to establish why the telescope was allowed to collapse.” Steven Magee CEng MIET

“Arecibo isn't the first radio telescope to unexpectedly fail. Here's what we can learn from Green Bank's collapse.” [https://www.space.com/arecibo-observatory-green-bank-telescope-collapse-lessons?fbclid=IwAR2xZD-varCW2EIQzY1nrIKCafeUoIPVSCIFFGNT56jfXB4j0LxkEFahI0](https://www.space.com/arecibo-observatory-green-bank-telescope-collapse-lessons?fbclid=IwAR2xZD-varCW2EIQzY1nrIKCafeUoIPVSCIFFGNT56jfXB4j0LxkEFahI0)
Social Problems in High Altitude Astronomy

- “I found that high altitude astronomy was riddled with nepotism.” Steven Magee CEng MIET - Q
- “nepotism /ˈnɛpəˌtɪzəm/ noun 1. favouritism shown to relatives or close friends by those with power or influence” [http://www.dictionary.com/browse/nepotism](http://www.dictionary.com/browse/nepotism)
- “Nepotism made it extremely difficult to function as a manager in certain high altitude observatories.” Steven Magee CEng MIET - Q
- “It was who you knew and not how good you were that determined success in certain high altitude observatories.” Steven Magee CEng MIET - Q
- “When one of the workers suggested they could automate some of the manager’s job with software they could easily develop, they were instructed not to do so.” Steven Magee CEng MIET - Q
Destruction Of Staff Records

- “After informing the management team at Dartmouth College that I was keeping daily records of the behavioral problems that I was observing in all staff that I supervised, they insisted that those records be destroyed.” Steven Magee CEng MIET – Q
- “I was shown the door by Dartmouth College after reporting behavioral problems in all workers that I supervised.” Steven Magee CEng MIET – Q
- “Trying to get Dartmouth College to acknowledge the behavioral problems in all staff that I supervised got me a final warning of dismissal, when no previous warnings had been received.” Steven Magee CEng MIET – Q
- “It is important for managers that are observing behavioral problems in their workers to investigate them, even if the upper management team wants to cover them up.” Steven Magee CEng MIET – Q
- “When reporting behavioral problems in all staff to the upper management team, expect them to engage in a cover up at your expense.” Steven Magee CEng MIET – Q
- “By the time I left Dartmouth College, I regarded the management team as a dangerous group of people.” Steven Magee CEng MIET – Q
Altidiots

- “Altitude and Idiot are combined into Altidiot to form a Portmanteau word.” Steven Magee CEng MIET - Q
- “Portmanteau word, also called blend, a word that results from blending two or more words, or parts of words, such that the portmanteau word expresses some combination of the meaning of its parts. Examples in English include chortle (from chuckle and snort), smog (from smoke and fog), brunch (from breakfast and lunch), mockumentary (from mock and documentary), and spork (from spoon and fork). A portmanteau is a suitcase that opens into halves.”
  https://www.britannica.com/topic/portmanteau-word
- “Altidiot: Definition – A sea level adapted human that works in a biologically toxic high altitude job or lives in a biologically toxic high altitude area.” Steven Magee CEng MIET - Q
- “Do not be a professional astronomer’s altidiot.” Steven Magee CEng MIET – Q
- “I am an altidiot.” Steven Magee CEng MIET – Q
Disability Hazards

- “The vast majority of initial disability applications are denied.” Steven Magee CEng MIET - Q
- “Disability denials: Congressman calls for federal investigation into eligibility decisions...Paid by the case, doctors were reviewing up to five application files per hour. Experts said such speedy review of applications, which can contain thousands of pages of medical records, isn't plausible. Lawmakers in Tennessee have already called for an investigation.” [https://www.usatoday.com/story/news/nation/2019/06/05/social-security-disability-benefits-gao-investigation-rep-john-larson/1363075001/]
- “I had my long term health severely damaged by very high altitude astronomy and incorrectly thought that the government disability system would look after me.” Steven Magee CEng MIET - Q
- “For many sickened people the corporate government disability process takes approximately two to four years to go through. During that time you receive no disability benefits whatsoever.” Steven Magee CEng MIET - Q
- “This is how corporate government disability works for many sickened people: Year 1. Application = benefits denied; Year 2. Appeal = benefits denied; Year 3. Appeal to judge = benefits denied and the corrupt corporate government wishes you the best of luck with your disabilities and future life of extreme poverty.” Steven Magee CEng MIET - Q
- “After my three year journey through the corporate government disability system, I came to the conclusion that it is blatantly rigged to deny eligible sickened people their earned benefits.” Steven Magee CEng MIET - Q
- “There is blatant propaganda that is being presented to the general public that there are extensive fraudulent applications in the disability system, but the reality is that this ‘war on fraud’ is being used by the corrupt corporate government to deny millions of eligible sickened people their earned disability benefits.” Steven Magee CEng MIET - Q
- “Judges pressured to deny disability appeals, one judge tells the AJC...Ginsberg said once one of his clients gets a hearing scheduled, the outcome can largely depend on who gets the case. Some judges approve a vast percentage of their cases, while others deny an equally large number.” [http://www.myajc.com/news/national-govt--politics/judges-pressured-deny-disability-appeals-one-judge-tells-the-ajc/wDh8dfN5j9kxSXY5LrMApN/]
- “My disability lawyer warned me prior to the hearing that one of the worst judges had been assigned to my case.” Steven Magee CEng MIET - Q
- “The corporate government disability system is like a lottery that really comes down to which judge you have been assigned to, regardless of how many medically diagnosed disabling health conditions you have.” Steven Magee CEng MIET - Q
- “Based on what I saw in my disability hearing, my lawyer won my case. It was very surprising to receive the disability denial letter several months later.” Steven Magee CEng MIET - Q
- “My lawyer informed me after my disability hearing that she believed that she had won my case because it was so strong.” Steven Magee CEng MIET - Q
- “The USA government seems to have conveniently forgotten that its disability system is an insurance program to award disability benefits to ALL people that can no longer be employed due to their long term sickness.” Steven Magee CEng MIET - Q
- “Getting really sick in the USA results in bankruptcy for many people.” Steven Magee CEng
“This Atlanta woman lost her home waiting for disability...For Statler, 53, the wait was financially devastating. She lost her car, her house and her savings. She cashed in her life insurance and her children’s college funds. She got worse medically as well as she was forced to put off costly treatment while her case was pending. A heart attack in September landed her in the hospital.”

“There is a global correlation between disability and poverty, produced by a variety of factors. Disability and poverty may form a vicious circle, in which physical barriers and stigma of disability make it more difficult to get income, which in turn diminishes access to health care and other necessities for a healthy life.[24] The World report on disability indicates that half of all disabled people cannot afford health care, compared to a third of disabled people.[25] In countries without public services for adults with disabilities, their families may be impoverished.”

“Getting disability payments can be a fight to the death. Portland’s Social Security office has some of the nation’s longest delays for benefits, and in the years-long waits some die before seeing a dime...Sharyn took a 9mm Ruger from the nightstand, put the handgun to her head and pulled the trigger. Her death was ruled a suicide. Sharyn, 43, didn't leave a note. Sharyn's claim had languished nearly four years.”

“A BUMP ON THE HEAD...There is a huge shameful scandal involving this program that most Americans know nothing about unless they need to apply for this benefit themselves. This insurance is supposed to be a safety net for millions of disabled Americans, but because of continued program problems, the process of getting SSDI benefits can cause devastating, irreversible harm to your health and financial well-being, and it affects every aspect of a
claimant’s life. I know this for a fact because it happened to me! The application process to get SSDI benefits often exacerbates/creates new health issues, and many people lose all their financial resources, their homes, even their lives while waiting for approval of their claims. If you don’t suffer from depression before applying for benefits, chances are you will, in fact many contemplate or attempt suicide.”

- “Unfit for Work. The startling rise of disability in America...There's no diagnosis called disability. You don't go to the doctor and the doctor says, "We've run the tests and it looks like you have disability." It's squishy enough that you can end up with one person with high blood pressure who is labeled disabled and another who is not....Dr. Timberlake is making a judgment call that if you have a particular back problem and a college degree, you're not disabled. Without the degree, you are.”

- “Long Waits And Long Odds For Those Who Need Social Security Disability...Hashmi was diagnosed with systemic lupus, a medical condition in which the body's immune system attacks its own tissues and organs. She's had surgery and other treatments, but now, at age 41, Hashmi is often bedridden. She finally had to leave her job about six years ago, but when she applied to the Social Security Administration for disability benefits, she was denied.”

- “The disability system discriminates against those that are educated.”

- “The corporate government disability system claiming that an extremely sickened educated person is not disabled would be akin to the scientific community falsely claiming that Albert Einstein was not a genius.”

- “While the USA corporate government took three years to deny my disability application, the UK approved my pension plan early disbursement on the grounds of ill-health in just a few months from applying using the same medical information.”

- “The disability system makes false assumptions to deny your payments.”

- “During the time I went through the corporate government disability system, I was aware that I had a strange sickness that would eventually kill me if not properly diagnosed and treated.”

- “In addition to the numerous disabling health conditions that I had been diagnosed with by the medical profession, there was a long term un-diagnosed vitamin B12 deficiency, commonly known as Pernicious Anemia, which has been historically fatal.”

- “Anemia and B12 Deficiency- Historically Fatal, Still Formidable...many of the symptoms of pernicious anemia are disabling, and often confused with other conditions like clinical depression, thyroid disorder, and diabetes.”

- “Mental Changes from B12 Deficiency. Some of the less classic, but still common, vitamin B12 Deficiency Symptoms are Mental Changes from B12 Deficiency. These are particularly devastating because they cause so much disability, and yet are very responsive to therapy with Methylcobalamin B12 if they are caught early. Unfortunately, physicians rarely, if ever do the necessary Methylmalonic Acid Test that would allow the deficiency to be caught early and the sufferers usually go on to be diagnosed with an ‘incurable’ mental or neurologic ‘disease’. Some of these mental changes of B12 deficiency mimic problems such as: Mental Illness.
Depression. Dementia and Alzheimers Disease. Multiple Sclerosis and other "Degenerative Spinal Cord" Diseases. 'Brain Fog' or the inability to think clearly."

- "The problem with getting old and sick is you learn that corporate government systems that you thought would protect you actually fail you.” Steven Magee CEng MIET - Q
- “As an experienced electrical engineer in the USA, I was earning in excess of $100,000 annual salary plus benefits. There was no incentive whatsoever to be disabled and in poverty on a corporate government disability program.” Steven Magee CEng MIET - Q
- “If you have a degree, an established career history prior to disability, and are under fifty years of age, getting on government disability is extremely hard no matter how sick you are.” Steven Magee CEng MIET - Q
- “It is disappointing to witness the corporate government disability system letting massive numbers of sickened people down during their greatest time of need.” Steven Magee CEng MIET - Q
- “While the corporate government wants you to believe many people that apply for disability are fraudulent, the reality is that the far bigger corporate government fraud are the massive numbers of eligible sickened people that are being denied their earned disability payments.” Steven Magee CEng MIET - Q
- “Corporate government social security left me sickened, unable to work, and without any disability income for the rest of my life.” Steven Magee CEng MIET - Q
- “Being denied disability payments shatters your faith in corporate government.” Steven Magee CEng MIET - Q
- “The corporate government is completely okay with sending sickened people into extreme poverty for the rest of their lives by blatantly denying their genuine disability claim.” Steven Magee CEng MIET - Q
- “Very high altitude workers should be aware that if they become disabled by Mauna Kea Sickness (MKS) that it is highly unlikely that they will get government disability payments.” Steven Magee CEng MIET - Q
- “If you apply for government disability, I wish you the best of luck...as you are going to need it!” Steven Magee CEng MIET - Q
- “Given that the corporate government disability system is denying sickened Mauna Kea workers their earned disability benefits, it falls back onto their very high altitude past employer to compensate them for their loss of earnings, pain and suffering.” Steven Magee CEng MIET - Q
- “3 Social Security Horror Stories” https://www.forbes.com/sites/kotlikoff/2016/05/22/3-social-security-horror-stories/#11f01e9b754e
- “ATTENTION: BE AWARE THAT WHAT YOU DON'T KNOW CAN DESTROY YOUR LIFE! AMERICANS ARE NOT GETTING THE SOCIAL SECURITY DISABILITY BENEFITS THAT THEY HAVE EARNED AND PAID FOR! SOCIAL SECURITY DISABILITY NIGHTMARE - IT CAN HAPPEN TO YOU! Before you read any further I am going to ask you a very important question, and as you read on, keep asking yourself - How long could YOU survive with ABSOLUTELY NO INCOME, if you got sick or hurt, and could no longer work? What you are about to learn may have an impact your life forever!”

http://www.frontiernet.net/~lindaf1/SOCIALSECURITYDISABILITYNIGHTMARE.html

who apply for disability benefits get rejected.”
https://www.fool.com/retirement/general/2014/09/06/social-security-disability-why-do-so-
many-american.aspx
• “Social Security Disability Approval Rates Remain Low…Approval rates for people seeking
Social Security Disability Insurance (SSDI) benefits in 2015 remained at historic lows…Only
33% of Social Security disability applicants were approved when they initially filed for benefits
during fiscal year 2015. Just 45% of those who appealed and went to the hearing level were
approved. In addition, hearing wait times continue to rise, reaching more than 700 days for tens
of thousands of claimants.” https://www.truehelp.com/social-security-disability-approval-rates-
remain-low-allsup-reports/
• “Best & Worst US States for Social Security Disability Approval”
https://visual.ly/community/infographic/politics/best-worst-us-states-social-security-disability-
approval
• “The USA disability statistics clearly show that the sordid system abandons the majority of its
sickened applicants in their time of greatest need.” Steven Magee CEng MIET - Q
• “Social security disability payments are modest,” Jarrett says. "At the beginning of 2015,
Social Security paid an average monthly disability benefit of $1,165." The payment is meant to
help people meet basic living needs, and the program is designed to replace some, but not all,
lost income. "It's a safety net for those who are no longer able to work on a regular basis,"
disability-insurance/
• “For many people, years spent voyaging through the corporate government disability system
results in a blatant denial of earned benefits and an education in how legal system fraud works.”
Steven Magee CEng MIET - Q
• “The government disability program has developed a wide range of feeble excuses to deny you
your earned benefits.” Steven Magee CEng MIET - Q
• “The disability system employs ‘Expert Doctors’ that interview you and write reports that do
not reflect your daily health problems in order to deny your earned disability payments.” Steven
Magee CEng MIET - Q
• “Several months after a judge denied my disability application, it emerged that the medical
profession had set my continuous positive airway pressure (CPAP) machine to the wrong
pressure. It had been set to a pressure of 7 cmH20 when it needed to be set to 13 cmH20, it had
been operating for years at almost half the required pressure and not correctly treating my sleep
disorders and low blood oxygen levels.” Steven Magee CEng MIET
• “If you pressure is too low, you won’t be getting the treatment you need or the health benefits.
You might wake up tired despite using your CPAP every night.” https://blog.easybreathe.com/5-
problems-that-can-be-fixed-by-upgrading-your-cpap/
• “A pressure setting which is too low makes people feel like CPAP therapy is not really working.
Many of the same symptoms of pre-CPAP therapy remain, such as daytime tiredness,
irritability, and lack of concentration.” http://www.thecpapshop.com/blog/addressing-the-
frustration-that-result-in-cpap-therapy-non-compliance/
• “That being said, people with more severe sleep apnea do more often need higher pressures on
CPAP, or even bilevel therapy…If the pressure is too low, your sleep apnea will not be
adequately controlled.” https://www.verywell.com/are-severe-sleep-apnea-and-cpap-pressure-
correlated-3015267

660
“The sleep apnea/hypopnea syndrome (SAHS) occurs in 2 to 4% of the middle aged population (1) causing impaired daytime functioning as a result of excessive daytime somnolence, cognitive impairment and altered mood.”
https://www.atsjournals.org/doi/full/10.1164/ajrccm.159.4.9807111

“The sleep cycle of alternate NREM and REM sleep takes an average of 90 minutes, occurring 4–6 times in a good night's sleep.[10][12] The American Academy of Sleep Medicine (AASM) divides NREM into three stages: N1, N2, and N3, the last of which is also called delta sleep or slow-wave sleep.[13] The whole period normally proceeds in the order: N1 → N2 → N3 → N2 → REM. REM sleep occurs as a person returns to stage 2 or 1 from a deep sleep.[1] There is a greater amount of deep sleep (stage N3) earlier in the night, while the proportion of REM sleep increases in the two cycles just before natural awakening.”
https://en.wikipedia.org/wiki/Sleep

“People with apnea may have reduced stages N3 and REM when their interrupted breathing causes sleep to be fragmented, possibly alternating between stages N1 and N2 over and over all night.”
https://www.sleephealth.org/sleep-health/importance-of-sleep-understanding-sleep-stages/

“I have a complete absence of stage N3 slow wave sleep that causes excessive daytime sleepiness, normal people spend 15-20 percent in N3. This has been repeatedly proven by the medical profession through numerous sleep studies. I spend 89 percent of the night in N2 light sleep, normal people spend only 50 percent of their night in N2. I fall asleep in one minute and have several awakenings per night. I have been diagnosed with excessive daytime sleepiness for years.”
Steven Magee CEng MIET

“I noticed that I had developed excessive daytime sleepiness after I started working extreme night shifts on the very high altitude summit of Mauna Kea in Hawaii. Staying awake during the daytime has been a problem ever since.”
Steven Magee CEng MIET - Q

“Sleeping Stage N3 is the deepest stage of sleep. Stage N3 sleep is called slow-wave sleep. Just recently Sleeping stage N4 (greater than 50% delta waves) was added to N3. N3 is acquired when only 20% of delta waves (0.5 to 2 Hz) are present This is the stage where parasomnias such as night terrors, nocturnal enuresis, bed wetting, sleepwalking, and somniloquy occur. Slow-wave sleep is the period when a person is least affected by its outside environment. At this point it is very difficult to wake up from noise, like an alarm clock. If you are waken up during this period, you are likely to be tired. Sleep inertia is the period for 30 minutes after when you wake up in slow-wave sleep. During sleep inertia your brain activity and mental performance are slower and less accurate. If you are sleep deprived, slow-wave sleep will be longer and deeper in order to restore energy. Some of the few factors known to increase slow-wave sleep in the sleep period that follows them include body heating, high carbohydrate ingestion, and long exercise.”
http://alm7.wikispaces.com/Sleeping+Stage+N3

“Excessive daytime sleepiness (EDS) is characterized by persistent sleepiness and often a general lack of energy, even during the day after apparently adequate or even prolonged nighttime sleep. EDS can be considered as a broad condition encompassing several sleep disorders where increased sleep is a symptom, or as a symptom of another underlying disorder like narcolepsy, sleep apnea or a circadian rhythm sleep disorder. Some persons with EDS, including those with hypersomnias like narcolepsy and idiopathic hypersomnia, are compelled to nap repeatedly during the day; fighting off increasingly strong urges to sleep during inappropriate times such as while driving, while at work, during a meal, or in conversations. As the compulsion to sleep intensifies, the ability to complete tasks sharply diminishes, often mimicking the appearance of intoxication. During occasional unique and/or stimulating
circumstances, a person with EDS can sometimes remain animated, awake and alert, for brief or extended periods of time. EDS can affect the ability to function in family, social, occupational, or other settings. A proper diagnosis of the underlying cause and ultimately treatment of symptoms and/or the underlying cause can help mitigate such complications.”

https://en.wikipedia.org/wiki/Excessive_daytime_sleepiness

- “Most people do not realize how corrupt the corporate government disability system is until they become so sick that they try to use it.” Steven Magee CEng MIET - Q
- “The USA claims to be a first world country but it has the disability system of a third world country.” Steven Magee CEng MIET - Q
- “Social Security Disability Insurance...Qualification. According to the Social Security Administration (SSA) they have a physical or mental condition that prevents them from engaging in any "substantial gainful activity" ("SGA"), and the condition is expected to last at least 12 months or result in death, and they are under the age of 65, and generally, they have accumulated 20 social security credits in the last 10 years prior to the onset of disability (normally four credits per full or partial year); one additional credit is required for every year by which the worker's age exceeds 42.”


- “Permanently and Totally Disabled. Being permanently and totally disabled means that you (or your spouse) can't engage in any substantial gainful activity because of your (or your spouse's) physical or mental condition. Substantial gainful activity generally includes full-time or part-time work done for pay (or generally done for pay) that is commensurate with the minimum wage. A physician must certify that the condition has lasted or can be expected to last continuously for 12 months or more, or that the condition can be expected to result in death.”

H&R Block

- “The corporate controlled government is completely okay with your health being damaged by your employer, but shirks its responsibility to give you disability payments when you have become too sick to work.” Steven Magee CEng MIET - Q
- “One of the biggest government frauds is denying eligible sickened people their disability benefits.” Steven Magee CEng MIET - Q
- “I can sum up the corporate government disability system with two words: Toxic Bureaucrats.” Steven Magee CEng MIET - Q
- “Disabled in the USA? Congratulations, you have now obtained the secret corporate government status of ‘Garbage’.” Steven Magee CEng MIET – Q
- “Turned down for federal disability payments, thousands die waiting for appeals to be heard.”


- “After being denied my earned disability benefits, I concluded that I had nothing to lose by speaking out about the illegal workplace activities I had observed during my career.” Steven Magee CEng MIET – Q
Workers Compensation

- “Workers’ compensation is a form of insurance providing wage replacement and medical benefits to employees injured in the course of employment in exchange for mandatory relinquishment of the employee's right to sue their employer for the tort of negligence. The trade-off between assured, limited coverage and lack of recourse outside the worker compensation system is known as "the compensation bargain". One of the problems that the compensation bargain solved is the problem of employers becoming insolvent as a result of high damage awards. The system of collective liability was created to prevent that, and thus to ensure security of compensation to the workers. Individual immunity is the necessary corollary to collective liability. While plans differ among jurisdictions, provision can be made for weekly payments in place of wages (functioning in this case as a form of disability insurance), compensation for economic loss (past and future), reimbursement or payment of medical and like expenses (functioning in this case as a form of health insurance), and benefits payable to the dependents of workers killed during employment. General damage for pain and suffering, and punitive damages for employer negligence, are generally not available in workers' compensation plans, and negligence is generally not an issue in the case. These laws were first enacted in Europe and Oceania, with the United States following shortly thereafter.”
  https://en.wikipedia.org/wiki/Workers%27_compensation
- “Workers' Compensation Benefits FAQ. Frequently asked questions about workers' compensation for job-related injuries and illnesses.”
- “Can I file a workers’ comp claim after I quit? It’s possible to qualify for workers’ comp benefits if you were injured before you left your job—even if you didn’t file a claim until later—as long as you meet certain requirements.”
- “Workers' Compensation: What Happens If I'm Late Reporting My Injury?...If you have an occupational illness or a condition that develops gradually, such as arthritis or chronic obstructive pulmonary disease (COPD), the time period for notifying your employer may be longer and typically doesn’t start until you discover the condition and its connection to your work. This usually happens when a doctor tells you that your job activities caused the problem. Because your back injury worsened over time, you may still be eligible for benefits even if the deadline has passed from the date of the accident. However, now that you know your back condition is related to your job, you should report it immediately.”
- “An occupational disease is any chronic ailment that occurs as a result of work or occupational activity. It is an aspect of occupational safety and health. An occupational disease is typically identified when it is shown that it is more prevalent in a given body of workers than in the general population, or in other worker populations. The first such disease to be recognised, squamous-cell carcinoma of the scrotum, was identified in chimney sweep boys by Sir Percival Pott in 1775[citation needed]. Occupational hazards that are of a traumatic nature (such as falls by roofers) are not considered to be occupational diseases. Under the law of workers' compensation in many jurisdictions, there is a presumption that specific disease are caused by the worker being in the work environment and the burden is on the employer or insurer to show that the disease came about from another cause. Diseases compensated by national workers..."
compensation authorities are often termed occupational diseases. However, many countries do not offer compensations for certain diseases like musculoskeletal disorders caused by work (e.g. in Norway). Therefore, the term work-related diseases is utilized to describe diseases of occupational origin. This term however would then include both compensable and non-compensable diseases that have occupational origins.”

- “Workers' Compensation: Occupational Disease...Occupational diseases cause 860,000 illnesses and 60,300 deaths in the United States annually according to the American Academy of Family Physicians. Illness directly attributable to work conditions and exposures is diagnosed in approximately 10 percent of hospitalized patients.”

- “What Is An Occupational Disease in Workers’ Compensation?...occupational diseases covered by workers’ compensation are diseases caused by conditions that are characteristic with a particular trade or occupation, but excluding ordinary diseases of life to which the general public is equally exposed outside of the employment. For example, if a worker, whose job was a paint sprayer for many years, has lung damage due to him breathing a specific chemical in the paint, he would probably have an occupational disease. However, an office worker who happens to develop a lung disease that is common to the everyday public would probably not have a compensable occupational disease under workers’ compensation…1) the employee was exposed to a hazardous substance in the employment, 2) the employee developed a disease, 3) the occupation exposed the employee to a greater risk of developing the disease compared to the general public, 4) the exposure to the substance was a substantial factor in the employee developing the disease, and 5) the occupational disease caused injury or death. An occupational disease claim must be filed within two years of the diagnosis by a physician.”

- “The Doctor’s Statement of Causation...the injured worker bears the burden of proof; meaning that you must prove to the insurance company and/or the Virginia Workers’ Compensation Commission that your injuries are a result of your work place accident. It is up to the injured worker to show that timely notice of the injury was given to the employer and to prove that the accident caused your injury and disability.”

- “Injured workers seeking benefits must be evaluated and diagnosed by workers’ compensation doctors approved by the employer’s insurance company. For many injured workers, that means facing an Independant Medical Examination, or IME ordered by the workers’ compensation insurance company.”
https://www.injuryclaimcoach.com/workers-comp-doctor.html

- “Why Your Workers' Compensation Claim Could Be Denied. Here are some of the most common reasons a workers' compensation insurer would question the validity of your work injury claim.”

- “The Demolition of Workers’ Comp. Over the past decade, states have slashed workers’ compensation benefits, denying injured workers help when they need it most and shifting the costs of workplace accidents to taxpayers.”
https://www.propublica.org/article/the-demolition-of-workers-compensation

- “Except as provided in s. 102.555 with respect to occupational deafness, “time of injury”, “occurrence of injury”, or “date of injury” means: Occupational Injury or Disease Under Workers Compensation Law...1. In the case of accidental injury, the date of the accident which
caused the injury. 2. In the case of disease, the date of disability or, if that date occurs after the cessation of all employment that contributed to the disability, the last day of work for the last employer whose employment caused disability.”

- “The Fallout of Workers’ Comp ‘Reforms’: 5 Tales of Harm. Injured workers share their stories, revealing the real-life impact of rollbacks that have been spreading across the country.”

- “Worked to Death. How victims are shut out of the workers’ comp system by big bills, bad laws, and companies that will do anything but pay...When it comes to chemically induced illnesses and other job-triggered diseases that creep up over time, according to researchers and the federal agency overseeing occupational safety, workers’ comp rarely works at all.”

- “DOES THE WORKERS’ COMPENSATION SYSTEM FULFILL ITS OBLIGATIONS TO INJURED WORKERS?...Despite the sizable cost of workers’ compensation, only a small portion of the overall costs of occupational injury and illness is borne by employers. Costs are instead shifted away from employers, often to workers, their families and communities. Other social benefit systems – including Social Security retirement benefits, Social Security Disability Insurance (SSDI), Medicare, and, most recently, health care provided under the Affordable Care Act – have expanded our social safety net, while the workers’ compensation safety net has been shrinking. There is growing evidence that costs of workplace-related disability are being transferred to other benefit programs, placing additional strains on these programs at a time when they are already under considerable stress.”

- “In 2019 indoor air quality testing had revealed that Multiple Chemical Sensitivity (MCS) was present. House fresh air ventilation had to be substantially increased to reduce elevated carbon dioxide levels within the home that was causing malaise, chronic fatigue and daytime sleepiness. Several months of mercury chelation had delivered improved health, which had confirmed my suspicion of mercury poisoning. I was showing a beneficial response to radiation treatment using DHEA hormone supplementation. Based on the range of diagnosed conditions and treatments, it was clear at this point that I had developed a classic case of High Altitude Observatory Disease (HAOD) and I applied for workers compensation in March 2019 to the W. M. Keck Observatory and the Ivy League institutions of Columbia University and Dartmouth College. It had emerged that I was having chronic fatigue reactions to over the counter medications and to prescription medications and was displaying ‘Drug Intolerance.’. Drug intake reduced. Sleeping with a nighttime mouth guard to treat sensitive teeth problems.”

Steven Magee CEng MIET

- “I applied directly to the W. M. Keck Observatory and the Ivy League institutions of Columbia University and Dartmouth College for workers compensation for the long term effects of High Altitude Observatory Disease (HAOD) One month later, all of them had not supplied the requested information to enable me to apply for their Workers Compensation insurance.”

Steven Magee CEng MIET

- "What To Do When Your Employer Is Uncooperative with Workers’ Comp Claim…If you get the sense that your employer is trying to cause problems for your claim – or if they simply..."
refuse to give you what you need – you should seek legal help as soon as possible. In many cases, the sooner you get an attorney involved, the sooner you will be able to receive the benefits you deserve.”

- “‘My Boss Won’t Report to Workers’ Comp’...When you report an injury to your employer, the company is required to complete an injury report and file it with the company’s workers’ compensation insurance provider. The completion of this task is important to the commencement of your treatment and timely payment of benefits. Unfortunately, it is not uncommon for employers to either refuse their cooperation in the process or employ tactics to discourage your involvement in the workers’ compensation process.”

- “Four weeks after sending letters and receiving no information from W. M. Keck Observatory and the Ivy League institutions of Columbia University and Dartmouth College regarding workers compensation for the long term effects of High Altitude Observatory Disease (HAOD), I applied directly to the government workers compensation departments of the states of Hawaii, New York and New Hampshire.” Steven Magee CEng MIET

- “I applied for workers compensation for the long term effects of High Altitude Observatory Disease (HAOD) caused by the W. M. Keck Observatory and the Ivy League institutions of Columbia University and Dartmouth College. To date, I have not received any compensation from any of them for my injuries or diseases.” Steven Magee CEng MIET

- “Why Won’t my Doctor Accept Workers’ Compensation Insurance?...all health insurance policies have an exclusion for work-related injuries. That means that if you are injured during the course of your employment, your health insurance policy will not pay for any medical treatment that is determined to be made necessary by your work injury. The only exception to this rule is a situation where you are injured at work and your employer’s workers’ compensation insurer has denied payment for your medical treatment. The workers’ compensation insurer’s denial will then trigger your health insurer’s obligation to pay for the medical treatment so long as it is determined to be treatment that is reasonable and necessary.”

- “A high-altitude job may lead to workers’ compensation injury...With the beautiful mountains in Colorado, traveling to high altitudes from lower ones can be a near daily event for some workers as well as visitors. For those having that work commute or condition, however, this kind of work-related reality may cause altitude sickness. For instance, those working in mining may deal with it. However, it would seem even a service worker who commutes up a high mountain could be subject to it, and it may constitute an occupational illness. If a worker suffers from such occupational illness, he may find it to be an illness covered under Colorado’s workers’ compensation laws...As noted by the United States’ National Center for Biotechnology Information, federal authorities recognize occupational forms of AMS and have sought to identify controllable risks to reduce the incidence of AMS.”
Workers Compensation - Occupational Diseases

- “What is an Occupational Disease? To meet the definition of an occupational disease, your condition must be contracted in the course of employment. In such a situation, the conditions of employment put the employee at a greater risk of illness than the general public. In order to receive workers’ compensation benefits, you have to establish that your illness was caused by a work-related exposure. According to OSHA, some of the most common occupational diseases are caused by exposures to: Air contaminants such as dust, gases, or fumes. Chemicals. Extreme levels of noise, vibrations, temperature, or light. Repetitive motions, heavy lifting, or other ergonomic problems. Biological hazards such as bacteria, viruses, fungi, or other living organisms. Radiation or radioactive rays.”

- “Handling the Occupational Disease Case...in order to establish a claim for an occupational disease, a claimant must establish that the condition is not only caused by the employment, but by a distinctive feature of the employment. As we can see from the Aldrich case it does not need to be some element found only in very unique employments, such as exposure to asbestos or silica dust, but only something that is a distinctive feature of the job, such as a nurse who has to do a great deal of walking, certainly an activity not limited to those in the nursing profession.”

- “The conditions of employment, however, which distinguish occupational diseases from ordinary diseases of life need not be unusual chemicals or fumes. They may be distinctive because familiar harmful elements are present in an unusual degree. For example, exposure to change in temperature is common to all life and employment. A moderate amount of it, resulting in splotches on the legs of a theatre ticket seller, has therefore been held not to render that condition an occupational disease. But in the same state the contraction of rheumatoid arthritis has been held occupational when it resulted from continued handling of ice and iced vegetables by a worker in a wholesale market.” Likewise, a butcher's pulmonary emphysema has been recognized as an occupational disease, although the disease itself is common to mankind, because of the causal relation to the employment hazard of breathing refrigerated air.”

- “PSYCHIATRIC INJURIES...employees who have suffered from psychiatric injuries, such as depression or PTSD, in the course of their employment. Various injuries fall under the coverage...including psychological stress, trauma, and occupational disease.”

- "OCCUPATIONAL DISEASE...Workers’ compensation benefits include payment of medical bills for treatment associated with the occupational disease. The benefits you can expect to receive will depend on the specific facts of your claim. In general, an award can include following types of compensation: Temporary total compensation. Wage loss compensation. Percentage of permanent partial disability for residual impairment. Permanent total disability. Lump sum settlement award"
Environmental Radiation LLC - https://www.environmentalradiation.com

Supplementary benefits may be available in cases of death or disability.”

The following health conditions would likely be covered as a high altitude occupational disease by workers compensation:

- Heavy metal poisoning:
  - If you have handled mercury systems with no industry recognized training, no respiratory protection and no gloves and have had to chelate heavy metals to improve health, you should be eligible. Steven Magee chelated mercury to gain improved health in 2019. He had extensively handled observatory mercury systems without respiratory protection or gloves. He has many photographs of his coworkers doing the same thing.
- Multiple Chemical Sensitivity:
  - Arises from breathing low pressure abnormal air contaminated with chemicals and gasses. Steven Magee discovered that he had multiple chemical sensitivities in 2019 and now has to stay in environments below 1,000ppm of carbon dioxide.
- Lung damage:
  - High altitude exposure and chemical exposures damage the lungs. Steven Magee has small airways disease of the lungs and asthma.
- Heart damage:
  - High altitude and chemical exposure damages the heart. Steven Magee has heart arrythmias and a hole in the heart.
- Brain damage:
  - High altitude exposure and chemical exposure damages the brain. Steven Magee has extensive anxiety, memory, confusion and absence seizure problems.
- Liver damage:
  - Abnormal air, chemical exposure and abnormal radiation exposures may cause B12 deficiency, commonly known as Pernicious (fatal) Anemia. Steven Magee has to take high doses of B12 daily to treat pernicious anemia.
- Kidney damage:
  - Oxygen starvation and poisoning may cause kidney damage. The kidneys are noted to increase their urine and bicarbonate output at high altitudes. Workplace poisoning is typically filtered by the kideys and is urinated out. Steven Magee was mercury poisoned in high altitude astronomy and had to cleanse his kidneys of toxins in 2019.
- Abnormally high ultraviolet radiation (UV) exposures:
  - Damages the skin, causes premature aging and cancer. Causes low level radiation sickness to occur. Steven Magee has to take DHEA daily to offset UV radiation damage.
- Abnormally high ionizing radiation exposures:
  - Causes premature aging and cancer. Causes low level radiation sickness to occur. Steven Magee had to avoid sunlight for several months to detoxify from ionizing radiation damage.
- Skin damage:
  - High altitude exposure damages the skin causing vitamin D deficiency. Steven Magee had to dose for years with high levels of vitamin D to restore depleted levels.
- Sleep Apnea:
• High altitudes and abnormal air increases sleep disorders that result in low blood oxygen levels during sleep, daytime sleepiness, fatigue and irritability. Steven Magee is medically diagnosed with sleep apnea and is prescribed a CPAP life support machine.

• Bruxism:
  • Commonly seen in high altitude workers and causes daytime tiredness and fatigue, sensitive teeth, tooth decay and gastrointestinal issues from swallowing air during sleep. Steven Magee discovered his bruxism in 2019 and now uses a mouth guard during sleep to reduce the complications from bruxism.

• Faraday Cage Sickness:
  • Working inside of Faraday cages appears to cause radiation deficiency in the brain that eventually leads to daily headaches. Steven Magee’s daily headaches only subsided after receiving a large dose of X-Ray radiation to the brain from a CT brain scanner.

• Interference Radiation Sickness:
  • Working near to large metal structures and metal walls appears to cause ill health from exposure to abnormal interference radiation.

• Electromagnetic Radiation Sickness
  • Working with electronic products, such as computers, or sitting in electromagnetic fields from electrical rooms, dirty electricity, radio frequency transmitters, and so on, may cause Electromagnetic Radiation Sickness to occur which may lead to Electromagnetic Hypersensitivity. Steven Magee developed Electromagnetic Hypersensitivity after sitting next to an electrical room daily for years. He was able to cure the condition.

• Industrial LASER exposures:
  • Industrial sodium laser exposures may lead to burns of the eyes and skin. The long term effects are currently emerging. Steven Magee was exposed to high powered sodium laser light and now sees rainbow halos and starbursts around bright night time lights and has focusing issues that require reading glasses and cannot see things at times that are in front of him.

• Eyes
  • High altitude exposures damage the eyes. Extensive computer use causes computer vision syndrome. Steven Magee sees rainbow halos and starbursts around bright night time lights, has focusing issues that require reading glasses and cannot see things at times that are in front of him.

• Ears:
  • Barotrauma may cause damage to the ears. Hearing tests have shown degraded hearing in Steven Magee.

• Drug Intolerance:
  • Very high altitude workers are directed to use the company supplied drugs and gas to offset altitude sickness. Steven Magee discovered in 2019 that he had developed intolerance to drugs after years of company supplied drug use.

• Ill Health:
  • High altitude exposures increase the rates of ill health. Steven Magee has been awarded his UK government pension plan for ill health.

• Growths:
  • High altitude exposures increase the rates of growths on and in the body, such a skin tags and tumors. Steven Magee has developed skin tags and has had to have growths surgically
removed from his skin, colon and knee. His coworker died from colon cancer.

- **Immune system problems:**
  - High altitudes depress the immune system. Steven Magee has had numerous problems with fungal growths on the skin and nails.

- **Memory problems:**
  - High altitude exposures increase the rates of memory problems in sea level adapted human, particularly short term memory issues. Steven Magee is medically diagnosed with amnesiac disorder and cognitive decline.

- **Seizures:**
  - High altitude exposures increase the rates of seizures. Steven Magee was diagnosed with absence seizures after a decade of high altitude work up to 13,796 feet.

- **Hormones:**
  - High altitude exposures damage the hormonal system in humans, causing fatigue, sleep and gender issues. Gender changing is noted to occur in high altitude workers. Steven Magee’s coworker developed LGBT gender issues, as did two other observatory workers. Steven Magee takes DHEA and melatonin hormone supplements for fatigue and sleep disorders.

- **Depression:**
  - High altitude exposures increase the rates of depression. Steven Magee is medically diagnosed with depression and is on depression treatment.

- **Anxiety:**
  - High altitude exposures increase the rates of anxiety. Steven Magee is medically diagnosed with anxiety and is on anxiety treatment.

- **Chronic Fatigue:**
  - High altitude exposures increase the rates of chronic fatigue. Steven Magee is medically diagnosed with chronic fatigue and is on chronic fatigue treatment.

- **Suicide:**
  - High altitude exposures increase the suicide rates. Steven Magee’s very high altitude coworker committed suicide.

- **Gastrointestinal Problems:**
  - High altitude exposures increases the rates of gastrointestinal problems. Steven Magee’s very high altitude coworkers developed throat and colon cancer.

Remember that there are time limits that vary between states that require eligibility for you to claim for these conditions. 1 to 2 years from discovery or death is the typical time limit. If your condition is outside of the discovery period, you may loose all rights to workers compensation for that condition.
Dear Sir/Madam,

I was an employee of <COMPANY NAME> from <YEAR> to <YEAR> working in the <DEPARTMENT NAME> for <SUPERVISOR NAME>. I developed ill health during working for your company. For many years the root cause of this ill health was a mystery to the medical profession that treated me. Today I now understand that I have High Altitude Observatory Disease (HAOD). The wide range of health conditions that constitute a diagnosis of High Altitude Observatory Disease (HAOD) are still emerging, but are sufficiently diagnosed at this point to go ahead and apply for Workers Compensation.

As such, can you inform your Workers Compensation insurance provider that I have developed High Altitude Observatory Disease (HAOD) and I am now applying for compensation.

Please be aware that all communications regarding this matter are open for public view and may be published to the internet, in books and articles, and so on.

I look forward to hearing from you with regards to:

1. Who your Workers Compensation provider is.
2. Their full contact details.
3. The full range of literature of your Workers Compensation scheme.
4. Confirmation that my application for Workers Compensation is being processed.
5. Could you fully detail any other benefits that your company can provide for my ill health, such as ill health payments, disability payments, and so on?

Yours faithfully,

<Your Name Here>
Columbia University Workers Compensation – New York

- “Columbia University ignored my application for workers compensation for occupational disease and I had to apply through the state.” Steven Magee CEng MIET
- “Workers' Compensation...If you are injured on the job, you should complete the Board's form Employee Claim (C-3) as soon as possible to ensure your benefits are not delayed or interrupted. You must also notify your employer in writing of when, where and how you were injured or became ill...Remember: You must file a claim within two years of the accident or within two years after you knew or should have known that a contracted disease was due to the nature of your employment.” [http://www.wcb.ny.gov/content/main/onthejob/howto.jsp](http://www.wcb.ny.gov/content/main/onthejob/howto.jsp)
- “Workers' Compensation Forms for Health Care Providers” [http://www.wcb.ny.gov/content/main/forms/Forms_HEALTH_PROVIDER.jsp](http://www.wcb.ny.gov/content/main/forms/Forms_HEALTH_PROVIDER.jsp)
- “Occupational Disease. An occupational disease arises from the conditions to which a specific type of worker is exposed. The disease must be produced as a natural incident of a particular occupation, such as asbestosis from asbestos removal. A person disabled by a work-related occupational disease receives the same benefits as for an on-the job injury. However, the time limit for filing a claim is the later of two dates: Two years from the date of the disabled worker's disability; or Two years from the time the disabled worker knew or should have known that the disease was due to the nature of employment.” [http://www.wcb.ny.gov/content/main/onthejob/OccDisease.jsp](http://www.wcb.ny.gov/content/main/onthejob/OccDisease.jsp)
- “PMA appointed lawyers Stewart Greenblatt Manning & Baez to represent them.”
- “Stewart Greenblatt Manning & Baez” [https://sgmlaw.com/](https://sgmlaw.com/)
- “Stewart Greenblatt Manning & Baez were provided with signed medical release forms.” Steven Magee CEng MIET
- “Stewart Greenblatt Manning & Baez were provided a copy of ‘Open Letter To The Astronomical Community’ that was over three hundred pages of scientific research into high altitude observatory disease (HAOD).” Steven Magee CEng MIET
- “Stewart Greenblatt Manning & Baez were provided with 48 pages of mercury poisoning information, including color photographs showing the staff handling the mercury systems with no gloves or respiratory protection.” Steven Magee CEng MIET
- “Stewart Greenblatt Manning & Baez were provided with my 46 page written statement titled “Statement: Details Of Specific Injuries And How This Occurred At The MDM Observatory” regarding how the mercury poisoning had occurred, including color photographs showing the staff handling the mercury systems with no gloves or respiratory protection.” Steven Magee CEng MIET
- “In April 2019, Stewart Greenblatt Manning & Baez denied my Workers' Compensation claim.” Steven Magee CEng MIET
- “I have never been compensated by Columbia University for the biological damage that high altitude work has caused to my health.” Steven Magee CEng MIET
PMA Insurance Denials

• “Pma is Dirty Anyone else Have Pma? My workers compensation claim was made in the State of: Virginia, I was injured after a 18 year career. PMA took over the handling of the place I worked. I can tell anyone who cares PMA is horrible. They took me to court to have my treating surgeon removed from my case because of several bogus claims they made up about my surgeon. Needless to say i won the case with the WC commission, and PMA requested an appeal. This kind of dirty business makes them look busy so the city keeps them on as administrators. They have done nothing but cause more damage to my injury, don't pay for meds , refuse physical therapy, I have endured 6 major surgeries and need a 7th PMA wants my surgeon removed because he actually cares for his patients. They make it impossible to get the necessary care I need, and they refuse to pay my doctors bills until it is convenient for them. Stay away from this evil company.”
Dartmouth College Workers Compensation – New Hampshire & Arizona

- “Dartmouth College ignored my application for workers compensation for occupational disease and I had to apply through the state.” Steven Magee CEng MIET

- “(NH) The injured worker has two (2) years from the date of injury to notify the employer of his injury in order to make a claim for benefits. In cases where an occupational illness develops gradually and an injury is not immediately recognized by the claimant, the claimant must provide notice the date he or she knows, or by reasonable diligence should have known, of the nature of the injury and its possible relationship to the employment.” https://www.nh.gov/labor/workers-comp/timeframe-claim.htm


- “I was notified by Dartmouth College and the State of New Hampshire in May 2019 that the workers compensation claim has been transferred to the state of Arizona and will be handled by Travelers Insurance.”

- “(AZ) Worker’s Report of Injury Form...An injured worker must file a workers’ compensation claim in writing with the Commission within one year after the injury occurred or when the injury becomes manifest which means that the injured worker knows or in the exercise of reasonable diligence should know that he or she has sustained a compensable work related injury.” https://www.azica.gov/forms/claims0407

- “It was interesting to note that the statute of limitations for workers compensation for occupational disease was 1 year less in Arizona.” Steven Magee CEng MIET


- “Everything You Need to Know about Workers’ Comp in Arizona...Permanent benefits. When your doctor finds that your condition is stationary, or not expected to improve any further, he or she will determine whether you have a permanent disability. If you do, the doctor will give you a percentage of disability. This number, along with your age, education and work history, and earning capacity, determines your rate of compensation.” https://www.summitinsuranceaz.com/news/2017/03/everything-you-need-to-know-about-workers-comp-in-arizona

- “Travelers contacted me in May 2019 about releasing my medical records to them. After consulting with a lawyer about signing the release forms, they notified me that my claim had been closed.” Steven Magee CEng MIET

- “Travelers were provided with signed medical release forms.” Steven Magee CEng MIET

- “Travelers were provided a copy of ‘Open Letter To The Astronomical Community’ that was 318 pages of scientific research into high altitude disease.” Steven Magee CEng MIET

- “Travelers were provided with 48 pages of mercury poisoning information, including color photographs showing the staff handling the mercury systems with no gloves or respiratory protection.” Steven Magee CEng MIET

674
“In June, I found that the Arizona Corporation Commission had stopped returning my multiple phone messages regarding the workers compensation claim.” Steven Magee CEng MIET

“In June 2019 Travelers and the State of Arizona were provided with my 46 page written statement titled “Statement: Details Of Specific Injuries And How This Occurred At The MDM Observatory” regarding how the mercury poisoning had occurred, including color photographs showing the staff handling the mercury systems with no gloves or respiratory protection.” Steven Magee CEng MIET

“Good Afternoon, I received the additional paperwork you sent to myself and Brian. At this time your claim remains denied as I do not have any information to support an Industrial Injury. Please contact your provider and have them file necessary paperwork with the Industrial commission to get official claim filed. If you have any questions/concerns with this please contact the ICA Ombudsman at 602-542-4661. Once we are notified by the Industrial commission of Arizona and official notice will be issued and then at that time you will have 90 days to file a protest. Once protest received by the Industrial Commission of Arizona then a hearing will be set and the matter will go before a Judge. Thank you and have a great day. Lori Jensen | claim Professional, Mountain West Claim Center – Phoenix, PO Box 660456, Dallas, TX 75265-0293 W: 720-963-7179  F: 877-801-9674”

“I have never been compensated by Dartmouth College for the biological damage that high altitude work has caused to my health.” Steven Magee CEng MIET
Travelers Insurance Denials

- “Travelers insurance accused of not providing needed medical care...Neurologist selected by Travelers accused of providing false information in workers’ comp matter that led to denied benefits...These IME doctors are handpicked by the insurance company and make careers out of testifying against people. We hear stories of IME doctors taking less than five minutes in the exam room and not even making eye contact. Workers’ comp benefits are disputed based upon these written reports...We tell our clients to get ready for a fight if they have been scheduled for an IME. The insurance company is looking for some reason to dispute the claim. Excuses range from preexisting conditions to no evidence of disability.” https://www.workerscomplawyerhelp.com/blog/2019/02/travelers-insurance-accused-of-not-providing-needed-medical-care/

- “Workers’ Compensation Bad Faith Disputes with Travelers...The Travelers Companies is the largest American insurance company by market value, with revenues exceeding $25 billion and total assets worth over $105 billion. To some extent, most people recognize that auto and homeowners insurance companies are profit-focused and dealings with them can be frustrating. The fact that the same problems come up with workers’ compensation claims is less well known...we have taken action against Travelers on behalf of many injured workers whose valid claims have been unreasonably denied, delayed and then ultimately granted after the victim endured serious physical, emotional and psychological damages.” https://doylelawfirm.com/workers-compensation-bad-faith/workers-compensation-bad-faith-disputes-with-travelers

- “Attorney Helping Employees with Travelers Insurance Workers Comp Claims. Learn What to Expect When You Have a Travelers Workers Compensation Claim...If your employer has Travelers workers’ compensation insurance, we recommend hiring an experienced attorney. Travelers has the assets and resources to fight every part of your workers compensation claim. And like all insurance companies, they routinely dispute and deny claims when injured workers fail to meet all the procedural and substantive hurdles present in the Virginia workers compensation system. Though the insurance adjuster may act like he or she has your best interests at heart, the truth is that they are getting paid to make sure you receive as little as possible for your work injury claim.” https://cpollardlaw.com/virginia-workers-compensation/travelers-insurance/

- “ERISA Disability Help...Long-term disability refers to different types of disability benefits that are insurance based and are received for longer than a period of one year. These benefit payments are not made by the Social Security Administration but by the insurance company covering the retirement, health, or benefit plan offered by your employer...Claims with private insurance companies may be extremely difficult. ERISA has established the process for claimant application, time frames and procedures for determinations by insurance companies, an internal appeals process, and (if the internal appeals process has been exhausted) the right of the claimant to file suit against the insurance company in state or federal court. However, disability coverage has been a growth industry for insurance companies because they have found legal loopholes and practices that enable them to circumvent many of the ERISA guidelines established to protect you!...An act of "bad faith" on the part of an insurance company is not an honest mistake or oversight. Bad faith implies that there has been an intentional practice set in place by an insurance company to purposefully commit fraud or deny
legitimate disability claims. A charge of "bad faith" against an insurance company is very
difficult to establish. Nonetheless, there have been a number of bad faith cases that have
resulted in substantial awards to beneficiaries (see Boicourt v. Amex Assurance Co., David
Clayton v. United Service Automobile Association, Vann v. The Travelers Insurance Company,
etc.). Some examples of bad faith insurance practice are: A baseless denial of coverage.
Failure to communicate policy information to a claimant. Denial of a claim without proper
investigation. Untimely or unnecessary delay of determination or payment. Failure to pay the
full value of a claim. Refusal to enter negotiations or legal procedures with regard to the
W. M. Keck Observatory Workers Compensation - Hawaii

- “HRS Chapter 386 - HAWAI‘I WORKERS' COMPENSATION LAW” https://www.hawaii.edu/uhwo/clear/home/HRS386-2.html
- “The right to compensation under this chapter shall be barred unless a written claim therefor is made to the director of labor and industrial relations[:] (1) Within two years after the date at which the effects of the injury for which the employee is entitled to compensation have become manifest; and (2) Within five years after the date of the accident or occurrence which caused the injury. The foregoing limitations of time shall not apply to a claim for injury caused by compressed air or due to occupational exposure to, or contact with, arsenic, asbestos, benzol, beryllium, zirconium, cadmium, chrome, lead, fluorine, or other mineral or substance with carcinogenic properties, as incorporated in the Hawaii Occupational Safety and Health Standards, or to exposure to X-rays, radium, ionizing radiation, or radioactive substances, but such claim shall be barred unless it is made to the director, in writing, within two years after knowledge that the injury was proximately caused by, or resulted from the nature of, the employment. The claim may be made by the injured employee or the employee's dependents or by some other person on the employee's or their behalf. The claim shall state in ordinary language the time, place, nature, and cause of the injury.” https://codes.findlaw.com/hi/division-1-government/hi-rev-st-sect-386-82.html
- “The W. M. Keck Observatory ignored my application for workers compensation for occupational disease and I had to apply through the state.” Steven Magee CEng MIET
- “(HI) Who can receive Workers Compensation (WC) benefits? Most full-time and part-time employees who suffer from any injury or disease, which results from work or working conditions, are covered. Under the law, certain kinds of employment are not covered.” http://labor.hawaii.gov/dcd/home/aboutwc/
- “After applying for Hawaii workers compensation in March 2019, I did not receive any reply from the W. M. Keck Observatory or the state of Hawaii until mid May.” Steven Magee CEng MIET
- “I was informed in Mid may that there was no open workers compensation state claim, as I had filled out the application form incorrectly. I was not surprised, as I suffer from confusion.” Steven Magee CEng MIET
- “The workers compensation state claim form was filled out per the direction of the Hawaii Government. I am now awaiting to hear more from them.” Steven Magee CEng MIET
- “I was contacted by their workers compensation insurance company HEMIC in May 2019.” Steven Magee CEng MIET
- “Hawaii Employers’ Mutual Insurance Company. (HEMIC)” http://hemic.net/
- “HEMIC appointed lawyers Adams Krek LLP to represent them in May 2019.” Steven Magee CEng MIET
- “Adams Krek LLP” https://www.adamskrekllp.com/
- “Adams Krek LLP were provided with signed medical release forms.” Steven Magee CEng MIET
- “Adams Krek LLP were provided a copy of ‘Open Letter To The Astronomical Community’ that was over three hundred pages of scientific research into high altitude observatory disease (HAOD).” Steven Magee CEng MIET

678
• “In August 2019, lawyers Adams Krek LLP denied my Workers' Compensation claim.” Steven Magee CEng MIET
• “I have never been compensated by the W. M. Keck Observatory for the biological damage that very high altitude work has caused to my health.” Steven Magee CEng MIET
**HEMIC Insurance Denials**

- “Kauai Trial Court Finds Workers' Compensation Carrier's Delayed Payment in Bad Faith...the decedent was killed on January 4, 2005, when her all-terrain vehicle, used by her employer to check hiking trails, overturned. Decedent was survived by her indigent mother, a resident of Venezuela. A workers' compensation claim for full dependency benefits was filed on Plaintiff's behalf with Hawaii Employers Mutual Insurance Company (HEMIC). HEMIC contested the claim and refused payment. After a hearing in January 2006, the Department of Labor and Industrial Relations ordered that full dependency benefits be paid. The Department found HEMIC had delayed making payments for more than a year without reasonable basis for doing so. After payment was made, Plaintiff sued HEMIC for bad faith in its delay in making payments. After a trial, Findings of Fact and Conclusions of Law were issued on April 9, 2009. The court ruled HEMIC had sufficient information in January 2005 to determine the decedent's death was compensable. The delay in acknowledging the claim was unreasonable and violated established industry standards for good faith and fair dealing. The court further found HEMIC's motivation in denying Plaintiff's claim was to delay payment so the statute of limitations would expire and HEMIC could escape ever making payment. Plaintiff was awarded $75,000 in general damages and $250,000 in punitive damages.”

- “Waiting In Pain. About the Series. A Civil Beat Investigation: In Hawaii’s workers’ comp system, people with long-lasting injuries are often forced to battle doctors hand-picked by insurance companies to get treatment and disability payments.”

- “Insurance ‘Hell’ Leaves Many Injured Workers Broken...Kauwalu didn’t know it on that March day in 2007, but he was about to embark on a 10-year odyssey into Hawaii’s system for compensating and treating injured workers.Kauwalu has a simpler name for it: “Hell.”...The system was designed to be “no-fault,” much like auto insurance – you get hurt, you get treatment. But for workers like Kauwalu, it too often turns into a litigious nightmare...While workers often prevail, it can mean hiring lawyers and waiting for years as the insurers deny treatment plans and appeal administrative decisions over and over again on the same or similar grounds. In the meantime, disability payments and treatment are cut off. The insurers can afford to wait out workers...denial equals trying to starve the patient out...When all my workers’ comp stopped, I had no money to pay my rent, I had no money to pay my car. I had nothing, nothing, nothing…Ten years later, Kauwalu battles on against the workers’ comp system, one of many injured workers trying to navigate a system they say seems set up to break them...Two of Masui’s clients committed suicide, he said...Workers can become enmeshed in a system of complex rules and hardball tactics that looks much like what they would have found in a courtroom. Some injured workers describe the sinking sensation of walking into a hearing room, where they planned to represent themselves, only to find a table of briefcase-toting suits lined up against them...“What defense comp attorneys told me when I was still practicing law was that they just automatically deny everything,” said Rhoads, the state senator. “And the reason they do that is they know a certain percentage of people will just give up. That is so counter to the spirit of what workers’ comp is supposed to be for. It’s just appalling.””

- “Spying On Injured Workers Often Adds To Their Pain. Surveillance is accepted practice in
workers’ comp cases. It can lead to a cutoff of benefits, but things are not always as they appear...Ken Weir claimed he had seriously injured his neck, back, shoulder and knee when he stepped into two open drains at work and twisted awkwardly. So how was he able to help his uncle carry a washing machine? That’s what his workers’ comp insurer wanted to know after it paid private investigators to follow him and take video on 18 days over more than a year...Surveillance is an accepted tactic in the workers’ comp world, especially in long-running, complicated cases. Insurers say it controls losses to fraud...Surveillance may be particularly upsetting to those with psychological conditions such as PTSD. An Australian investigative news program in 2016 reported that insurance companies were tailing former police officers with PTSD, sometimes worsening their mental suffering. One insurer said that it would no longer use surveillance in claims involving mental illness. Spying on injured workers is generally legal in the U.S., as long as detectives don’t peek through windows, adopt a fake persona like a utility worker or induce the worker to do something incriminating...Insurers, he said, use surveillance, in tandem with medical exams by their hand-picked doctors, to harass injured workers and try to get them to drop their claims.“They’d rather spend the money than fairly compensate the injured worker,” Moore said.”

- “This Woman Lost 10 Years Battling A System Where Insurers Call The Shots. Hobbled by pain from work injuries, Vanessa Sylva had to overcome medical reports by insurance doctors that challenged her need for surgeries...Dr. Leonard Cupo had just testified in a workers’ compensation case in a windowless hearing room in downtown Honolulu. Cupo, a gregarious man, stood up and shook hands with the small group of attorneys and officials who attended the hearing. Then he came to Vanessa Sylva, the injured worker whose case was the subject of his testimony. He’d been paid by a workers’ comp insurance company to examine and write a report about her. Sylva refused to take his hand. She turned to others in the room and apologized. “This man has caused me so much pain that I cannot shake his hand,” she recalls saying. This is the story of Cupo and Sylva — how they came to that acrimonious moment a year ago in a clash made possible, even inevitable, by Hawaii’s workers’ comp system...That system, developed over more than a century, allows insurance companies to pay doctors of their choosing to examine injured workers. A Civil Beat investigation shows how companies use those results to block claims or deny treatment, with far-reaching effects on workers’ lives even if the doctor’s opinions are later discounted...there’s no limit on what insurers pay doctors — it’s typically a few thousand dollars per exam or more. Critics say the big money, despite claims of impartiality, gives doctors a strong incentive to write reports to the liking of insurers...In one year alone, 2006, one workers’ comp carrier paid him almost $1 million, according to a tax document subpoenaed by an injured worker. His King Street office, which he owns, is valued at $1.6 million, and his Nuuanu house is worth about $3 million, records show. He and his wife also have had timeshares in Manhattan and Las Vegas, according to public records.”

- “Whose Side Is This Workers’ Comp Doctor On?...Workers are “members of the family,” the 67-year-old doctor told listeners at a convention in Las Vegas in December. “They really define who the company is.” And when they’re injured, he says, they should not be cast off as “disposable items.”...The system “is outdated, it’s dysfunctional,” he said. “We need to hold all the stakeholders accountable, and we need to do everything we can do to get better outcomes.” And no one on the other side would argue with what he says next, though they would dispute
“It’s a tragedy,” he said, “when people get caught up in this system.””

“The reasons. “It’s a tragedy,” he said, “when people get caught up in this system.””

“Delays, Denials, Wasted Tax Dollars: DOE’s Troubled Treatment Of Injured Workers...Annette didn’t know much about Hawaii’s workers’ comp system, but on the advice of her husband’s colleagues at the school she filed for survivor’s benefits for herself and her teenage son. That’s when the Department of Education’s workers’ comp unit got involved, launching Annette Kanaulu on an odyssey of denials and late payments that left her feeling angry and disrespected, even as she dealt with the loss of her husband. DOE still hasn’t paid her for funeral expenses…Workers struggle to keep afloat without income or treatment, and describe feeling cast away by the employer they served. “I can’t explain the hardship to you. I’m still in a hole,” said Bernadette Ishikawa, a special education aide whose payments were delayed for months. “You have to borrow money from this or that friend. It’s so embarrassing … They don’t care about people.”...“What they’re doing is deny, deny until they die,” he said….“It hurts when you know you’ve been such a good employee,” she said. “I think that’s what hurts the most. This is what I get when I’m hurt and miserable. They don’t care.””

“Injured Workers Still Searching For Relief... the system grinds on much as it has over the past few decades. Workers’ comp insurers pay hand-picked doctors to write reports that routinely deny that the injury occurred at work or that the worker needs treatment….A significant number of these so-called independent medical exams, or IMEs, are later discounted, but it may take years. During that time, workers may be cut off with no income or treatment while they appeal the denials, often requiring the help of attorneys. Many decide to settle for far less than they might get rather than keep fighting...“But unfortunately,” he said, “the same select group of worker comp carriers continue to use the system against the patient.”…One would have compelled insurers to pay benefits for injured workers while the insurer investigated whether the claim was valid, rather than delaying payments until they were deemed legitimate. In practice, the insurance investigation can go on for months, during which the injured worker may get no benefits….“This idea of ‘denied pending investigation’ basically destroys the whole no-fault idea,” Wayne Mukaida, a longtime workers’ comp attorney, told Civil Beat last year. “And that’s the start of unwarranted months and months of delay.”...After an IME doctor attributed Junker’s chronic pain to earlier shoulder problems, his workers’ comp insurer cut off his payments and denied further medical care. But a state hearing officer sided with Junker, appearing to clear the way for treatment, including a complicated surgery on his axillary nerve that would have to be done by specialists in Massachusetts. At the time the story was published, the insurer had denied a treatment plan from his doctor, citing the earlier IME report that had been discounted by the hearing officer.”
Workers Compensation – Problems

- “Once my medical center was aware that I was pursuing workers compensation for occupational disease, I found that they would no longer treat me. When I asked why, I was told that they do not accept workers compensation patients. It is one of the largest hospitals in Tucson, Arizona. I found myself in a medical no-man’s land where I could not get on-going treatment from my established medical center.” Steven Magee CEng MIET - Q
- “I found that there were few lawyers in Tucson, Arizona that specialized in workers compensation. The ones that I contacted were not interested in my case and that put me in the situation of having to handle my own workers compensation claim while suffering from depression, forgetfulness, confusion and absence seizures.” Steven Magee CEng MIET - Q
- “I followed up on why the lawyers were not interested in my case and found that few workers compensation claims for occupational disease are ever successful. Of the ones that do make it to a win, it has generally been handled by a workers compensation lawyer regarding a well established disease in case law.” Steven Magee CEng MIET - Q
- “It appears that workers compensation lawyers only get paid if they win their case. If your case lies outside of mainstream cases with a history of winning, they are unlikely to take it.” Steven Magee CEng MIET - Q
- “Unfortunately, the ultimate decision to incorporate occupational disease into the compensation framework, which had been designed primarily for injury, has disappointed both those seeking an economically efficient way to deal with disease and those seeking a fair one. Twenty-one states limit coverage to diseases peculiar to the workplace, thereby excluding ordinary diseases of life and eliminating coverage for a significant amount of occupationally related disease. In addition, 60 percent of disease claims are initially denied, as compared with 10 percent for accidents, placing a heavy burden on the ill worker who must establish the connection between workplace exposure and disease. This burden of proof is compounded by long latency periods, multiple causes, effects of synergism, and statutory minimum-exposure requirements, all of which combine to keep the rate of compensation for disease low. It is estimated that only 5 percent of occupational disease may be covered by workers' compensation, thus providing a possible disincentive to employers to internalize the costs of occupational disease with preventive measures.” https://www.healthaffairs.org/doi/full/10.1377/hlthaff.7.4.73
- “I found myself alone having to navigate through a legal system that required the guidance of a lawyer to be successful, a legal system that was set up from the outset to deny your genuine claim of occupational disease.” Steven Magee CEng MIET - Q
- “Changes in state workers’ compensation programs over the past 20 years have made it increasingly difficult for injured workers to receive the full benefits to which they are entitled. Furthermore, exclusions in many state programs exempt many work-related injuries and illnesses and many workers in high-hazard occupations from receiving workers’ compensation. The result is that employers now provide only a small percentage (about 21%) of the overall financial cost of workplace injuries and illnesses through workers’ compensation. Instead, the costs of workplace injuries are borne primarily by injured workers, their families, and taxpayer-supported components of the social safety net. States are engaged in a race to the bottom over workers’ compensation benefits, and as a result working people are at great risk of falling into poverty from work-related injuries.” https://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2018/01/18/the-critical-need-to-reform-workers-
"By the time I had seen the problems from applying for workers compensation for occupational disease, I had concluded that I was journeying through a third-world like system of employee protection." Steven Magee CEng MIET - Q

“I was surprised at how corrupted the USA workers compensation scheme is for workers with occupational diseases.” Steven Magee CEng MIET - Q

“Social security and workers compensation are following the policy of deny, deny, deny for occupational diseases.” Steven Magee CEng MIET - Q

“The USA has created a system of extreme poverty for the permanently disabled by allowing social security and workers compensation to deny the majority of occupational disease claims.” Steven Magee CEng MIET - Q

“If you become disabled by occupational disease in the USA, expect to be treated like garbage by social security and workers compensation.” Steven Magee CEng MIET – Q

“All USA high altitude astronomy employers denied my valid occupational disease claims for High Altitude Observatory Disease (HAOD), also known as Magee’s Disease (MD).” Steven Magee CEng MIET – Q

“Given that workers compensation is denying high altitude worker claims for occupation disease, it is common sense to never work in the biologically toxic field of astronomical observatories atop remote mountain summits.” Steven Magee CEng MIET – Q
Mauna Kea Sickness (MKS)

Mauna Kea Sickness (MKS) comprises of the long term effects of:
- Repeated poor very high altitude acclimatization.
- Breathing medical oxygen, nitrogen, helium and carbon dioxide gas.
- Breathing contaminated air.
- Breathing solvent fumes in oxygen deficient environments.
- Breathing radiation treated air.
- Drinking radiation treated fluids.
- Radiation exposure.
- Oxygen starvation.
- Low air pressure environments.
- Faraday Cage Sickness (FCS).
- Computer sickness.
- Industrial laser exposure.
- Mercury exposure.
- Car sickness.
- Motion sickness.
- Commuting sickness.
- Drinking fluids from canned and bottled supplies.
- Electrolyte imbalances.
- Isolation.
- Night shift work.
- Extremely long shifts.
- Insomnia.
- Company supplied drug use.
- Metal Interference Radiation Sickness (MIRS).
- Standing Wave Sickness (SWS).
- Metal Contact Radiation Sickness (MCRS).
- Stray Voltage Sickness (SVS).
- Electromagnetic Field Sickness (EFS).
- Electromagnetic Pulse Sickness (EPS).
- Wireless Sickness (WS).
- Dirty Electricity (DE).
- Delayed Radiation Complications (DRC).
- Continent Adaptation Disease (CAD).
- Coastal Adaptation Disease (CAD).
- Sick Building Syndrome (SBS).
- Artificial Light Adaptation Disease (ALAD).
- Processed Food Adaptation Disease (PFAD).
- Volcanic Smog (VOG).
- Indoor Adaptation Disease (IAD).
Environmental Radiation LLC - https://www.environmentalradiation.com

- Environmental Epigenetics (EE).

Mauna Kea Sickness (MKS) is also known as:
- High Altitude Disease (HAD).
- High Altitude Commuting Disease (HACD).
- High Altitude Observatory Sickness (HAOS).
- High Altitude Observatory Disease (HAOD).
- High Altitude Adaptation Disease (HAAD).
- Magee’s Disease (MD).
Mauna Kea Sickness (MKS) in Steven Magee

- 2001-2003: Working days with two to three days spent on the very high altitude summit of Mauna Kea: Chronic headaches, forgetfulness, confusion, runny nose, sore throat, digestive issues, loss of physical stamina, tired and fatigued after returning to sea level. Discharging industrial gas into the indoor environment, using medical oxygen and company supplied drugs to treat Mauna Kea Sickness.

- 2003-2006: Working several extreme night shifts every other week at very high altitude on Mauna Kea: Hallucinations, digestive disorders, chronic headaches, cracked & dry lips, chronic fatigue, depression, sleepiness, sleep disorders, amnestic disorders, mental disorders developing including invisible friend, confusion & irritability. Using medical oxygen & company supplied drugs to treat Mauna Kea Sickness. Sleeping at 9,200 feet between night shifts.

- 2006-2008: Working at high altitude on Kitt Peak: Regular visits to the doctor for chronic intestinal pains, pains from head to toe, hot and painful skin, severe chest pains during exercise, painful urethra during and after urination without infection, fatigue, daytime sleepiness, falling asleep at work, depression, insomnia, irritability, forgetfulness & confusion. Started visiting mental health doctors. Discharging large amounts of industrial gas into the indoor environment, working with mercury and sitting next to an electrical room daily.


- 2010: Realized that I had Low Level Radiation Sickness (LLRS) and spent six months avoiding sunlight to detoxify from it. Aches & pains from head to toe cleared up as well as hot and painful skin.


- 2011-2014: No medical insurance. Developed Electromagnetic Hyper-Sensitivity (EHS) and cured it with lifestyle changes, supplements, and over the counter medications.

- 2015 – 2017: Mental functioning significantly degraded at age 45 and referred to mental health & neurology, they diagnosed depression, amnestic disorders & seizures. I detected low blood oxygen levels during day & night using a Spo2 pulse oximeter, followed up by medical profession to diagnose lung disease and sleep disorders, prescribed medication and CPAP life support machine. Regular heart arrhythmia’s, medical profession diagnosed hole in the heart and prescribed medication. I noticed a positive response to 25,000 mcg daily doses of vitamin B12 and 65 mg of iron, medical profession following up and suspecting pernicious anemia. Taking numerous prescription medications and using a nighttime CPAP life support machine. Diagnosed with Excessive Daytime Sleepiness and Ideopathic Hypersomnia. Unable to work and denied government disability payments.

- 2018: Raising vitamin A, vitamin B12, vitamin B complex, vitamin C, vitamin D, vitamin E, vitamin K, iron, alpha lipoic acid, potassium bicarbonate and magnesium levels using supplements. Changes in diet indicate that Celiac Disease, gluten, lactose & fructose...
intolerance are present. Colonoscopy removed a 5mm polyp from the sigmoid colon. Unable to work and denied government disability payments.

- 2019: Indoor air quality testing had revealed that Multiple Chemical Sensitivity (MCS) was present. House fresh air ventilation had to be substantially increased to reduce elevated carbon dioxide levels within the home that was causing malaise, chronic fatigue and daytime sleepiness. I was the only person in the home showing these reactions. Several months of mercury chelation had delivered improved health, which had confirmed my suspicion of mercury poisoning. I was showing a beneficial response to radiation treatment using DHEA hormone supplementation. Based on the range of diagnosed conditions and treatments, it was clear at this point that I had developed a classic case of High Altitude Observatory Disease (HAOD) and I applied for workers compensation in March 2019 to the W. M. Keck Observatory and the Ivy League institutions of Columbia University and Dartmouth College. It had emerged that I was having chronic fatigue reactions to over the counter medications and to prescription medications and was displaying ‘Drug Intolerance’. Drug intake reduced. Sleeping with a nighttime mouth guard to treat sensitive teeth problems. Gastrointestinal problems significantly reduced after wearing a nighttime mouth guard and chinstrap leading to the discovery that the CPAP machine was feeding pressurized air into the intestinal tract during sleep and CPAP treatment was discontinued. The medical profession calls this Bruxism. Depression and confusion symptoms were continuing. I had encountered a treatment for high altitude depression during researching depression in the high altitude southwest USA. I started to take the recommended high altitude depression treatment of Creatine and 5-HTP daily in mid May. Suspecting that hormone issues may be more extensive than DHEA, I started testosterone support supplement and saw a beneficial response to it after month. Now under treatment of an endocrinologist that is looking into the hormone issues. Had to find a new primary care doctor and a new sleep doctor as the ones that I had said that they would not treat workers compensation patients. Currently have untreated sleep apnea that is causing daytime fatigue. Unable to work, denied government disability payments and denied workers compensation for occupational diseases by the USA professional astronomy community.

- 2020: I was investigating treatments for "Mauna-Pause" (Mauna means mountain in Hawaii), which is endocrine disease environmentally induced into high altitude workers. Nocturnal chest pains started and I was prescribed nitroglycerin by my cardiologist. It had emerged through years of supplement experimentation and blood tests that production of vitamin D is almost none existent, B12 production is low and hormone production is low. After five years of visits to four different sleep doctors, I was eventually diagnosed with positional sleep apnea and prescribed BiPAP treatment. Testing with a 10,000 lux full spectrum therapy light showed that Bright Light Adaptation Disease (BLAD) was present and treating this restored my natural waking time to sunrise. Treating a suspected ultraviolet radiation induced folate deficiency with a high dose folate supplement. In July 2020 at the age of 50, my eGFR blood test was at 54 which indicates mild to moderate loss of kidney function. Experimentation in October 2020 with red and infrared light therapy improved my nighttime circadian rhythm. Nighttime infrared video recording of sleeping revealed a Sleep Movement Disorder was occurring every 20 minutes during the night and Pramipexole was prescribed to treat it.
Mauna Kea Sickness (MKS) Prescriptions

The following controlled drugs were prescribed to Steven Magee (list is not complete):

1. **Abilify (Aripiprazole):** is used to treat the symptoms of psychotic conditions such as schizophrenia and bipolar I disorder (manic depression).
2. **Amoxicillin:** is a penicillin antibiotic that fights bacteria.
3. **Armodafinil (Nuvigil):** is a medication that promotes wakefulness.
4. **Atorvastatin:** is a cholesterol-lowering medication that blocks the production of cholesterol.
5. **Azelastine:** is an antihistamine that reduces the effects of natural chemical histamine.
6. **Brimonidine Tartrate:** is an antiglaucoma medication used to treat open-angle glaucoma or ocular hypertension.
7. **Ciclopirox:** is used to treat fungal infections of the fingernails and toenails.
8. **Dulera:** is used to control and prevent the symptoms of asthma.
9. **Escitalopram (Lexapro):** is an antidepressant belonging to a group of drugs called selective serotonin reuptake inhibitors (SSRIs).
10. **Flecainide Acetate:** is an oral drug that's used to prevent abnormal heart rhythms.
11. **Fluticasone Propionate:** is used to relieve allergic and non-allergic nasal symptoms.
12. **Fluticasone HFA:** is a corticosteroid to treat asthma.
13. **Gavilyte G:** is a prescription medicine used by adults to clean the colon before a colonoscopy.
14. **Gemfibrozil:** is used to treat high cholesterol and triglyceride levels in people with pancreatitis.
15. **Ibuprofen:** is a universal non-steroidal anti-inflammatory drug that is commonly used for the relief of pain symptoms.
16. **Loratadine:** is an antihistamine that reduces the effects of natural chemical histamine in the body.
17. **Nitroglycerine (Nitro-Time):** Nitroglycerin is used to treat congestive heart failure, to help prevent frequent chest pain caused by a heart condition known as angina, and to relieve pain caused by chronic anal fissures.
18. **Proair HFA:** is a bronchodilator that relaxes muscles in the airways and increases air flow to the lungs used to prevent and treat wheezing and shortness of breath.
19. **Provigil (Modafinil):** is a medication that promotes wakefulness.
20. **QVAR:** is used in the long-term management of asthma.
21. **Seroquel:** is used to treat schizophrenia, bipolar disorder, sudden episodes of mania or depression associated with bipolar disorder.
22. **Simvastatin (Zocor):** is a drug prescribed to reduce triglycerides, total cholesterol (LDL), and increasing HDL cholesterol.
23. **Tinzanadine:** is used to treat muscle spasms, such as multiple sclerosis or spinal cord injury.
24. **Ventolin HFA:** is used to prevent and treat wheezing and shortness of breath caused by breathing problems.
The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers

- “I observed many employees displaying Mauna Kea Sickness (MKS) on the very high altitude summit of Mauna Kea in Hawaii.” Steven Magee CEng MIET - Q
- “Employees that have developed long term Mauna Kea Sickness (MKS) typically have a myriad of health issues for the rest of their lives.” Steven Magee CEng MIET - Q
- “There is a need to set up a compensation fund for Mauna Kea Sickness (MKS) for damaged employees, their families and their survivors.” Steven Magee CEng MIET - Q
- “I propose that the sickened worker compensation fund be called 'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers'. All that is needed to be eligible is to medically demonstrate one health condition that is a known long term consequence of MKS.” Steven Magee CEng MIET
- “Initial funding for 'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers' should be set at one billion dollars to effectively compensate the decades of many workers that have passed through the known biologically toxic summit facilities.” Steven Magee CEng MIET
- “Mauna Kea Sickness (MKS) has cost me close to one million dollars in lost earnings. Long term that figure is expected to rise to four million dollars by age sixty five.” Steven Magee CEng MIET - Q
- “'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers' will apply to all workers and contractors on Mauna Kea.” Steven Magee CEng MIET
- “People that have toured the summit of Mauna Kea and feel that their long term health was damaged by doing so will be eligible to apply for compensation from the 'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers'. “ Steven Magee CEng MIET
- “'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers' should include compensation for lifetime loss of earnings, pain and suffering.” Steven Magee CEng MIET
- “'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers' will not be allowed to issue non-disclosure agreements to claimants.” Steven Magee CEng MIET
- “'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers' will compensate workers that have retained the ability to work for their reduced earning capacity that MKS has brought onto them.” Steven Magee CEng MIET
- “'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers' will not have any time limits for when a very high altitude worker can apply. Workers from decades ago or their survivors can apply at any time for compensation.” Steven Magee CEng MIET
- “There will be no limits on how many times a sickened Manua Kea worker applies for compensation. A worker that may have been able to work who has been already compensated can later apply for more compensation if their sickness degrades their earning abilities further.” Steven Magee CEng MIET
- “How Much Is A Wrongful Death Lawsuit Worth? Wrongful death is a catch-all term the law uses to describe any lawsuit involving the death of a family member. Everything from intentional homicide, to avoidable medical injuries, to an accident at a construction site is referred to as a “wrongful death and survival” claim. The wrongful death claim refers to the claims of a grieving spouse and the decedent’s children, while the survival claim refers to any
painless and suffering or lost lifetime wages of the decedents."

- “How much is a wrongful death case worth? According to many government agencies a life is worth anywhere from the EPA at $9.1 million for a life to the FDA who puts the value of a life at $7.9 Million. Harvard Studies put a statistical life value at $8.7 million.”

- “In the legal world, a sickened worker may be compensated far more than a killed worker.”
Steven Magee CEng MIET - Q

- “Jurors give $289 million to a man they say got cancer from Monsanto's Roundup weedkiller”

- “'The Mauna Kea Sickness (MKS) Compensation Fund for Damaged Workers' will have an automatic payment of ten (10) million dollars for any worker fatality. The survivors of workers killed decades ago can apply at any time for the compensation.“
Steven Magee CEng MIET
Suggested Cancer Classification For High Altitudes

The following is the suggested cancer risk classification for long term high altitude exposure (non-pressurised) to the sea level adapted human:

- Possibly Carcinogenic - Class 2B: High altitude = 1,500–3,500 metres (4,900–11,500 ft).
- Probably Carcinogenic - Class 2A: Very high altitude = 3,500–5,500 metres (11,500–18,000 ft).
- Carcinogenic - Class 1: Extreme altitude = above 5,500 metres (18,000 ft).

The following is the suggested cancer risk classification for long term high altitude exposure (pressurised) to the sea level adapted human:

- Possibly Carcinogenic - Class 2B: Extreme altitude = above 5,500 metres (18,000 ft) (Airplanes).
- Probably Carcinogenic - Class 2A: Low earth orbit (International Space Station).
- Carcinogenic - Class 1: Space.
Steven Magee's Astronomical Observatories

- **“1999 to 2001 - Roque de los Muchachos Observatory”**
  [https://en.wikipedia.org/wiki/Roque_de_los_Muchachos_Observatory](https://en.wikipedia.org/wiki/Roque_de_los_Muchachos_Observatory)
  - 2,423 m / 7,949 ft Altitude.
  - No acclimatization stops up or down the mountain.
  - Some workers would sleep on the mountain summit.
  - Daily car sickness was a problem due to the steep switchback road.

- **“2001 to 2006 - Mauna Kea Observatories”**
  - 4,207.3 m / 13,803 ft Altitude.
  - Half hour stop at 9,200 feet on the way up, No acclimatization stop down the mountain.
  - Some workers would sleep on the mountain at 9,200 feet.

- **“2006 to 2008 - Kitt Peak National Observatory”**
  - 6,886 ft / 2,099 m Altitude.
  - No acclimatization stops up or down the mountain.
  - Some workers would sleep on the mountain summit.
Steven Magee's Resume

Steven Magee’s Published Articles

- “Active control systems for large segmented optical mirrors”
Research By Steven Magee That Relates To High Altitude Astronomy

- Faraday Cage Sickness (FCS) - Astronomical Research Buildings, Radiant Foil Barriers, Metal Clad Building Structures, Underground & Undersea Structures, Metal Ships, Metal Airplanes, International Space Station (ISS), Natural Radiation Deficiency
- Standing Wave Sickness (SWS) - Electromagnetic Shielding Products, Metal Fences, Metal Walls, Metal Roofs, Natural Radiation Deficiency & Overloading
- Metal Interference Radiation Sickness (MIRS) – Metal Wall Studs, Metal Roof Supports, Metal Floor Supports, Metal Furniture, Metal Street Lights, Metal Power Poles, Metal Power Lines, Metal Antenna Masts, Solar Power Systems, Wind Turbines, Groupings of Tall Metal Structures, Airplanes, Satellites, International Space Station (ISS)
- Light Interference Radiation Sickness (LIRS): International Space Station (ISS), Satellites, Airplanes, Jet Aircraft Contrails/Chemtrails, Spinning Wind Turbine Blades, Partial & Full Eclipses Of The Sun by Natural & Man-Made Objects
- Metal Contact Radiation Sickness (MCRS) – Prolonged contact with metal chairs, metal desks, metal kitchen counters, metal mattresses, metal underwired bras, metal jewelry, metal implants
- Stray Voltage Sickness (SVS) - Electrical Earthing/Grounding Systems, Electrified Ground, Electrified Swimming Pools, Electrified Trees, Electrified Metalwork, Electrified Metal Building Structures, Anti-Static Devices
- Electromagnetic Sandwich Sickness (ESS) – The human when placed between the ground and an energized conductor, such as an overhead power line or a overhead solar photovoltaic (PV) system, may become sick.
- Electromagnetic Pulse Sickness (EPS) – Flash guns, Strobe Lights, Emergency Vehicle Flashing Lights, Lightning Storms
- Motor Run Capacitor Sickness (MRCS) – Motor run capacitors are found in air conditioners, fans, heaters, most items that have an AC motor inside them, power factor correction systems, large capacitive filters, street lights, older florescent lights.
- Ground Current Sickness (GCS) – Electrical utilities passing ground currents through properties is known to cause sickness in the residents.
- Seasonal Electrical Sickness (SES) – Electrical related sickness may only appear at certain times of the year as electrical systems such as cooling air conditioners, heating systems, solar
and wind power, and so on come onto the electrical grid in large numbers.

- Digital Dementia (DD) – Dementia symptoms occurring decades earlier than normal in many people that use electronic products daily.
- Energy Adaptation Disease (EAD) – Any biological organism that spends prolonged time in an unnatural energy environment should be expected to start the biological process of adapting to it.
- Radiation Biological Growth Defects in Plants (RBGDP) – Growth Enhancement, Deformity, Retardation, Death.
- Radiation Demineralization of Water (RDW) – Radiation exposed water takes on properties that resemble demineralized water with similar effects to growth hormone.
- Radiation Induced Abnormal Development (RIAD) – Various forms of radiation exposures are known to affect childhood development with Autism and Attention Deficit Disorders (ADD) being linked to it.
- Radiation Induced Bone Damage (RIBD) – Bone damage occurs due to long term exposure to abnormally high radiation levels. Typically shows up as brittle and weak bones that may ache and be painful.
- Radiation Induced Chronic Fatigue Syndrome (RICFS) – Daily chronic fatigue and narcolepsy.
- Radiation Induced Cold Sores (RICS) – Various forms of radiation exposures are known to cause recurrent cold sore outbreaks.
- Radiation Induced Diarrhea (RID) – A significant change in radiation levels may result in intestinal pains and/or diarrhea that clears up shortly afterwards as the body adjusts to the new radiation exposures.
- Radiation Induced Deficiencies Syndrome (RIDS) – Loss of essential minerals, vitamins & nutrients in unnatural radiation fields that results in poor health.
- Radiation Induced Drug Alteration (RIDA) – Various forms of radiation exposures may alter prescription drug effects on the human.
- Radiation Induced Dizziness (RID) – Various forms of radiation exposures may cause dizziness to occur in the human.
- Radiation Induced Dreams (RID) – Various forms of radiation exposures may cause dreams to occur in the human during sleep.
- Radiation Induced Eye Irritation (RIEI) – Various forms of radiation exposure can irritate the eyes, cause focusing problems, halos, starbursts and cataracts long term.
- Radiation Induced Fetal Overgrowth (RIFO) – Over-sized babies that no longer fit down the birth canal.
- Radiation Induced Headaches (RIH) – Various radiation exposures can induce headaches.
- Radiation Induced Heart Arrhythmia (RIHA) – Heart arrhythmia may occur when in or after exposure to unnatural radiation sources.
- Radiation Induced Insomnia (RII) – A significant increase in unnatural radiation levels may result in insomnia.
- Radiation Induced Intestinal Pains (RIIP) – A significant change in radiation levels may result in intestinal pains and/or diarrhea that clears up shortly afterwards as the body adjusts to the new radiation exposures.
Radiation Induced Irritability & Aggression (RIIA) - Various forms of radiation are known to induce irritability & aggression into humans & mammals.

Radiation Induced Life Shortening (RILS) – Dying years earlier than average from radiation induced illness and disease from high powered radiation exposures or long term exposure to abnormally low levels of natural radiation that result in radiation deficiency sickness and disease.

Radiation Induced Lung Injury (RILI) – Radiation exposures are known to damage the lungs.

Radiation Induced Rouloux Blood (RIRB) – Clumping of the blood cells may occur when in unnatural radiation fields.

Radiation Induced Sexual Impotence (RISI) – Various forms of radiation exposures are known to induce sexual impotence into humans.

Radiation Induced Skin Irritation (RISI) – Various forms of radiation exposures are known to induce skin irritation into humans with normal looking skin that feels hot, and red irritated skin being common reports.

Radiation Modified Glass Transmission (RMGT) – The characteristics of light transmission through glass change when placed into a man-made electromagnetic radiation field.

Radiation Modified Mental Functioning (RMMF) – Change in mental state.

Radiation Modified Personality Disorder (RMPD) - Changed personality.

Radiation Triggering of the Human Mating Cycle (RTHMC) – Female Hysteria, Male Hysteria, Sex Addiction, Fornication, Idolatry, Pornography Addiction.

Radio Wave Sickness (RWS) - Has characteristics of headaches, fatigue, depression, insomnia, confusion, irritability, vertigo, digestive issues & general sickness.

Electromagnetic Hypersensitivity (EHS) - A severe form of Radio Wave Sickness where levels of radio waves tolerated by the general population make the person really sick.

Lightning Adaptation Disease (LAD) – People that spend time in environments with abnormally high levels of lightning may start the biological process of adapting to it.

Low Level Radiation Syndrome (LLRS) – Long term exposure to low levels of man-made radiation or increased levels of natural radiation.

Delayed Radiation Complications (DRC) – Health complications from radiation exposures may show up months, years or decades after the toxic exposure was received.

Solar Radiation Overloading Sickness (SROS) – Sickness from daily overexposure to natural solar radiation resulting in accumulated systemic toxicity.

High Altitude Solar Radiation Overloading Sickness (HASROS) – Sickness from daily overexposure to an enhanced spectrum of natural solar, Space and man-made satellite radiation that the sea level adapted human has no genetic adaptation to.

High Altitude Snow Solar Radiation Overloading Sickness (HASSROS) – Sickness from daily overexposure to a reflected enhanced spectrum of natural solar radiation and increased Space and man-made satellite radiation that the sea level adapted human has no genetic adaptation to.

Cloud Reflected Light Adaptation Disease (CRLAD) - Sickness from routinely being above the clouds where daily overexposure to a reflected enhanced spectrum of natural solar radiation and increased Space and man-made satellite radiation occurs that the sea level adapted human has no genetic adaptation to.

Water Reflected Solar Radiation Overloading Sickness (WRSROS) – Sickness from daily overexposure to a water reflected enhanced power of natural solar radiation that the inland adapted human has no genetic adaptation to.
Accumulating Radiation Systemic Toxicity (ARST) – Over exposure to many forms of radiation results in accumulating systemic toxicity that may eventually result in general sickness. Left untreated, it may progress onto disease and premature death.

Solar Radiation Deficiency Sickness (SRDS) – Sickness from daily underexposure to natural solar radiation.

Natural Radiation Deficiency Sickness (NRDS) – Living in man-made environments and areas that reduce or block natural radiation exposures.

Natural Radiation Overloading Sickness (NROS) – Living in man-made environments and areas that increase natural radiation exposures.

Polar Radiation Sickness (PRS) – Solar radiation deficiency sickness may occur in people that have moved from the tropics to nearer the polar regions.

Tropical Radiation Sickness (TRS) - Solar radiation overloading sickness may occur in people that have moved from close to the polar regions to the tropics.

Continent Adaptation Disease (CAD) – Occurs in humans that have moved to a different continent with a very different set of environmental conditions.

Inland Adaptation Disease (IAD) – Occurs in coastal adapted humans that have permanently moved inland.

Coastal Adaptation Disease (CAD) - Occurs in inland adapted humans that have permanently moved to the coast.

Artificial Electromagnetic Radiation Disease (AERD) – Occurs in natural environmental radiation adapted humans that have constant exposure to many unnatural forms of man-made electromagnetic radiation.

Adverse Radiation Health Week (ARHW) – A wide range of adverse health conditions may be observed in the week after a biologically toxic radiation exposure has occurred.

Solar Adaptation Disease (SAD) - Commonly seen in workers of solar energy farms, high altitude workers, window cleaners and some solar powered home owners.

Vitamin R – The radiation (R) vitamin that is essential to life, however too much or too little will make you sick.

Vitamin S – The sunlight (S) vitamin that is essential to life, however too much or too little will make you sick.

Electromagnetic Blue Sky (EBS) – The blue sky that we see is created by solar radiation stimulation of the air in a dirty vacuum at approximately 100,000 feet.

Sonic Boom Sickness (SBS) – Regular exposure to sonic booms from military fighter jets is suspected of increasing the incidence of vibroacoustic disease, a thickening of heart tissue which may lead to heart arrhythmia or premature death.

Natural Sound Deficiency Sickness (NSDS) – Living in man-made environments devoid of natural sounds.

Extinction Silence (ES) – Any animal that devours its natural environment will eventually fall victim to the resulting silence.

Natural Smell Deficiency Sickness (NSDS) – Living in man-made environments devoid of natural smells.

Natural Pollen Deficiency Sickness (NPDS) – Living in man-made environments devoid of natural levels of pollen.

Nature Deficit Disorder (NDD) – Occurs from living in alien environments that are disconnected from the natural world.
- Computer Vision Syndrome (CVS) – Staring at computer monitors for long periods daily is known to induce sickness into the human.
- Toxic Light (TL) – Unnatural Spectrum of Light, Insufficient Brightness, Too Bright, Light Filtering, Polarization, Scattering, Refraction, Diffraction, Interference, Flicker, Light Modulation.
- Multiple Sun Effect (MSE) – Reflective architecture may create ground level solar radiation power that exceeds that found in Space.
- Extinction Wavelength of Light (EWL) – The addition of pollution to the atmosphere and water bodies that causes one of the wavelengths of light that is critical to life to be diminished or a substantial increase in one of the wavelengths of light that is harmful to life, causing a mass extinction event.
- Refraction Extinction (RE) – The addition of pollution to water and air causes the light to change direction (refract) and living species have no adaptation to this man-made change, leading to extinction.
- Diffraction & Interference Light Extinction (DILE) – The placement of water, land and air borne man-made objects causes light to reflect & diffract around them, leading to interference waves that living species have no adaptation to which may bring about extinction.
- Diffraction & Interference Metal Extinction (DIME) – The placement of water, land and air borne man-made metal objects causes electromagnetic waves to reflect & diffract around them, leading to interference waves that living species have no adaptation to which may bring about extinction.
- Satellite Extinction (SE) – A large object going into orbit around the Earth may cause a mass extinction event. Tens of thousands of smaller satellites in orbit around the Earth may have a similar effect.
- Radiation Extinction (RE) – Mankind changes the environment so much that radiation induced cancers kill off the future generations.
- Genetic Extinction (GE) - Mankind changes the environment so much that catastrophic cascading genetic errors kill off the future generations.
- Infertility Extinction (IE) – Subjecting biological organisms to abnormal environmental conditions may lead to permanent infertility after several generations which leads to extinction.
- Aggression Extinction (AE) – The changed environment induces aggression into animals that leads to them attacking each other and their own offspring through involuntary violent behaviors.
- Dementia Extinction (DE) - The changed environment induces early onset dementia into animals that leads to their brain functioning failing before reproductive age.
- Ground Extinction (GE) – The energy being radiated from the ground becomes toxic to biological life, eventually leading to extinction.
- Birth Extinction (BE) – The changed environment induces oversize offspring that no longer fit down the birth canal in female animals that leads to them dying during childbirth, leading to extinction.
- Fatigue Extinction (FE) – The changed environment induces chronic fatigue into biological organisms and they lie down and die from atrophy & starvation.
- Fog Extinction (FE) – The changed environment induces a light scattering fog into the atmosphere that animals have no genetic adaptation to, leading to their extinction.
- Water Vapor Extinction (WVE) – The addition of large amounts of water vapor to the atmosphere...
Environmental Radiation LLC - https://www.environmentalradiation.com

atmosphere causes strange optical effects to occur on a global scale that animals have no genetic adaptation to, leading to their extinction.

- Water Extinction (WE) - Abnormal structuring of the water eventually leads to extinction in those that live in it or consume it.
- Air Extinction (AE) – Abnormal structuring of the air eventually leads to extinction in those that breath it.
- Carbon Extinction (CE) – Massive amounts of carbon are artificially deposited into the atmosphere, land and water bodies to the point of causing a mass extinction.
- Atmospheric Voltage Extinction (AVE) – The electrical properties of the atmosphere are changed through pollution and the natural direct and alternating voltages and currents (DC & AC) change so much that they cause a mass extinction event.
- Lightning Extinction (LE) - The environment is changed so much that lightning rates are either substantially increased or decreased. Either event may cause a mass extinction.
- Storm Extinction (SE) – The environment is changed so much that massive storms wreak havoc on the Earth, causing a mass extinction event.
- Heat Extinction (HE) – Global warming is making the world a hotter place and may cause mass extinctions in species that cannot adapt.
- Changed Seasons Extinction (CSE) – Global warming and climate change are changing the seasons throughout the world and may cause mass extinctions in species that cannot adapt.
- Earthquake Light (EL) – Localized solar diffraction and interference effects in the atmosphere are suspected to be linked to the creation of earthquakes in the ground below.
- Low-E Adaptation Disease (LEAD) – Excessive filtering from energy saving Low-E glass windows causes wavelengths of light to be reduced or removed and this may induce long term sickness into the human that has no genetic adaptation to this strange man-made window light.
- Artificial Light Adaptation Disease (ALAD) – Results from the human switching its genetic outdoor natural light exposures to artificial man-made light sources.
- Nighttime Adaptation Disease (NAD) – The human is genetically a daytime active animal that sleeps during the night. Switching the human to a nighttime active schedule and daytime sleeping is known to increase disease in the human. Night shifts are a class 2A carcinogen.
- Nighttime Diffraction & Interference Radiation (NDIR) – The dark side of the Earth has diffraction and interference solar radiation waves passing over it that are generated by the Earth eclipsing the Sun.
- Moon Reflected Artificial Light Adaptation Disease & Extinction (MRALADE) – The moon is reflecting artificial light emitted by modern cities back to Earth during nighttime. Living species have no genetic adaptation to this reflected man-made light which may bring about disease and extinction.
- Extinction Energy (EE) – The reduction of environmental energy that is essential to life or the increase of environmental energy that is harmful to life which causes a mass extinction event to occur.
- Extinction Suicide (ES) – Any living organisms that willfully collectively engage in behaviors that the long term effects are known to cause their species extinction.

Pollution – Effects on natural atmospheric AC and DC voltage, natural ground AC and DC voltage, lightning strikes, atmospheric and water electrical conductivity, increasing carbon content of atmosphere and water bodies, atmospheric and ground electrical currents, increasing man-made radio frequencies (RF), water structuring, air structuring, increasing atmospheric water vapor, stressed and dying trees and coral reefs.

Oxygen Deficient Environments (ODE) - Known to cause behavioral changes, illness, injury and death in humans.

Oxygen Excess Environments (OEE) – Known to cause oxygen toxicity in the human and may damage the central nervous system (CNS), brain, lungs, heart and eyes.

Drug Adaptation Disease (DAD) – Feeding the human a daily cocktail of man-made drugs should be expected to cause the body to start adapting to them.

Processed Food Adaptation Disease (PFAD) – Eating a diet comprised primarily of processed foods with long shelf lives of years may lead to sickness.

Space Adaptation Disease (SAD) – Astronauts can only stay in Space for about a year until they become so sick that they have to return to Earth for extensive rehabilitation.

High Altitude Gas Health Effects (HAGHE) – Breathing medical and industrial gas at high altitudes is known to adversely affect human mental and physical health and can be fatal.

High Altitude Disease (HAD) – Spending significant time above 10,000 feet is known to induce long term health problems into sea level adapted humans such as oxygen starvation, lung issues, heart issues, Pulmonary Hypertension, blood oxygen issues, brain issues, eye issues, radiation sickness, problems from breathing radiation treated air and drinking radiation treated water.

High Altitude Commuting Disease (HACD) – Workers that go from sea level to high altitudes daily develop degraded health over time. Known to occur in pilots, aircraft cabin crew, frequent fliers, astronomy observatory workers and ski resort workers.

High Altitude Observatory Sickness (HAOS) – A range of sickness that is unique to high altitude observatory workers that inappropriately acclimatize and spend their time in low oxygen Faraday cage environments breathing medical and industrial gas and solvents and taking drugs.

Airplane Adaptation Disease (AAD) – The very unnatural environment of extreme altitude modern jet aircraft causes those who spend significant inside of them to start biologically adapting to it.

High Altitude Adaptation Disease (HAAD) – Occurs in sea level adapted humans that have permanently moved to high altitude.

Open Drain Sickness (ODS) – Dried out drain traps & faulty sewer air admittance valves (AAV) that vent sewer gas into the home may make the residents sick.

Insulation Adaptation Disease (IAD) – Results from the human switching its genetic outdoor exposures to a man-made heavily insulated home that is silent and devoid of natural sounds.

Ventilation Adaptation Disease (VAD) – Results from living in unnatural modern energy efficient homes that are sealed up and are devoid of sufficient natural outdoor air ventilation, smells and airborne pollen levels.
- Dominant Smell (DS) – The material that is out-gassing the most in a home becomes the Dominant Smell (DS). Elimination of the DS requires removal of the DS material, the installation of a higher out-gassing alternate DS (such as an air freshener) or increased outdoor ventilation.
- Sick Building Syndrome (SBS) – Many toxic homes, offices and workplaces have been constructed that long term exposure to these make the occupants sick.
- Car Adaptation Disease (CAD) – Many toxic cars have been constructed that have very unnatural environments inside of them. Those that spend prolonged time within them may start the biological process of adapting to them.
- Pollution Adaptation Disease (PAD) – Living in a polluted area is known to cause long term health degradation as the body tries to adapt to the unnatural environment.
- Volcanic Smog (VOG) - Vog is a form of air pollution that results when sulfur dioxide and other gases and particles emitted by an erupting volcano react with oxygen and moisture in the presence of sunlight. Headaches, watery eyes, sore throat, breathing difficulties (including inducing asthma attacks), flu-like symptoms, and general lethargy are commonly reported. Cardiac issues, including increased pulse rates associated with thickened blood from PM 2.5 particles.
- Atmospheric Radiation Absorption (ARA) – The atmosphere when filled with pollution typically absorbs more solar radiation and reduces the natural radiation at sea level.
- Indoor Adaptation Disease (IAD) – Results from the human switching its healthy genetic outdoor lifestyle to an abnormal irradiated lazy indoor cancer society that is disconnected from nature.
- Human Adaptation Disease (HAD) – Any human that is placed in an abnormal environment should be expected to start the process of biologically adapting to that alien environment.
- Environmental Epigenetics (EE) – Cascading genetic errors caused by biologically toxic environmental exposures.
- Multiple Chemical Sensitivities (MCS) – People who become reactive to household & workplace chemicals.
- Man-Made Environmental Sickness (MMES) – Humans that are locked inside of a man-made environment typically become sick after 1-2 years inside of that alien environment and have to be removed from it.
- Primary Cause of Cancer (PCC) - Incorrect human environmental conditions.
- Preventing Cancer (PC) - Correct human environmental conditions.
- Radiation Nutrition (RN) – The human mind and body requires regular environmental radiation exposures daily to stay healthy.
- Interference Green Light (IGL) – The tree canopy generates interference green light that is beneficial to biological organisms underneath it.
Recommended Medical Screening Of Very High Altitude Workers

Steven Magee CEng MIET recommends:

- A complete warning given to all new hires about the diverse range of health problems that are known to have occurred in high altitude employees, including diseases and fatalities.
- Sleep study of all high altitude workers is to be performed prior to working at high altitudes to establish their sleep, heart, lung, brain and blood oxygen baseline values at sea level. [https://en.wikipedia.org/wiki/Sleep_study](https://en.wikipedia.org/wiki/Sleep_study)
- Cardiac Stress Test of all high altitude workers is to be performed prior to working at high altitudes to establish their heart and blood oxygen baseline values during physical activity at sea level. [https://en.wikipedia.org/wiki/Cardiac_stress_test](https://en.wikipedia.org/wiki/Cardiac_stress_test)
- Mandatory full medical screening of all new very high altitude workers on their first day at the summit facility by a certified medical doctor that specializes in high altitude disease and low level radiation sickness. The doctor is to issue a medical prescription for daily medical oxygen use and train that worker in the correct administration of oxygen using a pulse oximeter. The doctor is to warn the worker of the hazards that long term oxygen administration are known to present. The worker is is to be issued with their own pulse oximeter that can record a complete workday of readings.
- Mandatory full medical screening of any very high altitude worker that is showing mental or physical distress at the summit facility by a certified medical doctor that specializes in high altitude disease and low level radiation sickness, including a full inspection of that workers environmental working conditions and abnormal exposures.
- Very high altitude workers should be screened at the summit facility every three months by a certified medical doctor that specializes in high altitude disease and low level radiation sickness for the following conditions:
  - Low level radiation sickness.
  - Headaches.
  - Irritability.
  - Aggressive behaviors.
  - Forgetfulness.
  - Confusion.
  - Fatigue.
  - Sleepiness.
  - Apathy.
  - A review of the company supplied drugs that the worker is taking.
  - A review of an 8 hour summit work day of pulse oximeter readings or a full night of pulse oximeter readings for night shift workers.
  - A review of pulse oximeter readings for a full day of sleep at high altitude for night shift workers.
  - Revised medical prescription issued for daily medical oxygen use.
- Very high altitude workers should be screened at the summit facility annually by a certified medical doctor that specializes in high altitude disease and low level radiation sickness for the following conditions:
  - Vitamin B12 deficiency.
  - Vitamin D deficiency.
○ Anemia.
○ Leukemia.
○ High cholesterol.
○ Low level radiation sickness.
○ Fatigue.
○ Headaches.
○ SPO2 blood oxygen levels at rest.
○ Heart disorders.
○ A mental status examination: [https://en.wikipedia.org/wiki/Mental_status_examination](https://en.wikipedia.org/wiki/Mental_status_examination)
○ A Mini–Mental State Examination: [https://en.wikipedia.org/wiki/Mini%E2%80%93Mental_State_Examination](https://en.wikipedia.org/wiki/Mini%E2%80%93Mental_State_Examination)
○ Brain disorders.
○ Sleep disorders including sleep apnea.
○ Hearing loss.
○ Digestive disorders.
○ Lung disorders.
○ Kidney disorders.
○ Liver disorders.
○ Lactose, fructose and gluten intolerance.
○ Bisphenol A (BPA) [https://en.wikipedia.org/wiki/Bisphenol_A](https://en.wikipedia.org/wiki/Bisphenol_A)

- All high altitude workers should be sent on an annual sleep study for early detection of sleep disorders, heart, lung, brain and blood oxygenation issues.
- Government supervision of all health inspections should be legally required to ensure compliance.
- Any company official that bypasses the medical screening process and harasses a sickened worker out of their job should be fired.
- Any very high altitude worker that fails the summit screening process should be offered a permanent transfer to the lower altitude office or be placed on the company disability plan.
- The company should be legally required to compensate a permanently sickened high altitude worker for their lifetime loss of earnings, pain and suffering.
Recommended Medical Treatment Of Very High Altitude Sickened Workers

Steven Magee CEng MIET recommends that doctors consider this treatment plan for very high altitude sickened workers:

- Send worker for sleep study.
- Examination of 24 hours of SPO2 blood oxygen and heart beat readings.
- Comprehensive blood tests.
- Comprehensive urine tests.
- Test for IgG and/or IgA antibody responses to gluten, and gluten-containing grains.
- Cancer screening.
- Radiation exposure screening.
- Place on a comprehensive multivitamin.
- Place on a comprehensive triple omega 3-6-9 oil supplement.
- Place on regular high dose vitamin B12 injections for 6 months to see if they respond to it.
- Place on daily B100 complex supplements to see if they respond to it.
- Place on daily 65mg iron supplements to see if they respond to it.
- Place on daily Vitamin A 10,000 IU supplements to see if they respond to it.
- Place on daily Vitamin C 3,000 mg supplements to see if they respond to it.
- Place on daily Vitamin E 400 mg supplements to see if they respond to it.
- Place on daily Vitamin K 550 mcg supplements to see if they respond to it.
- Place on daily Alpha Lipoic Acid 600 mg supplements to see if they respond to it.
- Place on daily Selenium supplements to see if they respond to it.
- Place Potassium Bicarbonate supplements.
- Place on daily lactose free, fructose free and gluten free diet to see if they respond to it.
- Place on daily DHEA (Dehydroepiandrosterone) supplements to see if they respond to it.
- Place on a sunlight avoidance program for six months if they are reporting hot skin or aches and pains throughout their body.

- Referrals for:
  - Sleep.
    - Sleep study.
  - Neurology.
    - Screen for Amnesiac disorders.
    - Screen for seizures.
    - Screen for early onset Dementia.
    - High resolution brain CT & MRI scan.
  - Mental Health.
    - Screen for depression.
    - Screen for oxygen starvation disorders.
    - Screen for brain damage.
    - Screen for prolonged over the counter drug abuse.
  - Audiology:
    - Screen for hearing loss.
  - Pulmonology.
    - Screen for throat & lung disease.
Screen for oxygen starvation disorders.
Screen for industrial gas exposures.
Screen for medical oxygen exposures.
High resolution lung MRI scan.
Screen for sensitivities to oxygen, carbon dioxide, helium and nitrogen gas.

- Cardiology.
  - Screen for heart problems.
  - Echo-cardiogram bubble study of heart looking for holes.

- Hematology.
  - Screen for Anemia disorders.
  - Screen for Leukemia.
  - Screen for low blood oxygen disorders.

- Gastroenterology:
  - Screen for lactose, fructose and gluten intolerance.
  - Screen for Celiac Disease.
  - Screen for vitamin and mineral deficiencies.
  - Colonoscopy.
  - Endoscopy.

- Low Level Radiation Sickness.
  - Screen for general body aches & pains.
  - Screen for skin disorders.
  - Screen for eye disorders.
  - Screen for headaches.
  - Test DHEA levels.
  - Test melatonin levels.
Recommended Books For Treating Damaged High Altitude Workers


- Altitude Illness: Prevention & Treatment by Stephen Bezhrucka. [https://www.amazon.com/Altitude-Illness-Prevention-Treatment-Mountaineers/dp/0898866855/ref=pd_cp_14_1?pd_rd_w=Ck08d&pf_rd_p=ef4dc990-a9ca-4945-ae0b-f8d549198ed6&pf_rd_r=CSF8TV8TGX4CD0EF5GVT&pd_rd_r=22f0044a-863e-11e9-97ac-510cb5876d74&pd_rd_wg=OITTy&pd_rd_i=0898866855&psc=1&refRID=CSFBTV8TGX4CD0EF5GVT](https://www.amazon.com/Altitude-Illness-Prevention-Treatment-Mountaineers/dp/0898866855/ref=pd_cp_14_1?pd_rd_w=Ck08d&pf_rd_p=ef4dc990-a9ca-4945-ae0b-f8d549198ed6&pf_rd_r=CSF8TV8TGX4CD0EF5GVT&pd_rd_r=22f0044a-863e-11e9-97ac-510cb5876d74&pd_rd_wg=OITTy&pd_rd_i=0898866855&psc=1&refRID=CSFBTV8TGX4CD0EF5GVT)

- Altitude Acclimatization and Illness Management by Headquarters Department of the Army. [https://www.amazon.com/Altitude-Acclimatization-Illness-Management-Medical/dp/1534679294/ref=pd_sim_14_15?pd_rd_i=1534679294&pd_rd_r=2cfca58a-863e-11e9-8887-9b31b6cb4217&pd_rd_w=YJsLD&pd_rd_wg=AR9B3&pf_rd_p=90485860-83e9-4fd9-b838-b28a9b7fda30&pf_rd_r=JP60PJP9ACYXXJ1X68B&psc=1&refRID=JP60PJP9ACYXXJ1X68B](https://www.amazon.com/Altitude-Acclimatization-Illness-Management-Medical/dp/1534679294/ref=pd_sim_14_15?pd_rd_i=1534679294&pd_rd_r=2cfca58a-863e-11e9-8887-9b31b6cb4217&pd_rd_w=YJsLD&pd_rd_wg=AR9B3&pf_rd_p=90485860-83e9-4fd9-b838-b28a9b7fda30&pf_rd_r=JP60PJP9ACYXXJ1X68B&psc=1&refRID=JP60PJP9ACYXXJ1X68B)

- Mercury Poisoning: The Undiagnosed Epidemic by David Hammond [https://www.amazon.com/Mercury-Poisoning-Undiagnosed-David-Hammond/dp/1494747898/ref=sr_1_1?keywords=mercury+poisoning&qid=1559593244&s=books&sr=1-1](https://www.amazon.com/Mercury-Poisoning-Undiagnosed-David-Hammond/dp/1494747898/ref=sr_1_1?keywords=mercury+poisoning&qid=1559593244&s=books&sr=1-1)


- Brain Longevity: The Breakthrough Medical Program that Improves Your Mind and Memory by Dharma Singh Khalsa. [https://read.amazon.com/kp/embed?asin=B000Q9EX4E&preview=newtab&linkCode=kpe&ref_=cm_sw_r_kb_dp_KJ1tCbQTVSHMH](https://read.amazon.com/kp/embed?asin=B000Q9EX4E&preview=newtab&linkCode=kpe&ref_=cm_sw_r_kb_dp_KJ1tCbQTVSHMH)

- Brain Maker by Dr. Perlmutter. [https://www.drperlmutter.com/learn/books/](https://www.drperlmutter.com/learn/books/)

- The Better Brain Book: The Best Tool for Improving Memory and Sharpness and Preventing Aging of the Brain Paperback by David Perlmutter. [https://read.amazon.com/kp/embed?asin=B000PC71SC&preview=newtab&linkCode=kpe&ref_=cm_sw_r_kb_dp_VG1tCbQ7M57W9](https://read.amazon.com/kp/embed?asin=B000PC71SC&preview=newtab&linkCode=kpe&ref_=cm_sw_r_kb_dp_VG1tCbQ7M57W9)

- No Grain, No Pain by Dr. Peter Osborne. [https://nograinnopainbook.com/](https://nograinnopainbook.com/)

- The Complete Low-FODMAP Diet: A Revolutionary Plan for Managing IBS and Other Digestive Disorders by by Sue Shepherd PhD and Peter Gibson MD. [http://a.co/d/55G1JlS](http://a.co/d/55G1JlS)

- The Plant Paradox - The Hidden Dangers in “Healthy” Foods That Cause Disease and Weight...
Gain by Dr. Steven Gundry. https://gundrymd.com/books2/
- Wheat Belly by Dr. William Davis. https://www.wheatbelly.com/
Repairing Altitude Brain Damage

- “Fixing Your Brain: A Guide to Balancing Neurotransmitters. Understanding, Troubleshooting, and Addressing a major component in Mental Illness and Chronic Conditions...Neurotransmitters are signaling chemicals in our brains. They are responsible for our moods, motivation, energy, learning ability, and much, much more. When our neurotransmitters become unbalanced, we experience some of the worst states of being known to man. When neurotransmitters become unbalanced, we may experience depression and anxiety (serotonin,) sloth, anger and lack of motivation (dopamine,) panic attacks, stress, and inability to calm down (GABA,) heart problems, burnout, and intolerance to exercise (noradrenaline,) and memory and focus problems (acetylcholine.)”
  https://medium.com/publishous/fixing-your-brain-a-guide-to-balancing-neurotransmitters-72649aab40b1
- “Amino Acids & Brain Chemistry...Amino acids are often described as the building blocks for protein-based tissues and compounds in your body such as muscles fiber, skin, hair and enzymes. However, amino acids are also needed to make neurotransmitters, which are chemicals in the brain that either excite or inhibit neurons. Amino acids that are able to cross the blood-brain barrier stimulate the synthesis of most neurotransmitters, which affects brain chemistry and impacts mood.”
- “Grow New Brain Cells...Taurine, a little-known amino acid, can do the seemingly impossible: stimulate new brain cells to grow in adult brains. This capability creates an entirely new paradigm for the ways we think about age-related cognitive decline, and even major neurodegenerative diseases like Parkinson’s and Alzheimer’s...Taurine also has a fundamental connection with longevity, particularly related to cardiovascular disorders. Animal studies demonstrate protection against heart disease with taurine supplementation, and human studies show that supplementation produces dramatic improvements in heart and blood vessel function.”
- “Eat protein to heal a damaged brain...A diet of chicken, fish and protein shakes might do wonders for people with brain injuries. Akiva Cohen of the University of Pennsylvania in Philadelphia and his colleagues mimicked brain injury in mice by injecting fluid through a hole drilled in their skull. After seven days, the brain-injured mice had much lower levels of three branched-chain amino acids (BCAAs), leucine, isoleucine and valine, compared with control mice. These are found in protein-rich food and are known for their ability to build muscle. The team then fed another set of brain-injured mice either plain water or water enriched with BCAAs. Five days later, those that had taken BCAAs had normal levels of the amino acids and performed better on a learning task.”
- “With Amino Acid Diet, Improvement After Brain Injury. Animal Study May Set Stage for Treating Brain Damage in People...Cohen’s study team first created standardized brain injuries in mice, and one week later compared the animals’ conditioned fear response to that of uninjured mice. A week after receiving a mild electric shock in a specific cage, normal mice tend to “freeze” when placed in the same cage, anticipating another shock. The brain-injured mice demonstrated fewer freezing responses—a sign that they had partially lost that piece of learning. On the other hand, brain-injured mice that received a diet of BCAAs showed the same
normal response as the uninjured mice. The BCAA cocktail had restored their learning ability.”

“Amino Acid and Protein Requirements: Cognitive Performance, Stress, and Brain Function...Given the importance of optimal cognitive function to soldiers and the documented relationship between several amine acids and brain function, studies to quantify CNS requirements for specific amine acids under conditions of metabolic, environmental, and psychological stress are required. Such studies could provide the basis for optimizing the amine acid content of field rations intended for use in extremely stressful combat conditions. Development of methods to evaluate CNS requirements for specific amine acids under normal and adverse circumstances is also necessary. Consideration should be given to conducting further animal research using techniques such as microdialysis to assess release of brain transmitters under various environmentally and nutritionally stressful conditions, including undernutrition, thermal stress, hypoxia, and psychological stress.”
U.S. Food and Drug Administration (FDA)

- “FDA Radiological Health Program. The mission of the FDA’s radiological health program is to protect the public from hazardous or unnecessary radiation exposure from radiation-emitting electronic products.”
  [https://www.fda.gov/Radiation-EmittingProducts/FDARadiologicalHealthProgram/default.htm](https://www.fda.gov/Radiation-EmittingProducts/FDARadiologicalHealthProgram/default.htm)
- “Radiation-Emitting Products” [https://www.fda.gov/Radiation-EmittingProducts/default.htm](https://www.fda.gov/Radiation-EmittingProducts/default.htm)
- “Drugs” [https://www.fda.gov/Drugs/default.htm](https://www.fda.gov/Drugs/default.htm)
- “Medical Devices” [https://www.fda.gov/MedicalDevices/default.htm](https://www.fda.gov/MedicalDevices/default.htm)
- “Contact FDA” [https://www.fda.gov/AboutFDA/ContactFDA/default.htm](https://www.fda.gov/AboutFDA/ContactFDA/default.htm)
The United States Pharmacopoeia (USP)

- “Contact Information” [http://www.usp.org/contact-us](http://www.usp.org/contact-us)
Federal Aviation Administration (FAA)

- “Federal Aviation Administration” [https://www.faa.gov/](https://www.faa.gov/)
- “FAA Regulations” [https://www.faa.gov/regulations_policies/](https://www.faa.gov/regulations_policies/)
- “Who to Contact if You're Impacted by Aircraft Noise” [https://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/airport_aircraft_noise_issues/noise/](https://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/airport_aircraft_noise_issues/noise/)
- “Policy, International Affairs and Environment - Contact Us” [https://www.faa.gov/about/office_org/headquarters_offices/apl/contact_us/](https://www.faa.gov/about/office_org/headquarters_offices/apl/contact_us/)
US Department of Labor

- “UNITED STATES DEPARTMENT OF LABOR” [https://www.dol.gov/]
- “Termination...If you've lost your job, you have certain rights, such as the right to continue your health care coverage and, in some cases, the right to unemployment compensation.” [https://www.dol.gov/general/topic/termination]
- “The Whistle-blower Protection Programs” [https://www.whistleblowers.gov/]
- “Workplace Posters” [https://www.dol.gov/general/topics/posters]
- “Unemployment Insurance. The Department of Labor's Unemployment Insurance (UI) programs provide unemployment benefits to eligible workers who become unemployed through no fault of their own, and meet certain other eligibility requirements.” [https://www.dol.gov/general/topic/unemployment-insurance]
- “Harassment” [https://www.eeoc.gov/laws/types/harassment.cfm]
- “Prohibited Employment Policies/Practices” [https://www.eeoc.gov/laws/practices/]
- “Constructive Discharge/Forced To Resign. Discriminatory practices under the laws EEOC enforces also include constructive discharge or forcing an employee to resign by making the work environment so intolerable a reasonable person would not be able to stay.” [https://www.eeoc.gov/laws/practices/]
- “Terms & Conditions Of Employment. The law makes it illegal for an employer to make any employment decision because of a person's race, color, religion, sex (including gender identity, sexual orientation, and pregnancy), national origin, age (40 or older), disability or genetic information. That means an employer may not discriminate when it comes to such things as hiring, firing, promotions, and pay. It also means an employer may not discriminate, for example, when granting breaks, approving leave, assigning work stations, or setting any other term or condition of employment - however small.” [https://www.eeoc.gov/laws/practices/]
U.S. Equal Employment Opportunity Commission

- “Employees & Job Applicants” https://www.eeoc.gov/employees/
- “Harassment” https://www.eeoc.gov/laws/types/harassment.cfm
- “FAQ“ https://eeoc.custhelp.com/app/answers/list
- “Contact EEOC” https://www.eeoc.gov/contact/index.cfm
Armed Forces Radiobiology Research Institute

- The AFRRI mission is to preserve and protect the health and performance of U.S. military personnel through research and training that advance understanding of the effects of ionizing radiation. This mission includes education and training to maintain a pool of qualified radiation biologists; and basic and applied research to identify and perform early development of measures to prevent, assess and treat radiation injury. AFRRI research thrusts include medical countermeasures, diagnosis of injury (biodosimetry), low dose/low dose rate/late effects, internalized radionuclides, and combined injury...AFRRI scientists publish original research articles in scientific journals, contributing to the general knowledge of the effects of ionizing radiation on living organisms. The research is critical to the Department of Defense for force protection and also contributes to the health and well-being of the population at large. The articles appear in preeminent scientific journals, such as PLoS One, Radiation Research, International Journal of Radiation Biology, Journal of Radiation Research, Cytokine, FASEB Journal, International Journal of Toxicology, Health Physics, etc....The institute’s most active research involves external penetrating ionizing radiation. The scientific efforts focus on discovering mechanisms of radiation injury in a search for potential drug targets and to guide medical treatment, assessing radiation injury severity, discovering and developing early preclinical radiation countermeasure candidates, and studying mechanisms and countermeasures for radiation combined with other injury...Development of a panel of seven efficacious radiation countermeasure candidates against acute radiation syndrome (ARS). These agents have low toxicity and practical routes of administration. They are ready for advanced development by other DOD agencies when resources become available. All are at Technology Readiness Level (TRL) 3 or above. This is the level for which AFRRI is funded (DOD S&T activities 6.2 and 6.3). One candidate (genistein or BIO-300) is at TRL 5, and another (5-AED) is at TRL 6. Five of these countermeasure candidates were conceived at AFRRI, and research and development initiated at AFRRI. These are 5-AED, tocols, genistein (BIO 300), ciprofloxacin (CIPRO), and ghrelin. Two were researched at early stages in collaboration with companies: Ex-Rad® and CDX-301. hree have FDA Investigational New Drug (IND) status for ARS: 5-AED, genistein (BIO 300), a d Ex-Rad®. Six have human safety trials: 5-AED, genistein (BIO 300), Ex-Rad®, CDX-301, C PRO, and Ghrelin. The seventh (tocols) has very low toxicity in non-GLP studies ( administered in a manner suitable for an ARS countermeasure). All enhance survival in irradiated animals in robust studies repeated multiple times. Four of these countermeasure candidates are dual use, i.e., approved or being developed for mainstream medical indications: CIPRO: antibiotic. Ghrelin: cachexia, hemodialysis, seizures, gastroparesis. CDX-301: hematopoietic stem cell transplantation. BIO 300: lung cancer, prostate cancer.” https://www.usuhs.edu/afrri/
US Army Research Institute of Environmental Medicine (USARIEM)

- “US Army Research Institute of Environmental Medicine (USARIEM)”
  http://www.usariem.army.mil/
- “Thermal & Mountain Medicine Division”
  http://www.usariem.army.mil/index.cfm/about/divisions/tmmd
- “Altitude Acclimatization Guide”
- “ALTITUDE ACCLIMATIZATION AND ILLNESS MANAGEMENT”
Altitude Research Centers

- “Altitude Research Center, University of Colorado.”
  http://www.ucdenver.edu/academics/colleges/medicalschool/centers/AltitudeResearch/Pages/Altitude%20Research%20Center.aspx
- “CCAMM (the clinical unit of the Altitude Research Center), University of Colorado.”
  https://com-cam.org/entity/altitude-research-center-arc/
- “Altitude Research Center, Aurora, Colorado.”
  https://www.facebook.com/Altitude-Research-Center-172672682782948/
- “The Institute for Altitude Medicine”
  http://www.altitudemedicine.org/
- “High Altitude Research Center (HARC) at St. Anthony Summit Medical Center”
  https://www.centura.org/care-and-health/high-altitude-health
- “United States Army Pikes Peak Research Laboratory”
  https://en.wikipedia.org/wiki/United_States_Army_Pikes_Peak_Research_Laboratory
- “Swiss Committee on Polar and High Altitude Research”
  http://www.polar-research.ch/e/index.php
- “White Mountain Research Center, University of California”
  https://www.wmrc.edu/
Future Large Telescopes

- “The TMT International Observatory LLC (TIO) – Currently scheduled for completion in 2027.” [https://www.tmt.org/](https://www.tmt.org/)
Occupational Safety and Health Administration (OSHA)

- “Know Your Rights. Under federal law, you are entitled to a safe workplace. Your employer must provide a workplace free of known health and safety hazards. If you have concerns, you have the right to speak up about them without fear of retaliation. You also have the right to: Be trained in a language you understand. Work on machines that are safe. Be provided required safety gear, such as gloves or a harness and lifeline for falls. Be protected from toxic chemicals. Request an OSHA inspection, and speak to the inspector. Report an injury or illness, and get copies of your medical records. See copies of the workplace injury and illness log. Review records of work-related injuries and illnesses. Get copies of test results done to find hazards in the workplace.” [https://www.osha.gov/workers/index.html]

- “How to File a Safety and Health Complaint. The Occupational Safety and Health Act of 1970 gives employees and their representatives the right to file a complaint and request an OSHA inspection of their workplace if they believe there is a serious hazard or their employer is not following OSHA standards. Workers do not have to know whether a specific OSHA standard has been violated in order to file a complaint. The complaint should be filed as soon as possible after noticing the hazard or lack of compliance because OSHA citations may only be issued for violations that currently exist or existed in the past 6 months. Complaints from workers or their representatives are taken seriously by OSHA. OSHA will keep your information confidential.” [https://www.osha.gov/workers/file_complaint.html]

- “File A Complaint. File a discrimination complaint if your employer has retaliated against you for exercising your rights as an employee. If you have been punished or retaliated against for exercising your rights under the OSH Act, you must file a complaint with OSHA within 30 days of the alleged reprisal. In states with approved state plans, employees may file a complaint under the OSH Act (Section 11(c)) with both the State and Federal OSHA.” [https://www.whistleblowers.gov/complaint_page]

- “Contact OSHA. To ask about a health and safety issue at your workplace, discuss your rights, or learn more about OSHA, please contact us. Your information will be kept confidential. Call us toll-free at 1-800-321-6742 (OSHA)” [https://www.osha.gov/html/RAmap.html]

- “Top 10 Most Frequently Cited Standards...The following is a list of the top 10 most frequently cited standards following inspections of worksites by federal OSHA. OSHA publishes this list to alert employers about these commonly cited standards so they can take steps to find and fix recognized hazards addressed in these and other standards before OSHA shows up. Far too many preventable injuries and illnesses occur in the workplace.” [https://www.osha.gov/Top_Ten_Standards.html]

- “OSHA Frequently Asked Questions” [https://www.osha.gov/OSHA_FAQs.html#!infoworkers]

- “Human beings must breathe oxygen . . . to survive, and begin to suffer adverse health effects when the oxygen level of their breathing air drops below [19.5 percent oxygen]. Below 19.5 percent oxygen . . . , air is considered oxygen-deficient. At concentrations of 16 to 19.5 percent, workers engaged in any form of exertion can rapidly become symptomatic as their tissues fail to obtain the oxygen necessary to function properly (Rom, W., Environmental and Occupational Medicine, 2nd ed.; Little, Brown; Boston, 1992). Increased breathing rates, accelerated heartbeat, and impaired thinking or coordination occur more quickly in an oxygen-deficient environment. Even a momentary loss of coordination may be devastating to a worker if it occurs while the worker is performing a potentially dangerous activity, such as climbing a
Concentrations of 12 to 16 percent oxygen cause tachypnea (increased breathing rates), tachycardia (accelerated heartbeat), and impaired attention, thinking, and coordination (e.g., Ex. 25-4), even in people who are resting. At oxygen levels of 10 to 14 percent, faulty judgment, intermittent respiration, and exhaustion can be expected even with minimal exertion (Exs. 25-4 and 150). Breathing air containing 6 to 10 percent oxygen results in nausea, vomiting, lethargic movements, and perhaps unconsciousness. Breathing air containing less than 6 percent oxygen produces convulsions, then apnea (cessation of breathing), followed by cardiac standstill. These symptoms occur immediately. Even if a worker survives the hypoxic insult, organs may show evidence of hypoxic damage, which may be irreversible (Exs. 25-4 and 150; also reported in Rom, W. [see reference in previous paragraph]). OSHA's experience confirms the record evidence that most work at higher altitudes is performed by fully acclimated workers (Exs. 54-6, 54-208). These provisions will allow acclimated workers to continue to perform their work without oxygen-supplying respirators, at any altitude up to 14,000 feet altitude, as long as the ambient oxygen content remains above 19.5% and the employee has no medical condition that would require the use of supplemental oxygen. (Federal Register, Vol. 63, p. 1203.) Therefore, in addition to the protection afforded to them by altitude acclimation, OSHA's Respiratory Protection Standard ensures that employees working under oxygen-deficient conditions at altitude will have an adequate and reliable breathing supply consisting of 19.5 percent oxygen, an oxygen content that will provide the employees exposed to these conditions with a substantial margin of safety. “https://www.osha.gov/laws-reggs/standardinterpretations/2007-04-02-0

DEPARTMENT OF LABOR Occupational Safety and Health Administration 29 CFR Parts 1910 and 1926 [Docket No. H-049] RIN 1218-AA05 Respiratory Protection...SUMMARY: This final standard, which replaces the respiratory protection standards adopted by OSHA in 1971 (29 CFR 1910.134 and 29 CFR 1926.103), applies to general industry, construction, shipyard, longshoring, and marine terminal workplaces. The standard requires employers to establish or maintain a respiratory protection program to protect their respirator-wearing employees. The standard contains requirements for program administration; worksite-specific procedures; respirator selection; employee training; fit testing; medical evaluation; respirator use; respirator cleaning, maintenance, and repair; and other provisions. The final standard also simplifies respirator requirements for employers by deleting respiratory provisions in other OSHA health standards that duplicate those in the final standard and revising other respirator-related provisions to make them consistent. In addition, the standard addresses the use of respirators in Immediately Dangerous to Life or Health (IDLH) atmospheres, including interior structural firefighting. During interior structural firefighting (an IDLH atmosphere by definition), self-contained breathing apparatus is required, and two firefighters must be on standby to provide assistance or perform rescue when two firefighters are inside the burning building. Based on the record in this rulemaking and the Agency's own experience in enforcing its prior respiratory protection standards, OSHA has concluded that compliance with the final rule will assist employers in protecting the health of employees exposed in the course of their work to airborne contaminants, physical hazards, and biological agents, and that the standard is therefore necessary and appropriate. The final respiratory protection standard covers an estimated 5 million respirator wearers working in an estimated 1.3 million workplaces in the covered sectors. OSHA's benefits analysis predicts that the standard will prevent many deaths and illnesses among respirator-wearing employees every year by protecting them from exposure to acute and chronic health hazards. OSHA estimates that compliance with this standard will
avert hundreds of deaths and thousands of illnesses annually. The annual costs of the standard are estimated to be $111 million, or an average of $22 per covered employee per year.“  
Breaking State or Federal Laws Leading To Fines Or Jail

- “Yes, OSHA violations can send you to jail...Can mis-steps with OSHA land you in jail? Several recent cases are a reminder that the risk is real. While OSHA rarely makes a criminal case out of safety violations, it does pursue criminal charges when people mislead the agency through false statements, falsified records, or destroyed documents. A company that does not take great care in handling an investigation risks such costly errors, leading to criminal prosecution and stiff penalties under federal law.”

- “Criminal Prosecutions Of Workplace Fatalities...Since the creation of the federal Occupational Safety and Health Administration (OSHA) 32 years ago, there have been more than 200,000 workplace-related deaths. However, OSHA has referred only 151 cases to the Justice Department for criminal prosecution -- and the maximum penalty companies face for a "willful violation" of OSHA laws is a misdemeanor. Federal prosecutors have declined to pursue two-thirds of these cases, and only eight of them have resulted in prison sentences for company officials. Here's a look at those eight cases.”
  https://www.pbs.org/wgbh/pages/frontline/shows/workplace/osha/referrals.html

- “OSHA Criminal Referrals on the Rise...Section 17(e) of the Occupational Safety and Health Act ("OSH Act") provides for a Class B misdemeanor criminal penalty, including imprisonment up to six months and substantial monetary fines if an employer’s willful violation of any OSHA standard causes the death of an employee.”
  https://www.oshalawupdate.com/2012/12/18/osha-criminal-referrals-on-the-rise/

- “Is OSHA Going to Put You in Jail?...Title 29 U.S.C. § 666(e) provides criminal penalties for any employer who willfully violates a safety standard prescribed pursuant to the Occupational Safety and Health Act, where that violation causes the death of any employee. Four elements must be proved in order to establish a criminal violation of 29 U.S.C. § 666(e). The government must prove that: (1) the defendant is an employer engaged in a business affecting commerce; (2) the employer violated a "standard, rule or order" promulgated pursuant to 29 U.S.C. § 665, or any regulation prescribed under the Act; (3) the violation was willful, and (4) the violation caused the death of an employee.”

- “Criminal Penalties For Violating OSHA Standards...VIOLATIONS THAT RESULT IN SERIOUS DEATH OR INJURY UNDER LABOR CODE § 6425 Willful Violation Of Standard Causing Death Or Serious Injury To Employee. Any contractor who willfully violates an OSHA standard is guilty of a public offense and may be subject to severe penalties if the violation causes death or serious injury to any employee.”

- “OSHA and MSHA Criminal Prosecutions – DOJ Announces New Procedures After CEO Verdict...criminal prosecution can also occur under general federal criminal law for making false statements to a government investigator, obstruction of justice (usually through document or evidence destruction), witness tampering, and conspiracy. These general federal criminal law provisions are felonies that can carry 25-year prison sentences.”
“Consequences of Violating Employees Rights...When an employer violates the rights of employees, she exposes herself to penalties ranging from minimal corrective measures to stiff monetary fines and, under unusual circumstances, jail and prison sentences. Worker rights to health and safety, fair pay, freedom from retaliation and a non-discriminatory workplace are a few of the rights covered by federal law.” [https://smallbusiness.chron.com/consequences-violating-employees-rights-14037.html](https://smallbusiness.chron.com/consequences-violating-employees-rights-14037.html)

“Labor Law: Violations and Penalties...Violating labor and employment laws comes with a price, and often a price that's both tangible and intangible. Aside from possible liability for monetary payments, court costs and attorneys' fees, companies embroiled in legal defense of their actions can suffer intangible damages to reputation and corporate citizenship. Small businesses aren't always exempt from the law because many laws apply to employers with just a handful of workers.” [https://yourbusiness.azcentral.com/labor-law-violations-penalties-15635.html](https://yourbusiness.azcentral.com/labor-law-violations-penalties-15635.html)
Government Health & Safety Websites

- Canada: “Canadian Centre for Occupational Health and Safety (CCOHS)” [https://www.ccohs.ca/](https://www.ccohs.ca/)
- USA: “Occupational Safety and Health Administration (OSHA)” [https://www.osha.gov/](https://www.osha.gov/)
Health & Safety Books

- “Operating Safely in Hazardous Environments By Cocciardi“ https://books.google.com/books?id=vBNLrm6CS3EC&pg=PA33&lpg=PA33&dq=organs+may+show+evidence+of+hypoxic+damage&source=bl&ots=ZxhJXhhOHq&sig=zKtzSwg_yNRbSvVngt5gcsFlhk&hl=en&sa=X&ved=0ahUKEwiS9Mafxo_AhUD5WMKHWWBD8Q6AEIdDAI#v=onepage&q=organs%20may%20show%20evidence%20of%20hypoxic%20damage&f=false
- “Nutritional Needs in Cold and High-Altitude Environments” https://www.nap.edu/download/5197
- “The excellent book ‘Going Higher. Oxygen, Man, And Mountains.’ should be compulsory reading for all high altitude workers.” Steven Magee CEng MIET – Q
- “Altitude Illness: Prevention & Treatment (Mountaineers Outdoor Expert) by Stephen Bezruchka” https://www.amazon.com/gp/product/0898866855/ref=pe_2640190_232748420_pd_te_o_ch_tie?_encoding=UTF8&pd_rd_i=0898866855&pd_rd_r=1PKYQ082WPA2DBNC9MY&pd_rd_w=CsNxn&pd_rd_wg=TzqnC
- "Ernsting's Aviation and Space Medicine by David Gradwell, David J Rainford" https://www.amazon.com/Erstnings-Aviation-Space-Medicine-5E/dp/1444179942/ref=dp賓gy_14_3/137-0093847-7340902?_encoding=UTF8&pd_rd_i=1444179942&pd_rd_r=3838121c-8501-472f-9466-dedd4e4e397&pd_rd_w=MiyTu&pd_rd_wg=JvZXL&pf_rd_p=a2006322-0bc0-4db9-a08e-d168e18ce6f0&pf_rd_r=5DVSNQAVJ5R71W81FHV1&psc=1&refRID=5DVSNQAVJ5R71W81FHV1
- "Life of Man on the High Alps by Angelo Mosso" https://www.amazon.com/Life-High-Angelo-1846-1910-Mosso/dp/1371231877/ref=tmm_pap_title_0?_encoding=UTF8&qid=&sr=
- "Barometric Pressure: Researches in Experimental Physiology by Paul Bert" https://www.amazon.com/Barometric-Pressure-Researches-Experimental-Physiology/dp/0260226114/ref=sr_1_1?keywords=paul+bert+barometric+pressure&qid=1566324652&sr=8-1
- "The Respiratory Function of the Blood by Joseph Barcroft"

- "I have no recollection of seeing books on high altitude diseases at remote astronomical observatories atop mountain peaks." Steven Magee CEng MIET – Q
Health & Safety Websites

- “EHS Today” http://www.ehstoday.com/
- “Safety+Health magazine” http://www.safetyandhealthmagazine.com/
Demolition Of The Mauna Kea Observatories

- "Biological science clearly states that it is impossible to make the summit of Mauna Kea safe for the sea level adapted workers. As such, the Mauna Kea Observatories should be demolished as soon as possible to protect the health and safety of the unsuspecting workers.” Steven Magee CEng MIET - Q
- “The cat is out of the bag: The very high altitude summit of Mauna Kea is biologically toxic to the sea level adapted workers. It is time to demolish the Mauna Kea Observatories.” Steven Magee CEng MIET - Q
- "Based on the medical evidence that clearly states being above 10,000 feet is hazardous to the health of sea level adapted humans, it is clear that all of the manned facilities on top of the 13,796 feet very high altitude Mauna Kea summit in Hawaii should be removed and the summit restored back to its native environment.” Steven Magee CEng MIET - Q
- “The summit of Mauna Kea should never have been developed as it is not safe for humans up there. I am now locked into an endless loop of doctors visits for what appears to be classic very high altitude heart, lung & brain damage because I was unfortunate enough to have worked there.” Steven Magee CEng MIET - Q
- “The very high altitude Mauna Kea Observatories (MKO) are unsafe for sea level adapted humans to work in. They always have been hazardous to health and always will be.” Steven Magee CEng MIET - Q
- “Mauna Kea Sickness (MKS) needs to be thoroughly researched and characterized by the medical profession before any more very high altitude workplaces are built on the summit. It is likely that once Mauna Kea Sickness is well characterized, that all of the manned summit facilities would need to be removed on the grounds of health and safety.” Steven Magee CEng MIET - Q
- “I am looking forward to attending the bulldozing ceremony for the removal of all very high altitude manned facilities atop the known biologically toxic summit of Mauna Kea.” Steven Magee CEng MIET - Q
- “Never underestimate the power of an educated person that has committed to shutting down your biologically toxic enterprise.” Steven Magee CEng MIET - Q
- “Dear Mauna Kea Observatories, I know that telescopes do not belong on sacred sites. I also know that you are willfully damaging your workers health by building astronomical observatories in known biologically toxic environments. As such, I now respectfully request your resignation from the very high altitude sacred mountain of Mauna Kea. Sincerely, Steven Magee, Damaged Mauna Kea Worker.” Steven Magee CEng MIET - Q
- “Astronomy needs to clean up its act and the first step in the right direction is the demolition of the biologically toxic Mauna Kea Observatories.” Steven Magee CEng MIET - Q
- “The fact that the USA government is denying damaged Mauna Kea workers their earned disability payments is reason enough to demolish the biologically toxic Mauna Kea Observatories.” Steven Magee CEng MIET - Q
- "There is only so much abuse a worker will take before they decide to shut your biologically toxic operation down with legal science." Steven Magee CEng MIET - Q
- "I am not going to apologize for scientific discovery that prevents the construction of the Thirty Meter Telescope (TMT) atop Mauna Kea." Steven Magee CEng MIET - Q
"The development of the biologically toxic Mauna Kea Observatories (MKO) is the fruition of professional astronomers behaving badly." Steven Magee CEng MIET - Q
"The simplest way to shut down a known biologically toxic facility is to trawl the internet for scientific papers that prove the toxicity." Steven Magee CEng MIET - Q
“Why object to one very high altitude telescope when you can use science to object to them all.” Steven Magee CEng MIET - Q
“It was astronomical science that built the Mauna Kea Observatories (MKO) and I have every expectation that it will be biological science that demolishes them.” Steven Magee CEng MIET - Q
“Biological science is clear that the Mauna Kea Observatories must be shut down to protect the long term health of the summit workers. It will be interesting to see how long astronomers willfully ignore the science.” Steven Magee CEng MIET - Q
“If I can stay alive long enough to see the demolition of the biologically toxic Mauna Kea Observatories (MKO), then I will consider my life to be complete.” Steven Magee CEng MIET – Q
"It is a social responsibility to shut down the biologically toxic Mauna Kea Observatories (MKO)." Steven Magee CEng MIET – Q
Shutting Down The Biologically Toxic Space Industry.

- "Shutting down the biologically toxic Mauna Kea Observatories is the short term goal. The long term goal is shutting down the biologically toxic Space industry." Steven Magee CEng MIET - Q
- "The most dangerous job by far in the USA is an astronaut." Steven Magee CEng MIET - Q
- "When I see the President of the USA promoting the development of Space, I see an incompetent that does not understand the biological toxicity of the Space industry to over seven billion humans on planet Earth." Steven Magee CEng MIET - Q
- "Airplanes are the poor man’s satellites." Steven Magee CEng MIET - Q
- "Mother nature took millions of years to remove all but one satellite, the Moon, from Earth’s orbit. The modern human has undone that process since the launch of the first Sputnik satellite in 1957." Steven Magee CEng MIET – Q
- "Since 1957 the modern human has filled the sky with tens of thousands of satellites without examining the reason why Earth previously only had one satellite, called the Moon." Steven Magee CEng MIET - Q
- "Fifty years after landing on the Moon, we have learned that the Space industry is biologically toxic to over seven billion people on planet Earth." Steven Magee CEng MIET - Q
- "Steven Magee Photographs Altitude Interference Radiation (AIR)" [Link]
- "Steven Magee Video Records Altitude Interference Radiation (AIR)" [Link]
- "Astronomy group calls for urgent action on SpaceX Starlink satellites...The visible light isn’t the only problem: the satellites use radio signals to communicate, which could interfere with observations in those frequencies. “Recent advances in radio astronomy, such as producing the first image of a black hole… were only possible through concerted efforts in safeguarding the radio sky from interference,” the IAU statement says. Too many satellites emitting radio waves could endanger future studies." [Link]
- "Global Union Against Radiation Deployment from Space (GUARDS). GUARDS is an international coalition against global WiFi from space, a complex technology of radiation and toxic chemicals endangering all life on Earth...Planned Global WiFi from Space Will Destroy Ozone Layer, Worsen Climate Change, and Threaten Life on Earth. Thirteen companies are competing to cover the entire Earth with high-speed wireless Internet from low-orbit satellites within one to two years. This would be an ecological and public health nightmare. The biggest players are SpaceX (12,000 satellites), OneWeb (4,560 satellites) and Boeing (2,956 satellites). The recent finding, in 2018, that stratospheric ozone is still declining despite the Montreal Protocol took everyone by surprise. The increasing pace of ever-more-powerful rocket launches is a likely factor. Inminent plans for beaming high-speed Internet from space would require the launching of large rockets almost daily. This is expected to alter, if not destroy, the ozone layer and contribute significantly to climate change. Although many new rockets burn liquid fuel containing no ozone-destroying chlorine, the assumption that this is environmentally friendly is proving wrong." [Link]
"INTERNATIONAL APPEAL. Stop 5G on Earth and in Space. We the undersigned scientists, doctors, environmental organizations and citizens from (___) countries, urgently call for a halt to the deployment of the 5G (fifth generation) wireless network, including 5G from space satellites. 5G will massively increase exposure to radio frequency (RF) radiation on top of the 2G, 3G and 4G networks for telecommunications already in place. RF radiation has been proven harmful for humans and the environment. The deployment of 5G constitutes an experiment on humanity and the environment that is defined as a crime under international law." [https://www.5gspaceappeal.org/the-appeal](https://www.5gspaceappeal.org/the-appeal)

"Shutting down the biologically toxic Mauna Kea Observatories (MKO) is the smaller target, the larger target is shutting down the biologically toxic Space industry." Steven Magee CEng MIET - Q
Astronomy Health & Safety

- “To speak out or not to speak out, that is the question.” Steven Magee CEng MIET - Q
- “My interest in astronomy has been replaced by my fascination with the biological damage that occurs in very high altitude workers.” Steven Magee CEng MIET - Q
- “Having extensively researched the toxicity of high altitude astronomy, I consider myself lucky that the astronomy management teams did not murder me.” Steven Magee CEng MIET - Q
- “I am blowing the whistle on high altitude astronomy because it is well overdue.” Steven Magee CEng MIET - Q
- “Researching the high altitude workplace damage to my health has turned into a fascinating voyage of astronomical discovery.” Steven Magee CEng MIET - Q
- “Astronomy’s dirty secrets are in the process of coming to light.” Steven Magee CEng MIET - Q
- “The biggest mistake that I made in high altitude astronomy was not realizing that the onset of sickness I saw at the first astronomical observatory were the initial signs of High Altitude Observatory Disease (HAOD).” Steven Magee CEng MIET - Q
- “While altitude sickness was disclosed to the astronomy workers, high altitude observatory disease (HAOD) was not disclosed.” Steven Magee CEng MIET - Q
- “High altitude astronomy is a catch 22: Stay inside the observatory and get high altitude observatory disease (HAOD) or go outside and get radiation sickness. Either way, the sea level adapted human may develop disease.” Steven Magee CEng MIET - Q
- “The science clearly states that it is impossible not to damage the long term health of a sea level adapted human that spends its life going from near sea level up to very high altitude on a daily basis.” Steven Magee CEng MIET - Q
- “If you are a sea level adapted human, then your health is at risk by working at the biologically toxic Mauna Kea Observatories.” Steven Magee CEng MIET - Q
- “There is ample evidence that all very high altitude manned astronomical facilities should be shut down that use sea level adapted workers.” Steven Magee CEng MIET - Q
- "The lasting physical and mental health effects of long term very high altitude exposure appear to be remarkably similar to daily heavy smoking." Steven Magee CEng MIET - Q
- “I was trained by senior managers to instruct high altitude workers to discharge large amounts of industrial gas into the indoor environment without respiratory protection and without oxygen deficiency monitors.” Steven Magee CEng MIET - Q
- “High altitude astronomy is a strange world of oxygen starvation, sleep deprivation and radiation sickness.” Steven Magee CEng MIET - Q
- “Poisoning puts you into a mental state of wondering if you are alive or dead, as you are trapped in an intermediate state of mind.” Steven Magee CEng MIET - Q
- “The various forms of radiation exposures are far more harmful to long term health than what the corporate governments are telling their mass populations.” Steven Magee CEng MIET - Q
- “When I started to research what had made me sick, I had no idea that it would turn me into an expert on inconvenient truths.” Steven Magee CEng MIET - Q
- “During death I have every expectation that I will be accompanied by spirits, as that is what happened when my brain was in oxygen starvation at very high altitudes.” Steven Magee CEng MIET - Q
“Over time, it became clear that my invisible friend and the Hawaiian visions were arising out of erratic low blood oxygen levels, company supplied drugs, malnutrition, abnormal electromagnetic radiation exposures, very high altitude damage, pernicious anemia, altered hormones, sleep apnea, bruxism and food intolerance.” Steven Magee CEng MIET - Q

“The senior managers would advise their staff to take a break and breath oxygen when they started to exhibit ‘Summit Brain’.” Steven Magee CEng MIET - Q

“The senior astronomy managers were aware of ‘Summit Brain’ and did not disclose to workers that it may lead to permanent damage to mental functioning.” Steven Magee CEng MIET - Q

“There are no doubts that the Mauna Kea management teams knew that summit workers were suffering from the serious effects of oxygen starvation to the brain and body.” Steven Magee CEng MIET - Q

“It was with the benefit of hindsight that I realized the extensive behavioral issues that I had been documenting in high altitude workers was a known aspect of the biological toxicity of astronomical observatories.” Steven Magee CEng MIET - Q

“If you are going to go crazy, go inconveniently crazy.” Steven Magee CEng MIET - Q

“The only known way for a sea level adapted human to avoid lifelong high altitude induced disease is to not venture to high altitudes.” Steven Magee CEng MIET - Q

“Sleep disorders are a known occupational hazard for astronomers and their support staff.” Steven Magee CEng MIET - Q

“I was aware of many workers that were showing behavioral problems during my time in high altitude astronomy.” Steven Magee CEng MIET - Q

“With the benefit of hindsight, it was clear that astronomy management teams were lying through silence to their workers regarding the toxicity of their high altitude astronomical facilities.” Steven Magee CEng MIET - Q

“With the benefit of hindsight, I realized that astronomers had successfully avoided fully researching the harmful biological effects that their high altitude facilities were having on their workers health and safety.” Steven Magee CEng MIET - Q

“Since 1996 the W. M. Keck Observatory has been observing what happens to workers that spend their time in and around two massive Faraday cages.” Steven Magee CEng MIET - Q

“High altitude observatories are commonly constructed with few to no windows, meaning that their staff are typically natural light deprived during their work day.” Steven Magee CEng MIET - Q

“Every observatory summit office that I was based in had no windows in high altitude astronomy. My workdays were spent bathing in artificial florescent light.” Steven Magee CEng MIET - Q

“Health and safety is challenging in an environment where the workers are suffering from oxygen starvation, sleep deprivation and the side effects of company supplied drugs and gas.” Steven Magee CEng MIET - Q

“It is time to stop the abusive workplace practices of very high altitude astronomy.” Steven Magee CEng MIET - Q

“My message to the high altitude astronomy community is this: You need to start abiding by the laws and regulations of the government and stop the abuse and harassment of workers.” Steven Magee CEng MIET - Q

“High altitude astronomy is a sad story of a myriad of environmental toxins that should have been avoided by the unsuspecting sea level adapted workers.” Steven Magee CEng MIET - Q
“My dislike of the W. M. Keck Observatory, Columbia University and Dartmouth College is based on unpleasant experiences in their employment.” Steven Magee CEng MIET - Q

“When diagnosing my long term health problems, it was logical to inspect the environmental exposures that occurred at the workplaces where I saw the onset of each particular health issue.” Steven Magee CEng MIET - Q

"As a manager in high altitude astronomy, if you report to the upper management team that their staff appear sick and that they are displaying behavioral problems, it was my experience that they respond by notifying you that your contract will not be renewed and that you will be terminated without notice if anyone complains about you! High altitude astronomy is a very shady industry that only functions by ignoring worker health and safety issues." Steven Magee CEng MIET - Q

“If the astronomy management team becomes aware that you have developed long term high altitude sickness, then it is reasonable to think that you may be terminated soon.” Steven Magee CEng MIET - Q

“The USA is turning into a Nazi like country where sick people are treated like garbage.” Steven Magee CEng MIET - Q

“After a decade of mal-acclimatization, Steven Magee’s body will no longer acclimatize to any altitude.” Steven Magee CEng MIET - Q

“It has been my experience that the astronomical industry will not rehire past staff members whose health they know was damaged by their biologically toxic high altitude workplaces.” Steven Magee CEng MIET - Q

“I remember how excited I was to work for the Ivy League. By the time I left, I would not advise anyone to work for them.” Steven Magee CEng MIET - Q

“Out of all of my employers, the Ivy League was by far the worst.” Steven Magee CEng MIET - Q

“You have to be careful about damaging workers health because those damaged workers may publicly research your toxic workplace to discover what made them sick.” Steven Magee CEng MIET - Q

“All high altitude workers have a right to be fully informed about the complete range of environmental toxins that they are being exposed to and the known health issues in current and past workers, including what workers have died from.” Steven Magee CEng MIET - Q

“After a decade in high altitude astronomy, I had come to the conclusion that the primary purpose of the human resources department was to facilitate the company objectives at the expense of the employees.” Steven Magee CEng MIET - Q

“By the time I left high altitude astronomy I had formed the opinion that the human resources department was the shadiest.” Steven Magee CEng MIET - Q

“It should be standard practice in the medical profession to send a sickened very high altitude worker on a sleep study and put them onto high dose vitamin B12 injections for six months to see if they respond to it.” Steven Magee CEng MIET - Q

“The medical profession seem incompetent at diagnosing Low Level Radiation Sickness (LLRS).” Steven Magee CEng MIET - Q

“It was my experience that the medical profession could not correctly diagnose me. It fell onto me to discover the low level radiation sickness (LLRS), low blood oxygen levels during sleep, B12 deficiency, food intolerance, multiple chemical sensitivity(MCS), DHEA (Dehydroepiandrosterone) deficiency, bruxism and mercury poisoning.” Steven Magee CEng
“The more that I research very high altitude astronomy, the more I feel the need to advise sea level adapted people to avoid it for health and safety reasons.” Steven Magee CEng MIET - Q

“If a workplace makes you sick enough to self medicate on a daily basis, then you should aim to leave at the earliest opportunity to safeguard your long term health.” Steven Magee CEng MIET - Q

“There really needs to be a thorough review of current long term summit staff and past summit employees to characterize the long term health effects and fatalities that Mauna Kea Sickness (MKS) causes.” Steven Magee CEng MIET - Q

“Manua Kea's summit astronomical facilities were run by incompetents for the benefit of incompetents.” Steven Magee CEng MIET - Q

“There is a lot of willful irresponsibility in professional astronomy.” Steven Magee CEng MIET - Q

“It is absolutely scandalous that the astronomical community are trying to build the world’s largest telescope atop the known biologically toxic very high altitude summit of Mauna Kea.” Steven Magee CEng MIET - Q

“High altitude astronomy is a very unprofessional profession.” Steven Magee CEng MIET - Q

"Never trust a high altitude astronomer." Steven Magee CEng MIET - Q

"the hashtag #WeAreMaunaKea...and the hashtag #ProtectMaunaKea have seen big jumps in use this week." http://www.bbc.com/news/blogs-trending-32239000

“If I were asked ‘Is it safe?’ by a person considering working atop the summit of Mauna Kea in Hawaii, my response would be ‘It is a biologically unsafe workplace for sea level adapted humans.’” Steven Magee CEng MIET - Q

“La Palma or Hawaii for the Thirty Meter Telescope (TMT)? Hawaii is far more hazardous for the health and safety of sea level adapted summit workers.” Steven Magee CEng MIET - Q

“The Thirty Meter Telescope (TMT) atop Mauna Kea will never meet this USA legal requirement: ‘Under federal law, you are entitled to a safe workplace. Your employer must provide a workplace free of known health and safety hazards.’” Steven Magee CEng MIET - Q

"Stop TMT Construction and Arrests of Mauna Kea Protectors"


“Should the Thirty Meter Telescope Be Built?” http://pbshawaii.org/insights-on-pbs-hawaii-should-astronomy-related-development-on-mauna-kea-continue/

“To build the Thirty Meter Telescope (TMT) atop Mauna Kea requires a willful ignorance to Mauna Kea Sickness (MKS) by the many people involved with the project.” Steven Magee CEng MIET - Q

“When I saw how many people were objecting to the construction of the Thirty Meter Telescope atop Mauna Kea, I realized that there needed to be an open and honest discussion about the toxicity of the 13,796 feet very high altitude summit and the health and safety issues of astronomical observatories.” Steven Magee CEng MIET - Q

“The Thirty Meter Telescope (TMT) is just a small part of a very large problem.” Steven Magee CEng MIET - Q

“The Thirty Meter Telescope (TMT) atop Mauna Kea is highlighting the biological damage that corrupt governments and harmful corporations engage in with unsuspecting workers to progress the toxic Space industries.” Steven Magee CEng MIET - Q
“I expect that the 2019 attempt to construct the Thirty Meter Telescope (TMT) atop Mauna Kea will be remembered for desecration of the native Hawaiian’s beliefs, a commitment to damaging very high altitude workers health, and a continuation of the willful ignorance to the laws in the USA.” Steven Magee CEng MIET - Q

“The Thirty Meter Telescope (TMT) atop Mauna Kea will only get built if corrupt government officials blatantly ignore the fundamental health and safety issues of the very high altitude mountain and the biological toxicity of astronomical observatories.” Steven Magee CEng MIET - Q

“The next time you look at a wonderful astronomical picture taken from the summit of Mauna Kea, you must remember that workers health was damaged in order to obtain it.” Steven Magee CEng MIET - Q

"The electrical, electronics and wireless radio frequency (RF) industries are creating an increasingly high radiation environment for the human. This is comparable to the elevated radiation environment found at high altitudes and smart health researchers would be wise to contrast high altitude diseases to the epidemics of our time, such as Autism, Attention Deficit Disorder (ADD), Fibromyalgia, Electromagnetic Hypersensitivity (EHS), and so on." Steven Magee CEng MIET - Q http://www.emfscientist.org/index.php/emf-scientist-appeal

“At the age of 47, the medical profession had me on four RX-Only prescription drugs for lung and heart problems, an RX-Only prescription continuous positive airway pressure (CPAP) life support machine during sleep, two brain RX-Only prescriptions, a brain supplement, and high cholesterol medication. I am still in the process of being fully diagnosed by the medical profession and this drugs list may increase.” Steven Magee CEng MIET - Q

“Continuous positive airway pressure (CPAP) is a form of positive airway pressure ventilator, which applies mild air pressure on a continuous basis to keep the airways continuously open in people who are able to breathe spontaneously on their own.” https://en.wikipedia.org/wiki/Continuous_positive_airway_pressure

“I had observed similar problems in numerous poor performing high altitude workers that I supervised to the ill health that I displayed at age 48.” Steven Magee CEng MIET - Q

“At the age of 49, I had been in the X-Ray radiation computerized tomography (CT) scanner for two brain scans, one nasal scan, and four lung scans.” Steven Magee CEng MIET - Q

“After developing serious mental and physical health issues during and after a decade in high altitude astronomy, I decided to dedicate my mind and body to medical research for the biological science of High Altitude Observatory Disease (HAOD).” Steven Magee CEng MIET - Q

“As a manager in high altitude astronomy, I found poor performing employees to be a feature of remote observatories.” Steven Magee CEng MIET - Q

"I have worked with many of the greatest minds in astrophysics and it is now clear that they were the dunces of astrobiology.” Steven Magee CEng MIET - Q

“There is a lot of willful incompetence in high altitude astronomy that is in the process of coming to light.” Steven Magee CEng MIET - Q

“I will use science to shut down the toxic Thirty Meter Telescope (TMT) project atop Mauna Kea in Hawaii.” Steven Magee CEng MIET - Q

“Time's up for very high altitude astronomy.” Steven Magee CEng MIET - Q

“It is time to end the insanity that calls itself very high altitude astronomy.” Steven Magee CEng MIET - Q
“I'm just a sickened person that researches the toxicity of the many dubious things that I was exposed to.” Steven Magee CEng MIET - Q

“It really should not fall onto a sickened Mauna Kea Observatories (MKO) manager to research the biological toxicity of the very high altitude summit research facilities.” Steven Magee CEng MIET - Q

“I guess when it come to corporate government science interests, the inconvenience of worker sickness will be covered up.” Steven Magee CEng MIET - Q

“The biggest threat to the future of very high altitude manned astronomy is a full understanding of what Mauna Kea Sickness (MKS) really is.” Steven Magee CEng MIET - Q

“Mauna Kea Sickness (MKS) left me appearing alive on the outside and feeling dead on the inside.” Steven Magee CEng MIET - Q

“Mauna Kea Sickness (MKS) in the summit workers is the inconvenient truth of the Mauna Kea Observatories (MKO).” Steven Magee CEng MIET - Q

“When I worked in high altitude astronomy, I had no idea how dangerous the management teams were.” Steven Magee CEng MIET - Q

“I can assure you that after developing workplace mercury poisoning, the astronomy management team will not renew your contract.” Steven Magee CEng MIET - Q

“When I reflect on my time working for the W. M. Keck Observatory, Columbia University and Dartmouth College, my memories are not of brilliant minds advancing science, but rather of shady people damaging their workers health in order to obtain tainted astronomical data.” Steven Magee CEng MIET - Q

"The biggest surprise that I had during my time in high altitude astronomy was being prevented from arranging a free Occupational Safety & Health Administration (OSHA) onsite evaluation to assist with bringing the observatory into OSHA compliance by the upper management team that I reported to.” Steven Magee CEng MIET - Q

“When the National Optical Astronomy Observatory (NOAO) found out that Occupational Safety and Health Administration (OSHA) were going to visit the site to assist in bringing it into legal compliance, they freaked out! They insisted that the visit had to be canceled and the result was that I eventually became so sick from the toxic workplace environment that I had no option but to leave.” Steven Magee CEng MIET - Q

“When sending your children to an Ivy League school, you must remember that some schools prevent Occupational Safety & Health Administration (OSHA) from visiting their training and research facilities.” Steven Magee CEng MIET - Q

“I advise people to avoid workplaces that prevent Occupational Safety & Health Administration (OSHA) visits.” Steven Magee CEng MIET - Q

“If you have arranged a free OSHA assistance visit to your facility and the management team insists on its cancellation, you are likely working in a known biologically toxic environment.” Steven Magee CEng MIET - Q

“During almost a decade in high altitude astronomy, I developed a strong dislike for the upper management teams through experience.” Steven Magee CEng MIET - Q

“Resarching the toxicity of high altitude astronomy led me to the conclude that it is primarily driven by astronomical greed.” Steven Magee CEng MIET - Q

“In high altitude astronomy, it is time for the old guard to be replaced with new blood that fully understands the law, health and safety, and the full range of toxicity that astronomical
observatories present to their workers.” Steven Magee CEng MIET - Q

- “Be careful, as once you lose your health, it may be gone forever.” Steven Magee CEng MIET - Q
- “The general public should be outraged by how poorly the very high altitude astronomy industry treats their unsuspecting sea level adapted workers.” Steven Magee CEng MIET - Q
- “I can assure you that there is a very large group of people that are completely okay with damaging your health as long as they can obtain their precious data by doing so.” Steven Magee CEng MIET - Q
- “The biggest discoveries of the Mauna Kea Observatories (MKO) are not going to come from astronomy, they are going to come from understanding Mauna Kea Sickness (MKS) in the sea level adapted workers.” Steven Magee CEng MIET - Q
- “The modern human has two options: Understand and treat environmental illness, or live life in a sickened state and die prematurely from environmental disease.” Steven Magee CEng MIET - Q
- “Do not get mad, get science.” Steven Magee CEng MIET - Q
- “Smart people use real science to shut down bad science.” Steven Magee CEng MIET - Q
- “With the benefit of hindsight, I realized that there was a blatant disregard for worker health and safety by the astronomical management teams that I worked for in the USA.” Steven Magee CEng MIET - Q
- “Professors are typically in their own little worlds, doing their own thing and thinking that the laws do not apply to them.” Steven Magee CEng MIET - Q
- “The mad scientist has gone crazy for a reason, and that reason typically lies in biologically toxic environmental exposures.” Steven Magee CEng MIET - Q
- “I was severely under-informed about the known toxicity of the very high altitude Mauna Kea Observatories (MKO) and what working there does to long term health.” Steven Magee CEng MIET - Q
- “During my time in high altitude astronomy, I was never informed that I was working in an abnormal radiation environment for the sea level adapted human.” Steven Magee CEng MIET - Q
- “The more I research high altitude astronomy, the more troubling I find the long term detrimental biological effects are.” Steven Magee CEng MIET - Q
- “It is through sickening experiences that I concluded that high altitude astronomy is hazardous to sea level adapted workers.” Steven Magee CEng MIET - Q
- “After a decade in high altitude astronomy, I concluded that astronomical observatories atop remote mountains are biologically harmful to sea level adapted humans.” Steven Magee CEng MIET - Q
- “Damage my health and I will hunt you down with science.” Steven Magee CEng MIET - Q
- “I always suspected that improvements in health would come from researching the biological toxicity of high altitude to the sea level adapted human.” Steven Magee CEng MIET - Q
- “As a manager in professional astronomy, I was keeping daily records on the abnormal behavioral problems in the staff. When the senior management team became aware of the records, they instructed me to destroy them.” Steven Magee CEng MIET - Q
- “The time has arrived for governments to start locking up very high altitude astronomy managers that have willfully damaged their sea level adapted civilian workers health in order to obtain tainted astronomical data.” Steven Magee CEng MIET - Q
“If we do not see any high altitude astronomy managers go to jail for willfully damaging their workers health, it will confirm that the corporate government systems of health and safety are blatantly fraudulent.” Steven Magee CEng MIET - Q

“I expect a lack of willing very high altitude workers that are prepared to sacrifice their long term health will eventually shut down manned astronomy on the summit of Mauna Kea.” Steven Magee CEng MIET - Q

“We are approaching a time where the masses will become wise and stop supporting the toxic pursuit of knowledge of Space and instead demand the closure of these biologically harmful industries.” Steven Magee CEng MIET - Q

“The professional astronomy cover-up of their sickened high altitude observatory workers needs to stop, as it is an illegal activity under USA law.” Steven Magee CEng MIET - Q

“It is important that the public knows the full story about what is occurring on the very high altitude summit of Mauna Kea in Hawaii.” Steven Magee CEng MIET - Q

“Professional astronomy dealt me a hand of cards from a stacked deck.” Steven Magee CEng MIET - Q

“Given that I have traced the primary cause of my disabling sickness to the toxic environment of high altitude astronomical research facilities, I am now expecting those that willfully damaged my health to go to jail.” Steven Magee CEng MIET - Q

“If the laws are applied correctly, we may see some of the biggest names in astronomy go to jail.” Steven Magee CEng MIET - Q

“When I reflect on how astronomy management teams collectively damaged my health, I concluded that they were able to do so because the corporate government facilitated it.” Steven Magee CEng MIET - Q

“It is clear that the protective functions of workplace health and safety have transferred to the workers through the process of corporate government deregulation and reduced funding of relevant government departments.” Steven Magee CEng MIET - Q

“Occupational Safety & Health Administration (OSHA) is largely an interrogation agency for whistle-blowers that extracts their full range of knowledge without upholding their legal rights.” Steven Magee CEng MIET - Q

“Occupational Safety & Health Administration (OSHA) is rigged to allow your employer to willfully damage your health and disability is rigged to deny you your earned benefits when you have become too sick to work because your toxic employer damaged your health.” Steven Magee CEng MIET - Q

“During its more than 40 years of existence, OSHA has secured only 12 criminal convictions” https://en.wikipedia.org/wiki/Occupational_Safety_and_Health_Administration

“Occupational Safety & Health Administration's (OSHA) lack of law enforcement has made the USA a dangerous place to work.” Steven Magee CEng MIET - Q

“In the area of worker health and safety, the USA is like a third world country.” Steven Magee CEng MIET - Q

"I have no faith in the corporate USA government systems of protection of public health and safety." Steven Magee CEng MIET - Q

"Most people have no idea that OSHA is a ghost and has been so for years"

Devra Davis – Author of the Secret History of the War on Cancer