A Review of Mountain Effects on People and Our Impact on the Ecosystem Presented at the Annual Meeting of the AAAS

Author: Pondrom, Sue

Source: Mountain Research and Development, 21(2) : 194-195

Published By: International Mountain Society

URL: https://doi.org/10.1659/0276-4741(2001)021[0194:AROMEO]2.0.CO;2

A Review of Mountain Effects on People and Our Impact on the Ecosystem Presented at the Annual Meeting of the AAAS

Mountain research has implications for heart and lung disease

Whether at work or play, when people ascend from low altitudes to high mountains, they find it more difficult to think, work, and sleep. Although some symptoms are reduced with time, others never disappear. Researchers know that the main factor limiting human performance at high altitude is hypoxia, a decrease in the amount of oxygen reaching body tissues. Current high altitude studies into the genetic cause and medical progression of hypoxia may provide answers for people at sea level who experience hypoxia as a major consequence of lung and heart disease or sleep disorders as well as for individuals who play or work at high altitudes.

On 18 February 2001, during the annual meeting of the American Association for the Advancement of Science (AAAS) in San Francisco, researchers from the United States and Canada discussed the effect of high altitude mountain environments on humans. In addition, they touched on the ways in which humans affect mountain ecosystems. The program was organized by Frank Powell, PhD, professor of physiology at the University of California, San Diego (UCSD) School of Medicine, who noted that millions of people pursue recreation at altitudes over 2500 m above sea level and nearly 140 million people worldwide live and work above this altitude. "At 4000 m, atmospheric oxygen is only 60% of the sea-level value. Blood oxygen levels in healthy people are similar to those in patients with lung disease who require supplemental oxygen at sea level. ... In the hope of reversing these effects, we need a better understanding of what happens to your body."

Impact of mountains on humans

Powell is director of the University of California's White Mountain Research Station, with laboratories up to 4300 m asl, just east of the Sierra Nevada mountains in California. Since 1950, the station has hosted the research of physiologists, ecologists, geologists, and astronomers. Much of Powell's research has been done on the mountain. His earlier work focused on respiration in birds and especially the mechanisms that allow birds to exercise harder than mammals at high altitude. His current research focuses on physiological acclimatization and genetic adaptations to chronic hypoxia, especially in the neural reflexes that control breathing in humans and other animals. A new research project this year is a study in mice from high altitudes in the White Mountains and the Andes to compare the roles that environment and genetics play in hypoxia.

Powell's UCSD colleague John B. West, MD, PhD, is currently investigating a highly promising technique to alleviate hypoxia in Cal Tech astronomers who work above 4800 m in northern Chile. This technique, in which the oxygen concentration of the rooms and laboratories is enriched with additional oxygen, is based on studies first conducted at the White Mountain Research Station by West, who is a UCSD professor of medicine and physiology and one of the AAAS presenters. "The Cal Tech astronomers are breathing 27% oxygen at an altitude of 5000 m, in effect lowering their altitude to a less-adverse 3100 m," West said. "The results are outstandingly good. Before, they had problems with memory, concentration and errors. Now, their work is almost as efficient as that at sea level." Oxygen-

These subjects in a decompression chamber study (Operation Everest II) were able to exercise under conditions at 8840 m. The unacclimatized scientists, however, had to breathe supplementary oxygen continuously. When one lost his supply, he fell unconscious almost immediately. (Photo by Operation Everest II team, courtesy of Charles S. Houston)

Mt. Kilimanjaro, Kenya: "The Snows of Kilimanjaro," made famous by Ernest Hemingway, among others, are now in danger of disappearing within the next 15 years as a result of global warming, as reported at the AAAS conference in San Francisco in February 2001. (Photo by Hanspeter Liniger)

enriched air may also be an option for a group of Chilean miners studied by West. They live at sea level and commute to copper mines located above 4600 m. The high altitude exposure has impaired the miners' sleep quality, mental performance, productivity, and general well being.

Another AAAS presenter on 18 February was Cynthia M. Beall, PhD, S. Idell Pyle professor of anthropology, Case Western Reserve University, Cleveland, OH, USA, who discussed her research since the mid-1970s with Andean and Tibetan individuals who live at high altitude. She said the health of these indigenous populations contrasts with the health and performance problems of visitors and has been used as indirect evidence that the natives have adapted to the high altitude hypoxia and therefore maintain normal function. However, Beall's research findings revealed considerable quantitative differences in traits thought to offset hypoxia such as ventilation and hemoglobin concentration in men, women, and children in the Andes as compared with Tibet. "The contrasts in high altitude physiology have been interpreted as the outcome of different micro-evolutionary processes," she said. "Figuring out how that happened and why and how long it took will have implications for understanding the tempo and mode of evolutionary adaptation to change in humans and for understanding the variable response (from life-threatening to temporary inconvenience) of low altitude visitors to high altitude."

A fourth AAAS speaker discussed another group of people in mountains—those who seek the fun, excitement, and thrill of mountain climbing, trekking, or skiing. Thomas F. Hornbein, MD, a retired professor from the University of Washington and former Mt. Everest mountain climber, understands the lure of a mountain high. "High altitude play is like a drug," he said. "It can do grand things for a person, but it can also be bad for your health and long life if you overdose on it. Research has shown residual neuropsychometric deficits, including brain cell injury." He added that "there's a new form of adventure travel where individuals, especially the wealthy, think they can visit very high altitudes risk-free if they go with an experienced guide. These inexperienced people put their lives in the hands of guides who may or may not have the experience and judgment to make it a safe trip."

Impact of humans on mountains

In addition to covering the effect of high altitude on people, the AAAS presentation included remarks about the impact of humans on mountains by Jack D. Ives, one of the world's leading experts on mountain environments. An honorary research professor at Carleton University in Canada and an environmental studies professor emeritus, UC Davis, Ives said, "There is great misunderstanding about the environmental impact on mountains, largely due to oversimplification or falsification."

Citing research conducted in the Himalayas and Southwest China since 1980, Ives said that several assumptions have proven to be false. For example, contrary to past belief, deforestation of the Himalayas as a result of tree cutting by rapidly expanding mountain populations is not the primary cause of soil erosion, landslides, and devastating floods in Gangetic India and Bangladesh. "Only since the Rio de Janeiro Earth Summit in 1992 have mountain environments gained serious international attention and research," he said. "This has culminated in the United Nations declaration of 2002 as the International Year of Mountains and the plan for more effective and objective interdisciplinary research on mountain environments." With several decades of significant mountain research, the team presenting the AAAS review has found that high-altitude studies are an important resource for better understanding of human health and happiness.

The presentation was cosponsored by the American Physiological Society.

Sue Pondrom
University of California, San Diego, USA.
spondrom@ucsd.edu