

Appendix A

DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Cancer Institute (NCI)
National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)
National Institute of Environmental Health Sciences (NIEHS)



Principal Areas of Focus

The Department of Health and Human Services supports a broad portfolio of research related to environmental health and the health effects of global change. Included in the U.S. Climate Change Science Program is research supported by the National Institutes of Health (NIH) that focuses on exposure to ultraviolet (UV) and near-UV radiation. The principal objectives of the NIH institutes supporting this research include an increased understanding of the effects of UV and near-UV radiation exposure on target organs (e.g., eyes, skin, immune system), the molecular changes and genetic susceptibilities that lead to these effects, and the development of strategies to prevent initiation or promotion of disease before it is clinically defined.

In addition to UV and near-UV radiation research, HHS also supports other research related to the health effects of global change. For example, the National Institute of Environmental Health Sciences (NIEHS) supports research on the health effects of 1) air pollution and temperature, 2) agricultural chemicals, and 3) materials used in new technologies to mitigate or adapt to climate change. In addition, the Centers for Disease Control and Prevention (CDC) is engaged in a number of activities related to climate change, such as emerging and reemerging infectious diseases. Such related research is growing in importance.

Program Highlights for FY 2008

The NIEHS program supports grants and intramural projects that investigate the effects of UV exposure on the immune system, aging process, sensitive tissues such as the retina and skin, and methods to reduce these harmful effects. Examples of research include projects that will characterize the DNA-damaging and mutagenic properties of UV-A radiation, a component of the solar spectrum that has been linked to melanoma, then attempt to find a molecular link between exposure to sunlight and melanoma.

The National Toxicology Program (NTP) funded and operated by NIEHS is carrying out a systematic analysis of commercially available sunscreens to characterize several nanoscale metal oxides (e.g., titanium, zinc) currently used with regard to their dermal penetration and photocatalytic action. Careful attention is being paid to determining critical aspects of size, surface area and chemistry, crystallinity, and biopersistence in relation to both dermal penetration and potential for toxicity in the presence or absence of simulated solar light.

The National Cancer Institute (NCI) is supporting a wide range of studies to characterize the etiology, biology, immunology, and pathology of a variety of changes in the skin (morphological effects that might precede skin cancer), including photoaging, non-melanoma skin cancers, and melanoma caused by exposure to UV radiation. In addition, NCI is supporting studies to reduce the risk of melanoma and

non-melanoma skin cancer through the development of clinically useful primary and secondary prevention strategies. One study is developing, implementing, and evaluating solar protection programs for middle school children. The interventions target school, community, recreation and beach settings, primary care practices, and parents. The interventions are based on theories that include social influence, psychological factors, and cognitive decisional factors in adolescence. Other studies are looking at the role of UV light exposure in the development of second malignant neoplasms in cancer survivors.

The National Institute of Arthritis, Musculoskeletal, and Skin Diseases (NIAMS) supports basic and clinical research on the effects of UV-A and UV-B radiation on skin. Examples of current studies include research that examines the ability of green tea polyphenols to protect against UV-B-induced skin cancers through the augmentation of the repair of UV-damaged DNA. Another study looks at the effects of UV-B radiation on the stability of cell cycle regulatory proteins, yielding insight into the mechanisms by which UV-B radiation increases the risk of non-melanoma skin cancer. There are also studies that are testing the role of acquired homoplasmic mitochondrial (mtDNA) changes in the process of photoaging and aberrant keratinocyte hyperplasia, novel biosynthetic pathway for secosteroids (such as vitamin D) in the skin, as well as the expression of keratins induced whenever skin tissue is subjected to injury, UV exposure, and other challenges. Previous studies in this area have included research to better understand how vitamin D3 is made and processed in the skin. These chemical reactions require ultraviolet radiation. There was also a study on the role of overexposure to UV light in the development and exacerbation of vitiligo, a pigmentary disorder that leaves patients with disfiguring white skin patches that increase in size over time. Another patient-oriented research project involves the molecular mechanisms for the exaggerated response to UV-B of a polymorphism that is strongly associated with a photosensitive form of lupus erythematosus. Research is also conducted on the effect of UV-R on Langerhans cells, star-shaped cells in the germinative layer of the epidermis, and on immunity in skin. Using gene array technology, scientists have identified 52 genes that are consistently up-regulated by UV-R.

Related Research

CDC conducts public health research on a wide-range of topics that are associated with climate change ranging from vector-borne diseases to human health effects of heat waves. CDC has established a long-term national surveillance system to monitor enzootic transmission activity and patterns across the entire country. For West Nile virus (WNV), the agency is conducting research on the potential human health burdens and transmission characteristics of the disease in Guatemala to see how climate change may influence the distributions of arboviruses in the Western Hemisphere. CDC is conducting interrelated investigations of the complex ecology of WNV to better understand its distribution in the United States. Scientists from CDC are working with colleagues from around the world to analyze the key climatic variables and other ecological factors that impact the transmission and distribution of other zoonotic diseases including Chikungunya virus, Japanese encephalitis, Rift Valley Fever, and plague. Researchers are developing mathematical models that relate changing weather conditions, among other factors, to the risk of infectious diseases in humans, including hantavirus, lyssaviruses, and filoviruses.

CDC is also developing models to predict mortality risks from the most direct effects of climate change—heat waves. Collaborations with university colleagues on four current projects use remote sensing data to determine urban neighborhoods and populations most at-risk for deaths during an extreme heat event. Research is also focusing on the knowledge, attitudes, and beliefs of the public on health issues related to climate change to effectively craft health education messages.