National Institute of Environmental Health Sciences
*Your Environment. Your Health.*

# FY 2009 NIEHS Director's Statement

## Department of Health and Human Services National Institutes of Health

## FY 2009 Budget Request

Witness appearing before the Subcommittee on Labor-HHS-Education Appropriations:
**Samuel Wilson, M.D., Acting Director, National Institute of Environmental Health Sciences**
**Richard Turman, Deputy Assistant Secretary, Budget**
**2008**

Mr. Chairman and Members of the Committee:

I am pleased to present the President's budget request for the National Institute of Environmental Health Sciences (NIEHS) of the National Institutes of Health (NIH). The Fiscal Year (FY) 2009 budget of $642,875,000 includes an increase of $622,000 over the FY 2008 appropriated level of $642,253,000.

## Introduction

NIEHS has played a central role in disease prevention and improving human health for many years, beginning in 1966, when it was a Division within the National Institutes of Health (NIH). Today, NIEHS looks forward to the rest of the 21st Century with an exciting array of new scientific and technological tools. These new capabilities enable NIEHS to fully pursue NIH's four P's of health research – to predict the roles that environmental agents play in disease; to pre empt disease by eliminating potential risk factors; to personalize, for each individual, their susceptibility to disease and thereby predict and/or pre empt it; and to incorporate individual initiative in the disease prevention process, making environmental health more and more participatory. Predictive, pre emptive, personalized and participatory research -- these aren't long-range dreams or informed speculations, but realities that are taking shape in laboratories and clinics even as I speak. I am pleased to share with you some highlights of these initiatives that I think you too will find exciting.

# DNA, Genetics, Epigenetics and Epigenomics

Today we know that genes, the coded DNA molecules that carry instructions within all living organisms, do not convey their messages in isolation--genes interact with the environment. Epigenetics focuses on processes that regulate how and when certain genes are turned on and off. These processes control normal growth and development. Diet and exposure to environmental chemicals throughout all stages of human development among other factors can influence epigenetic changes to certain genes. Genes can be turned on, off or be otherwise altered by environmental factors. Changes in genes that would normally protect against a disease could make people more susceptible to developing that disease later in life. Researchers believe some epigenetic changes can be passed on to future generations.

Gene-environment interactions usually do not occur between just one gene and one environmental influence but occur over a wide range of genes and between multiple environmental influences. So, it is a challenge to understand not just one gene-environment reaction at a time, but a whole “keyboard” of such reactions and interactions. Epigenomics pertains to analysis of epigenetic changes across many genes in a cell or entire organism and introduces a new perspective to our understanding of how genes work. There are strong indications that environmental factors can affect genes in an epigenomic way, so that environmental impact on the genes is passed from one generation to the next. This is an exciting concept of diversity in how DNA functions and epigenomics will play a central role in increasing the possibility of predicting susceptibility to specific diseases, pre empting disease, personalizing the knowledge of susceptibility for individuals, and eliciting individual action and participation in sustaining health and preventing disease. The importance of epigenomics has prompted NIH to initiate the NIH Roadmap Epigenomics Program.

# Knowing the Exposures: The Exposure Biology Program

As NIEHS probes more deeply into the interaction between genes and the environment, it has taken a central role in better monitoring of environmental exposures, using cutting edge technologies and funding innovative research to develop these monitoring methods. NIEHS is the lead Institute in the Exposure Biology Program (EBP), a component of the trans-NIH Genes, Environment and Health Initiative. In FY 2007, EBP announced the first set of awards to researchers at universities, research institutes and firms in the private sector to develop new monitoring technologies. These technologies are highly miniaturized, user-friendly and address a wide range of exposures, from air particulates, to pesticides, to allergens that prompt respiratory episodes and disease. Some of the

technologies can monitor a number of environmental agents at once. Others can transmit information to central databases. All of them address the need to know real-life, real-time exposures humans encounter in their daily lives, in school, at work, at play and at rest. We have some advanced monitoring devices now, but we need better ones, both for research and clinical use, and that is exactly what we are after with this important research investment in EBP.

## From NIEHS Lab to Drug Enclosure Sheet

Relating a patient's genetics to the drug and dose prescribed is becoming a reality. Research supported by NIEHS identified gene variations that cause some patients to over-react to the blood thinning medicine warfarin, putting them in danger of uncontrolled bleeding. This genetic information is now part of the drug enclosure sheet given to patients and made available to physicians and pharmacists. The enhancement in therapeutic management of warfarin dosage emerged from NIEHS' continuing interest in understanding the family of liver enzymes known as P-450s; these enzymes break down, or metabolize, environmental chemicals, as well as pharmaceuticals. This class of enzymes has been extensively studied for decades, and researchers have matched specific P-450 enzymes with the individual environmental chemicals or pharmaceuticals they metabolize. Recently, using improved genetic tools, scientists have begun to understand why the activity of a specific P-450 enzyme against a specific compound can vary from one individual to the next. As with warfarin, this knowledge is likely to be useful in administering many other medicines and in understanding the health effects of a wide variety of environmental agents.

## Time Between Exposure and Disease

The length of time elapsing between an environmental exposure and an associated disease can often be years or even decades. This length of time obscures the association between exposure and disease, so it is important to find ways to establish early pre-clinical indicators of harmful exposures. Classic examples of this cause and effect challenge include smoking causing lung cancer over the course of decades, asbestos causing the cancer mesothelioma, and sunlight exposure causing skin cancer. NIEHS, in collaboration with the National Cancer Institute, is better defining exposures that may play a role in adult breast cancer through the Breast Cancer and the Environment Research Centers. In these Centers, parallel animal studies will examine exposure to various environmental agents and the attendant emergence of mammary gland tumors. These Centers, working as a national consortium, will more precisely identify exposures

that are linked with cancer risk, and hence, better inform women and parents of girls on what exposures to avoid.

A recent study by an NIEHS grantee suggested that lead exposure earlier in life plays a significant role in the cognitive decline from Alzheimer's disease in later life. A separate NIEHS-sponsored report showed links between exposure to lead and the risk of heart disease in aging men. Men with the highest lead exposure levels had more heart attacks or angina episodes than men with lower overall lead exposure. The higher lead levels correlated with an approximate 25 percent increase in risk for ischemic heart disease.

Merging the exposure and genetic components, NIEHS continues its Sister Study to prospectively examine environmental and familial risk factors for breast cancer and other diseases in a cohort of 50,000 sisters of women who have had breast cancer. Such sisters have a higher risk of developing breast cancer than other women, increasing the statistical power of the study to detect risks.

## Engaging Future Generations of Scientists

NIEHS supports a variety of educational and research initiatives and strategies aimed at bringing students and younger scientists into the environmental health field. Providing field experiences for interested students, increasing the likelihood of funding for future researchers, aggressively recruiting students at health fairs and scientific meetings, and creating customized approaches for attracting students at various points in the educational pipeline are all part of this effort. NIEHS is increasing awareness and interest in pursuing environmental health careers by targeting the best students at the high school, college and graduate school levels, as well as by engaging the broader biomedical community in environmental health research. Examples of recent research pursuits by NIEHS trainees include studies of: (1) the effect of air pollution on young cystic fibrosis patients, (2) the role of environmental pollutants in childhood kidney disease, (3) the relationship between pollution and asthma, and (4) the use of laboratory animals to better understand the relationship between environmental agents and Attention Deficit and Hyperactivity Disorder. These younger scientists bring highly honed scientific knowledge and skills to the field, along with youthful energy and fresh insight, and their work bodes well for continuing progress into the future.

## Summary

For the field of environmental health, the future is exciting. There has been tremendous growth in the power and sophistication of many of the technologies used in biomedical

research, bioimaging, and bioinformatics. NIEHS is engaged in converting these technological advances into novel tools that will definitively identify the ways in which environmental exposures alter cellular and molecular events, and thus affect human biology and alter disease risk. This new understanding will be particularly important for developing strategies that can reduce the burden of complex diseases such as asthma, cancer, and neurodegenerative diseases that are caused by multiple environmental and genetic factors. By capturing this larger understanding of disease initiation and progression, we can achieve our ultimate goals – to alleviate suffering and to improve human health.

**Department of Health and Human Services**
**National Institutes of Health**
**National Institute of Environmental Health Sciences**
**Samuel H. Wilson, Acting Director**

Samuel H. Wilson, M.D. joined the National Institute of Environmental Health Sciences (NIEHS) as its Deputy Director in 1996. He was appointed Acting Director on August 20, 2007. Dr. Wilson was instrumental in the development of NIEHS' programs in genetic susceptibility, functional genomics, children's health research, minority institutions' research, and community outreach. He has also strengthened partnerships between NIEHS and other federal agencies concerned with environmental health. He received his training in medicine and biochemistry at Harvard Medical School, and began his research career at the National Institutes of Health in 1970. In 1991, he moved to the extramural community to found a center focused in the areas of genetic toxicology and structural biology. An active researcher, Dr. Wilson is the principal investigator of the DNA Repair and Nucleic Acid Enzymology Group in the Laboratory of Structural Biology at NIEHS. He has authored more than 300 research articles.

**Department of Health and Human Services**
**Office of Budget**
**Richard J. Turman**

Mr. Turman is the Deputy Assistant Secretary for Budget, HHS. He joined federal service as a Presidential Management Intern in 1987 at the Office of Management and Budget, where he worked as a Budget Examiner and later as a Branch Chief. He has worked as a Legislative Assistant in the Senate, as the Director of Federal Relations for an association of research universities, and as the Associate Director for Budget of the National Institutes of Health. He received a Bachelor's Degree from the University of California, Santa Cruz, and a Masters in Public Policy from the University of California, Berkeley.