

FY 2008 NIEHS Director's Statement

Department of Health and Human Services National Institutes of Health

FY 2008 Budget Request

David A. Schwartz, M.D., Director

National Institute of Environmental Health Sciences

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Mr. Chairman and Members of the Committee:

The FY 2008 budget includes \$637,406,000 for the National Institute of Environmental Health Sciences.

Introduction

Lives saved by environmental health research can be counted in millions. By the Environmental Protection Agency's (EPA) estimates on air pollution alone, the Nation's commitment to cleaner air will prevent 23,000 premature American deaths; 1,700,000 new asthma attacks or aggravation of chronic asthma; 67,000 new cases of acute and chronic bronchitis; 22,000 respiratory-related hospital admissions; and 42,000 cardiovascular hospital admissions (EPA 410-R-99-001) by the year 2010. The commitment to new air standards arose from NIEHS-supported research on air pollution such as the Six-Cities Study which revealed important associations between air pollution and mortality from respiratory and cardiovascular disease.

Air pollution is only one example of the public health impact of environmental health research. Studies on adverse effects of lead, much of it funded by NIEHS, revealed lead-associated decrements in the IQ scores of young children, as well as increased tendencies to aggression. It was these types of neurobehavioral problems that led the Nation to ban sources of lead contamination, a move that has led to a 78% decrease in average blood lead levels in this country (JAMA, 272:284-91 (1994)) and a corresponding improvement in the health of our children. Further NIEHS-supported research involving adults found that long-term exposure to lead is associated with an increased risk of high blood pressure

(hypertension), kidney problems and cataracts. Reduced lead levels in the environment are expected to translate in the future into a decreased incidence of hypertension, kidney failure, and cataracts among the elderly.

NIEHS-supported researchers have made other recent discoveries with potential public health impact. Some examples include identification of a novel biological mechanism that controls airway tone and could be targeted for the treatment of asthma; discovery of important mechanistic linkages between exposure to inhaled particulate matter and cardiovascular disease; new insight into regulatory mechanisms within the brain that affect learning and memory; and identification of the structural basis of errors in DNA synthesis that may result from environmental stress and have profound effects on a variety of human diseases, including cancer.

As these examples illustrate, environmental health science can exponentially return its investments on improvements in a wide spectrum of diseases and disabilities. Operating on multiple molecular and cellular pathways, environmental agents provide scientists with ways to study the complex molecular pathways that lead to chronic diseases such as cancer, birth defects, hypertension, and neurological disorders. Because environmental agents often operate early in the disease process, they can be useful to identify very early events in disease, suggesting ways to diagnose and remedy diseases before they progress.

Many of NIEHS' recent achievements have been possible because of powerful tools used to study events at the genetic and molecular level that would have been impossible ten years ago. With so many promising avenues to explore, NIEHS developed a new strategic plan, [New Frontiers in Environmental Health Sciences and Human Health](#) that focuses on three major challenges and seven specific goals to prevent disease and improve human health by using environmental sciences to understand human biology and human disease. This resulted in research in exposure biology (personalized measures of exposure), epigenetics (inheritance not based on the sequence of DNA), comparative genomics (use of model systems to understand the biological effects of environmental exposures), translational research (integrating basic and applied sciences to understand the effect of the environment on human health), and focused training and career development programs to expand the workforce in environmental sciences. Our success will be measured in the disease and suffering that we are able to prevent.

Exposure Biology Program

The Exposure Biology Program, a component of the larger Genes, Health and Environment Initiative at the National Institutes of Health (NIH), was created to develop

tools to precisely measure the exposure to chemical/biologics, dietary changes, physical activity, psychosocial stress, and addictive substances and subsequently assess the effect of these exposures on human health. This program will produce non-invasive tools that can be used to track exposures critical to human health. While new technology will be developed, this program will also borrow and re-engineer tools from other fields that have focused on measuring various component of the environment. Possibilities include the use of molecularly imprinted polymers that show promise in identifying antibodies, enzymes, and animal tissues or cells; small labs-on-a-chip that can be made through recent advances in silicon and glass micromachining; and the use of nanoparticles in biomolecular sensors. These technologies would be combined with new techniques to assess co-modifiers of response such as diet and physical activity. As these technologies are incorporated into large-scale epidemiological studies, much of the background "noise" obscuring our ability to identify environmental components of disease will be reduced. Furthermore, the program is soliciting researchers to develop these new tools in ways that can also provide insight into the molecular underpinnings of disease response, thus identifying therapeutic targets for intervention.

Epigenetics - Beyond the Sequence of DNA

The field of epigenetics is uniquely related to environmental health sciences. Epigenetics refers to a modification of gene expression that does not involve a change in gene sequence; rather, a sometimes slight modification of DNA or its associated proteins or sugars that can dramatically change gene function, sometimes into subsequent generations. Almost all known factors causing epigenetic change are from the environment, diet, or supplements. Epigenetic mechanisms are being linked to multiple illnesses, including cancer, cognitive dysfunction, and respiratory, cardiovascular, reproductive, autoimmune, and neurobehavioral diseases.

Recently, NIEHS developed a program in epigenetics that supports research to understand how the epigenome is affected by environmental exposures and how this ultimately affects human health. This field is particularly promising in identifying how early life exposures can generate disease outcomes later in life. One purpose of this program is to identify critical windows of susceptibility to epigenetic changes, particularly during pregnancy, early life, and puberty. The fruits of this research will help us develop biomarkers of early exposure, as well as identifying possible therapeutic strategies to prevent disease later in life.

Clinical and Translational Research

In the summer of 2007, NIEHS will complete construction of its first clinical research unit that will be used to study how human subjects respond to a variety of environmental stressors. This facility will foster integrated, interdisciplinary research opportunities between our basic and clinical scientists to speed the translation of knowledge from bench to bedside. NIEHS' Office of Translational Research is also focusing on taking discoveries from our basic and population-based studies and translating them into research findings that have direct relevance to human health and disease. New integrative research programs such as the extramural DISCOVER Program and the intramural Director's Challenge are designed to promote an interdisciplinary approach to focus environmental sciences on important human health conditions.

Workforce to Meet New Challenges

The much greater complexity of research techniques and the new focus on human health and disease requires a new, specialized workforce. The new environmental health workforce must be increasingly collaborative and must have skills to work across multiple research disciplines. NIEHS is refashioning its training program in order to produce researchers with the skill sets needed in the future. For promising high school and college students, the Short Term Educational Experiences for Research (STEER) program provides needed support for attracting and developing this next generation of environmental health scientists. NIEHS and NHGRI developed a collaborative training program for pre- and post-doctoral students in environmental genetics. The Outstanding New Environmental Scientists Award (ONES) program is a new way to recruit talented young independent researchers into environmental health science research. These programs complement existing training programs and, in concert, will help develop a workforce that can meet the many demands of environmental health research.

Summary

The opportunities within environmental health sciences are greater than ever. New programs initiated this past year will produce a more sophisticated understanding of the environmental components of disease, as well as a better knowledge of how individuals vary in their response to exposures. This more extensive understanding of environment-disease associations will lead to improved intervention and therapeutic strategies that can lessen the disease burden of our citizens. I would be happy to answer your questions.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
NATIONAL INSTITUTES OF HEALTH
BIOGRAPHICAL SKETCH

NAME	<u>David A. Schwartz, M.D., M.P.H.</u>
POSITION	Director, National Institute of Environmental Health Sciences (NIEHS) and Director, National Toxicology Program (NTP)
BIRTHPLACE	Flushing, New York
DATE OF BIRTH	March 3, 1953
EDUCATION	B.A., University of Rochester, 1975; M.D., University of CA, San Diego, 1979; M.P.H., Harvard School of Public Health, 1985
<p>EXPERIENCE Director, NIEHS and NTP, 2005-present; Vice Chair for Research, Department of Medicine, Duke University Medical Center, 2003-2005; Walter Kempner Professor of Medicine, Duke University Medical Center, 2001-2005; Professor of Environmental Sciences and Policy, Nicholas School of the Environment and Earth Sciences, Duke University, 2001-2005; Professor of Medicine and Genetics, Chief, Division of Pulmonary and Critical Care Medicine, Duke University Medical Center, 2000-2005; Director, Center for Environmental Genomics, Institute for Genome Science and Policy, Duke University Medical Center, 2000-2005; Staff Physician, Veterans Administration Medical Center (5/8 full time), 2000-2004; Director, Occupational Medicine, Department of Internal Medicine, University of Iowa, 1988-2000; Sabbatical in Laboratory of Dr. Jeffrey Murray, Department of Pediatrics, University of Iowa, 1994-1996; Assistant, Associate, and Full Professor, Pulmonary Division, University of Iowa, 1988-2000; Pulmonary Fellow, University of Washington, 1985-1988; Clinical Scholar, Robert Wood Johnson Clinical Scholars Program, 1985-1987; Occupational Medicine Residency and MPH, Harvard School of Public Health, 1984-1985; Intern, Resident and Chief Resident, Medicine, Boston City Hospital, 1980-1984.</p> <p>PROFESSIONAL ORGANIZATIONS (Active and Inactive) American College of Chest Physicians, American College of Physicians, American Federation for Clinical Research, American Public Health Association, American Society for Clinical Investigation, American Society of Human Genetics, American Thoracic Society, Association of American Physicians, Society of General Internal Medicine.</p> <p>HONORS AND AWARDS Member, NIH/NHLBI Innovative Grant Program Review Committee, 2001-2004; American Thoracic Society Scientific Accomplishment Award, 2003; Member, NIH/NIEHS Study Section, 1999-2003; Member, American Association of Physicians, 1998; Member and Chair, VA Pulmonary Study Section, 1997-2000.; Member, NIH GCRC Study Section, 1995-1999; American Thoracic Society Grant Review Committee, 1993-1997; Editorial Board, American Review of Respiratory Disease, 1993-1996; Member, American Society for Clinical Investigation, 1995; Member, Central Society for Clinical Research, 1991; Public Service Science Resident, National Science Foundation, 1979; Phi Beta Kappa, 1974.</p>	