



## Theme 4: Health Disparities and Global Environmental Health

Research to understand environmental contributors to global health and health disparities

NIEHS has been a leader in studying health risks associated with environmental toxicants and other stressors borne by vulnerable populations where they live, work, and play. NIEHS has invested heavily in building capacity of affected communities to partner with environmental health scientists in order to study environmental concerns. It has long been recognized that individuals and communities that are socioeconomically disadvantaged also tend to suffer inequalities in both health and environmental burdens. It is also known that characteristics such as age, gender, and occupation can be factors in vulnerability.

*Theme 4 incorporates aspects of all the other themes: fundamental research, exposure research, translational science, training and education, and communications and engagement.*

Under this theme, NIEHS endeavors to support environmental justice research, by defining the environmental factors and their complex interactions that contribute to environmental health disparities, and by studying chemical and nonchemical stressors at the community level. This research includes developing new approaches to community-based research, fostering collaborations between community groups and research groups, establishing training programs for environmental health disparities research, and capacity building within institutions well placed to undertake health disparities research. For environmental health disparities research, it is necessary to incorporate social and behavioral aspects, as well as implications of environmental exposures into the research.

Environmental exposures of widespread public health significance occur throughout the world — many disproportionately affect not only the disadvantaged in our country but also the developing world. Populations around the world will continue to be a focus of NIEHS research. Taking a global environmental health focus includes opportunities to perform research to learn about risks from widespread exposures. For example, increasing changes in global climate are expected to result in changes to weather, ecosystems, water supplies, and other aspects of our physical environment. These changes, and the mitigation and adaptation efforts that accompany them, will have implications for emerging environmental exposures, especially affecting vulnerable populations. Environmental exposures are also major contributors to the worldwide increase in chronic, noncommunicable diseases and their effect on health and economic costs.

An additional component of this theme that intersects with Theme 3 is the development of new tools and approaches that will help us understand the economic impacts of environmental health risks, decisions, and policies. The field of health disparities research can benefit greatly from the contributions of cost-benefit analyses and comparative effectiveness research. Developing quantitative approaches that can be linked to economic impact is an important capability that can be used to inform decision-making in ways that will disproportionately benefit exposed communities.

As with all the themes, implementation of the goals under this theme will depend on wide-ranging and effective partnerships and collaborations. This requirement points to the need for good relationships between community groups, their leaders and representatives, and the invested researchers. Internationally, the collaborations extend also to foreign scientists and governments.



## Theme 6: Communications and Engagement

Advancing translation and dissemination of scientific knowledge on the role of the environment and human health and pursuing appropriate and effective means of engagement of the broad range of Institute stakeholders in environmental health research and public health promotion

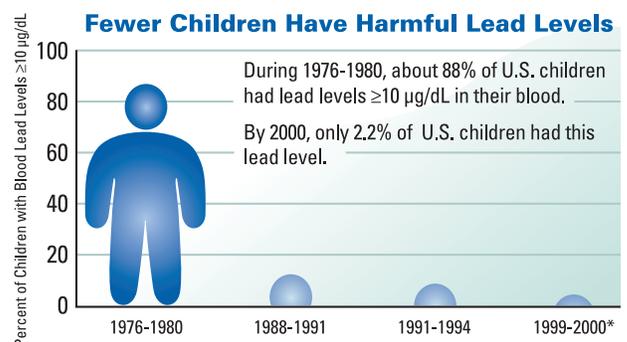
A part of the congressionally mandated purpose of NIEHS is the dissemination of research findings, knowledge, and information on environmental health science. Because the prevention of illness and the improvement of public health are central to the mission and vision of NIEHS, this mandate is interpreted broadly and covers a wide range of communication activities.

In order to be successful in these activities, NIEHS must continue to develop, refine, and implement an innovative and comprehensive communication and engagement strategy that draws on the latest in best practices, standards, and technologies established by professional communications practitioners and researchers.

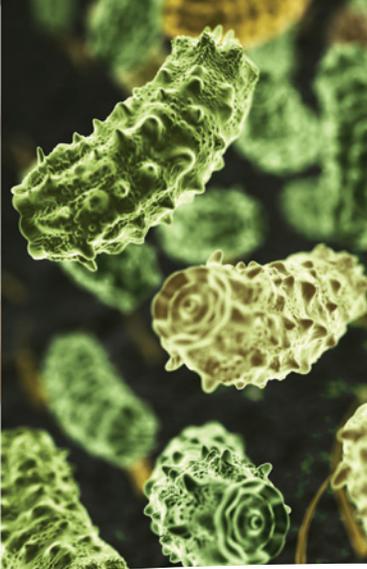
Communication and engagement activities provide information that can be easily understood and applied by the range of NIEHS stakeholders, including decision-makers at all levels, from individuals to global organizations. A good communication strategy for NIEHS features two-way engagement with our stakeholders and is deployed both internally and with external partners to develop a broad constituency for environmental health sciences.

### Preventing Disease

Lead poisoning in American children has decreased by about 86% since the late 1970s. Much of this success is due to research supported by NIEHS and others, which helped to identify and reduce the health effects of lead poisoning in children and adults. NIEHS and other agencies help to stop preventable diseases, by communicating the most up-to-date information about environmental risks to health care providers and the public.



Source: National Health and Nutrition Examination Surveys (NHANES) for children 1-5 years old.  
\*Data for 1999-2000 are variable, relative standard error >30%.



# NIEHS Strategic Goals

## Goal 1

Identify and understand fundamental shared mechanisms or common biological pathways, e.g., inflammation, epigenetic changes, oxidative stress, mutagenesis, etc., underlying a broad range of complex diseases, in order to enable the development of applicable prevention and intervention strategies.

- a. Investigate the effects of the environment on genome structure and function.
- b. Investigate the effects of the environment on the epigenetic regulation of biological and pathological processes.
- c. Understand the role of key biological mechanisms and their regulation in determining resistance and susceptibility to environmental stressors.
- d. Understand the normal processes of human development, maturation, and aging, and identify environmental factors that contribute to altered function.
- e. Develop a pipeline to integrate high-throughput screening, cell systems, and model organisms, to identify fundamental mechanisms underlying responses to existing and emerging environmental toxicants, and to better predict their relationship to disease.

## Goal 2

Understand individual susceptibility across the life span to chronic, complex diseases resulting from environmental factors, in basic and population-based studies, to facilitate prevention and decrease public health burden.

- a. Using a life-span approach, identify critical windows of susceptibility to the effects of environmental exposures.
- b. Deepen our understanding of dose-response relationships to environmental factors across the life span.
- c. Study the factors that determine individual susceptibility to environmental stressors across the life span.

## Goal 3

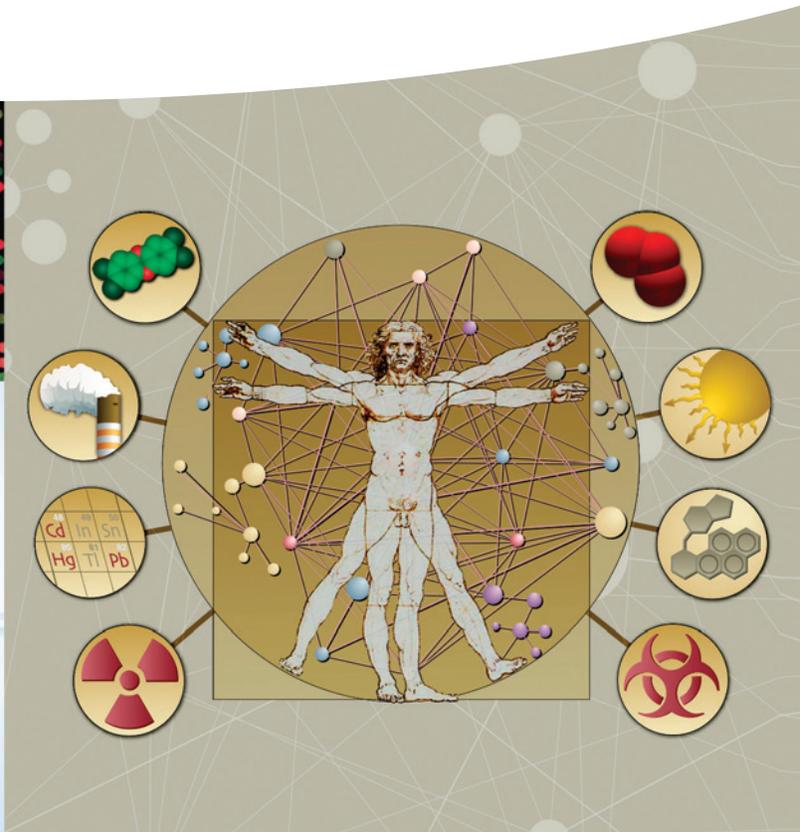
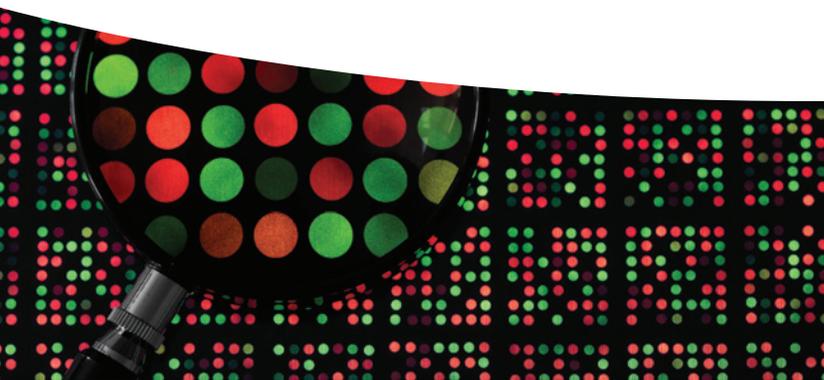
Transform exposure science by enabling consideration of the totality of human exposures and links to biological pathways, and create a blueprint for incorporating exposure science into human health studies.

- Advance characterization of environmental exposures through improved exposure assessment, at both the individual and population levels.
- Define and disseminate the concept of the exposome.
- Create tools and technologies and the research capacity needed to characterize the exposome.

## Goal 4

Understand how combined environmental exposures affect disease pathogenesis.

- Assess the joint action of multiple environmental insults, including chemicals, nonchemical stressors, and nutritional components, on toxicity and disease, and identify interactions resulting from combined exposures.
- Study the role of the human microbiome and its influence on environmental health, and explore the role of the microbiome in responses to environmental exposures.
- Study the interactions of infectious agents with environmental exposures.
- Understand how nonchemical stressors, including socioeconomic, behavioral factors, etc., interact with other environmental exposures to impact human health outcomes, and identify preventive measures that could be taken.





## Goal 5

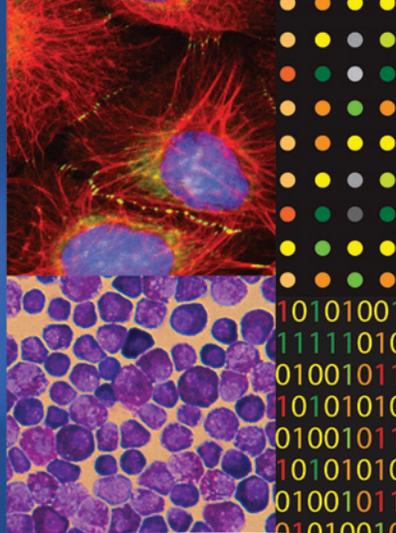
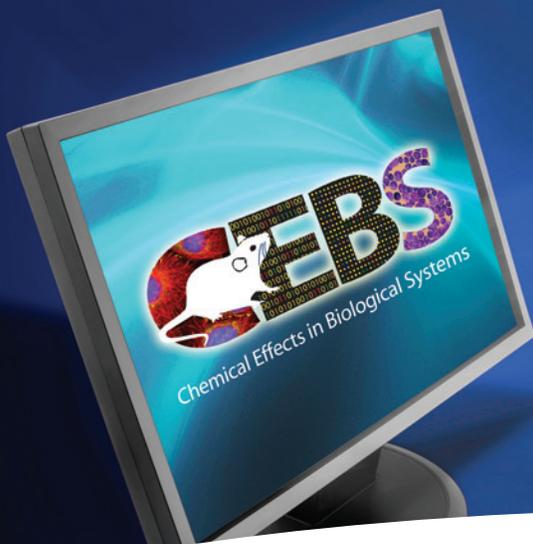
Identify and respond to emerging environmental threats to human health, on both a local and global scale.

- a. Enlist the capacity of the environmental health science (EHS) research enterprise to elucidate information necessary for timely and effective public health action.
- b. Act proactively with other public health partners to provide appropriate responses to emerging environmental threats, both natural and man-made.
- c. Focus on research needs to help inform policy responses in public health situations in which lack of knowledge hampers policymaking, e.g., health effects of exposures related to hydrofracking or climate change, or exposures to engineered nanomaterials.

## Goal 6

Establish an environmental health disparities research agenda to understand the disproportionate risks of disease, and to define and support public health and prevention solutions in affected populations.

- a. Conduct community-based participatory research that incorporates cultural competencies.
- b. Include research and education on the ethical, legal, and social implications of EHS research, including human participation issues, research integrity, reporting of results, and other issues.
- c. Develop and recommend or implement interventions to reduce or eliminate environmental exposures that cause the greatest burden of disease to affected populations.



## Chemical Effects in Biological Systems (CEBS)

The CEBS database houses data of interest to environmental health scientists. CEBS is a public resource and has received depositions of data from academic, industrial, and governmental laboratories. CEBS is designed to display data in the context of biology and study design, and to permit data integration across studies.

## Goal 7

Use knowledge management techniques to create a collaborative environment for the EHS community, to encourage an interdisciplinary approach to investigate, analyze, and disseminate findings.

- a. Develop bioinformatics, biostatistics, and data integration tools to conduct interdisciplinary research for application to environmental health science.
- b. Develop and invest in publicly available resources and computational tools, for integrating and analyzing environmental health data.

## Goal 8

Enhance the teaching of EHS at all levels of education and training — kindergarten through professional — to increase scientific literacy and generate awareness of the health consequences of environmental exposures.

- a. Empower individuals at all levels of education with knowledge to make better health decisions.
- b. Use leadership and partnerships to strengthen EHS education and literacy, using research on effective EHS education strategies and creating mechanisms for educators to promote EHS education.
- c. Develop critical training programs in EHS research tailored for multiple groups, e.g., students, postdocs, foreign scientists, and science teachers.
- d. Incorporate EHS into medical education and practice, e.g., nursing, M.D., etc., to increase awareness of environmental medicine in health care practice.

### ***NIEHS Scholars Connect Program (NSCP): Connecting Minority Scholars with Environmental Health Science***

NSCP is designed to provide an opportunity for highly motivated science, technology, engineering, and math-focused undergraduate students from historically black colleges and universities, minority-serving institutions (MSI), and other nearby academic institutions with minority student populations, to connect with NIEHS and engage in many of its educational, informational, training, and career-oriented outlets.

For more information, visit <http://www.niehs.nih.gov/about/od/deputy/osed/scholars/index.cfm>.

## Goal 9

Inspire a diverse and well-trained cadre of scientists to move our transformative environmental health science forward, and train the next generation of EHS leaders from a wider range of scientific disciplines and diverse backgrounds.

- a. Foster cross-disciplinary training in areas that are necessary, but underrepresented, in EHS, e.g., informatics, engineering, biobehavioral, etc.
- b. Recruit trainees from other disciplines to diversify our science base.
- c. Ensure effective opportunities across the entire career trajectory, for young investigators' transition to independence, and for retraining midcareer scientists and other EHS professionals.
- d. Promote the integration of EHS into medical education to increase the number of physician or nurse researchers who are trained in EHS.
- e. Build environmental health research capacity in those countries around the world experiencing the greatest burden of death, disease, and disability due to environmental factors.
- f. Increase diversity within training programs for environmental health scientists.

## Goal 10

Evaluate the economic impact of policies, practices, and behaviors that reduce exposure to environmental toxicants, through prevention of disease and disabilities, and invest in research programs to test how prevention improves public health and minimizes economic burden.

- a. Develop an interdisciplinary research and training program in environmental health economics, to better understand the economic costs and benefits of environmental exposures, related diseases, and interventions to prevent exposures and diseases.
- b. Measure economic benefits and comparative effectiveness of NIEHS investments, employing health economics as a part of the NIEHS research agenda, and develop tools and databases to advance this research.
- c. Assist policymakers with systematic review and state-of-the-science assessments to help them make clinical and policy recommendations.



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## Goal 11

Promote bidirectional communication and collaboration between researchers and stakeholders, e.g., policy-makers, clinicians, intervention and prevention practitioners, and the public, in order to advance research translation in the environmental health sciences.

- a. Promote NIEHS as a trusted and accessible source of EHS-based information and increase reach and effectiveness in communication and outreach.
- b. Identify and expand our relevant stakeholder communities and enhance engagement to understand their priorities, concerns, and needs related to EHS.
- c. Build and lead long-term federal and nonfederal partnerships with health education agencies and mission-related stakeholder groups, to create a pipeline for the coordination of disseminating scientific results to the public and to hear back from constituents.
- d. Conduct research, as needed, on effective EHS communication strategies, including risk communication and public health.
- e. Develop an integrated, searchable knowledge base on the impact of the environment on health.

### ***EHP Goes Paperless***

NIEHS proudly publishes Environmental Health Perspectives (EHP), the top peer-reviewed scientific journal for environmental, occupational, and public health research.

As part of its long-standing commitment to sustainable publishing, EHP is going paperless! This move is part of an overall strategy to increase the use of electronic communication technologies, such as tablet and other mobile versions, which will enhance the journal's reach and impact.

Check out the EHP podcast series at <http://ehp03.niehs.nih.gov/static/podcasts.action> and follow EHP on Twitter at <https://twitter.com/ehponline>.