

## Draft NIEHS Strategic Plan Goals

1. Identify and understand fundamental shared mechanisms or common biological pathways (e.g., inflammation, epigenetic changes, oxidative stress, mutagenesis) underlying a broad range of complex diseases, in order to enable the development of broadly 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 protective mechanisms and their regulation in determining resistance and susceptibility to environmental stressors.
  - d. Understand the normal processes of human development 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.
  
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 lifespan.
  - c. Study the factors that determine individual susceptibility to environmental stressors across the lifespan.
  
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.
  - a. Advance characterization of environmental exposures through improved exposure assessment at both the individual and population levels.
  - b. Define and disseminate the concept of the exposome.
  - c. Create tools and technologies, and the research capacity, needed to characterize the exposome.

4. Understand how combined environmental exposures affect disease pathogenesis.
  - a. Assess the joint action of multiple environmental insults (including chemicals, non-chemical stressors, and nutritional components) on toxicity/disease and identify interactions resulting from combined exposures.
  - b. Study the role of the human microbiome and its influence on environmental health; explore the role of the microbiome in responses to environmental exposures.
  - c. Study the interactions of infectious agents with environmental exposures.
  - d. Understand how non-chemical stressors (including socioeconomic, behavioral factors, etc.) interact with other environmental exposures to impact human health outcomes, and identify preventive measures that could be taken.
5. Identify and respond to emerging environmental threats to human health on both a local and global scale.
  - a. Enlist the capacity of the 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.
  - 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).
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.
  - 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.
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
8. Enhance the teaching of EHS at all levels of education and training (K-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 (students, postdocs, foreign scientists, and science teachers).
  - d. Incorporate EHS into Medical Education/Practice (nursing, MD, etc.) to increase awareness of environmental medicine in healthcare practice
9. Inspire a diverse and well-trained cadre of scientists to move our transformative environmental health science forward; 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 (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 also for retraining of mid-career scientists and other EHS professionals.
  - d. Promote the integration of EHS into Medical Education to increase the number of physician or nurse researchers that 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 related to the environment.
  - f. Increase diversity within training programs for environmental health scientists.
10. Evaluate the economic impact of policies, practices, and behaviors that reduce exposure to environmental toxicants through prevention of disease and disabilities; 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 – developing the tools and databases to advance this research.
  - c. Assist policymakers with systematic review and state of the science assessments to help them make clinical/policy recommendations.
11. Promote bidirectional communication and collaboration between researchers and stakeholders (policy makers, clinicians, intervention/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. Increase NIEHS's reach and effectiveness in communication and outreach.
  - b. Identify and expand our relevant stakeholder communities; enhance engagement to understand their priorities, concerns and needs related to EHS.
  - c. Build and lead long-term federal and non-federal 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 also to hear back from their constituents.
  - d. Conduct research as needed on effective EHS communication strategies (including risk communication).
  - e. Develop an integrated, searchable knowledge base on the impact of environment on health.