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Translational research in environmental health sciences

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Clearly, a need exists to translate more quickly myriad discoveries in biomedical research into more effective applications relevant to human health and disease. In recognition of the need for a more efficient and coordinated translational effort, the National Institutes of Health (NIH) has created a new consortium of integrated translational centers through the Clinical and Translational Science Awards (CTSAs).[1] These new "academic homes" for translational research offer unique opportunities to investigators interested in environmental health sciences.

For much of the biomedical enterprise in the United States, translational efforts are focused on improving diagnostic testing and therapeutic approaches that can assess and treat human disease more effectively. Although the American public may focus on the new tests and treatments publicized in the lay press, many complex and silent contributions to these reported discoveries come from investigators in basic science, which are clinical or population sciences that form the bedrock for many of these newly reported discoveries.

The National Institute of Environmental Health Sciences (NIEHS) is unique among the various institutes and centers at NIH because it focuses on improving our understanding of how the environment and its perturbations may contribute to human health or may cause human disease. As NIEHS is not focused on a single organ system or disease, fewer examples of newer diagnostics or therapeutics from NIEHS exist compared with other institutes and centers. However, a rich history of translational research supported by NIEHS has improved the health of the American public by demonstrating environmental etiologies for human disease and by implementing policy and public health interventions that reduce disease prevalence. For example, the effect of lead on neurodevelopment was recognized as a major public health risk and its mitigation in the environment was accomplished by effective health policies, dissemination of public health information, and effective new regulations. As a result of this translational research, the blood levels of lead in young children (1–5 years) have been reduced by 77% since the 1970s.[2]

In addition, particulate matter in outdoor air pollution was reported to cause excess cardiovascular morbidity and mortality in American cities, and with subsequent reductions in ambient levels of particulate matter, a significant reduction in associated mortality occurred.[3] Both examples underscore the value of determining the impact of environmental exposures on human disease and of reducing exposures to prevent the development or progression of disease.

Many challenges exist in linking environmental exposures to human disease successfully. We need newer, more precise, and more personalized approaches to monitor exposures. NIEHS, as part of the trans-NIH Gene Environment and Health Initiative Research Funding Announcements, released several announcements in the past year designed to enhance this emerging technology and its relevance to human disease.

One of the most successful methods to link environmental exposures to human disease is to investigate the causes for an unexplained increase in disease incidence and prevalence in specific regions of the world. The story of how fungal aflatoxins that contaminated food stuffs in the developing world was linked to the epidemic of liver cancer remains a compelling example.[4] Obviously, the prevention of human liver cancer is a more successful and cost-

effective approach than all of the diagnostic and therapeutic discoveries that modern medicine can provide. However, such examples are few. In part, this may relate to our lack of current and accurate information on disease prevalence of the United States and much of the world. The challenge of linking the exposure to human disease is difficult detective work in the best of circumstances. In the absence of accurate estimates of changes in disease prevalence, the need to consider possible environmental etiologies might be overlooked. Development of new approaches to disease registries and/or applications of existing patient databases such as from Medicare/Medicaid or from private insurance companies could provide improved insights into disease frequency and geographic predilection.

Opportunities in translational research relevant to the impact of the environment may be enhanced in diseases with changing prevalence. Examples are diverse, which include diabetes, chronic pulmonary diseases, cancers, inflammatory bowel disease, neurodegenerative diseases, and autism. Attempting to establish environmental links to human disease represents a clear opportunity for joint efforts among clinicians, epidemiologists, and basic researchers.

Translating research and patient data should be viewed as an interconnecting and multidirectional network, with information that flows back and forth among basic research scientists, clinicians, epidemiologists, engineers, and policy makers. Key to this process is the transfer of knowledge (information) among these different groups and an effort to form research teams dedicated to specific but complex problems.

The concept of translational research is not meant to push academic scientists into starting biotech companies or to be totally product driven. Translation should be viewed as both an opportunity and in some ways an obligation, so that the general public receives some tangible benefit for supporting the vast research enterprise. Aside from the obligatory paragraph in grant applications that indicates how humanity will benefit some day, serious thought should be given to how some portion of what has been learned might be translated realistically to practical use. In environmental health sciences, this may represent any number of applications: a new device, a biomarker of exposure, a method of removing an environmental toxin, a change in environmental regulations or policy, a change in clinical practice, and so on.

NIEHS committed additional resources to promote translational research, which include the Director’s Challenge for intramural scientists and the Discover Program for the extramural scientific community. In addition, our T32 training programs have updated language to enhance the importance of translational research in the training experience. Furthermore, we have announced recently a K18 award in the NIH guide to provide support for a modular sabbatical experience from 3–12 months to encourage mid-year career scientists to develop new skills in translational research relevant to the mission of NIEHS.

This time is exciting for NIEHS to enhance training and research opportunities in translational research. The NIH has redoubled its commitment to translational research through the new CTSAs.[1] As the CTSA sites expand across the United States, unparalleled opportunities will exist for scientists interested in translational research to develop new collaborations and to use new pathways to apply our new discoveries successfully in biomedical research to improve human health. The NIEHS encourages the integration of environmental scientists into the broad opportunities afforded by the CTSAs.

The importance of translational research relative to the broad research enterprise is perhaps best summed up by the following quote from Goethe: “Knowing is not enough; we must apply. Willing is not enough; we must do.”

Having presented the challenge, several questions remain: How can investigators who are interested in environmental health sciences translate their work? What hurdles and barriers

have you experienced or do you anticipate, and what can the NIEHS do to help you overcome them? We encourage you to visit this website (translationalresearch@niehs.nih.gov) and give us your feedback.

References

1. Zerhouni E. Clinical and Translational Science Awards: a framework for a national research agenda. Transl Res 2006;148:4–5. [PubMed: 16887491]
2. Pirkle JL, Brody J, Gunter EW, et al. The decline in blood lead levels in the United States. The National Health and Nutrition Examination Surveys (NHANES). JAMA 1994;272:284–91. [PubMed: 8028141]
3. Laden Schwartz J, Speizer F, Dockery DW. Reduction in fine particulate air pollution and mortality. Amer J Resp Crit Care Med 2006;173:667–72. [PubMed: 16424447]
4. Kensler TW, Qian GS, Chen JG, Groopman J. Translational strategies for cancer prevention in liver. Nat Rev Cancer 2003;3:321–9. [PubMed: 12724730]