

Charting the Future: The NIH Roadmap

The NIH Roadmap for Medical Research, launched in 2004 by NIH Director Elias Zerhouni, M.D., is a series of far-reaching initiatives that the agency will pursue over the next decade to reshape medical research for the most profound impact on human health. This plan was created with extensive input from NIH leadership and more than 300 nationally recognized leaders in academia, industry, government and the public. The Roadmap is focused on three broad themes: New Pathways to Discovery, Research Teams of the Future and Re-engineering the Clinical Research Enterprise.

The first theme is aimed at creating new libraries of critically important “research tools,” such as the crystal structures of biologically crucial proteins, images of brain functioning and small chemical models that can effect the way genes are expressed and cells function. The libraries will help researchers everywhere to understand better the complex biological systems that are orchestrated by our genes and identify promising “targets” for therapeutic development.

The second theme focuses on stimulating new ways of combining skills and scientific disciplines to promote greater collaboration among teams of researchers; a new Pioneer Award to inspire investigators to take on creative, unexplored avenues of research that have the

Working Together to Transform Medical Research

Research advances have opened a new landscape of opportunities to understand human health and disease. With a burgeoning knowledge base, researchers at medical schools and teaching hospitals are working with the National Institutes of Health (NIH) to make the most of the knowledge gained and accelerate the pace of discovery.

Scientists are exploring the workings of the cell, molecule by molecule. They are devising more powerful research tools to answer questions they didn't dream of asking just five years ago. Interdisciplinary teams are bringing together the resources of diverse disciplines—biology, mathematics, engineering, and computer science—to move more quickly toward solutions to today's medical problems.

New Approaches

The human body is an amalgam of complex, interacting biological systems that need to be better understood to stop disease and disability. Researchers are beginning to apply a systems approach to understand diseases, using new research strategies to integrate knowledge from biology, genetics and environmental studies. As a result, whole new areas of research have been born—genomics, proteomics, pharmacogenetics, nanomedicine—all aimed at understanding the workings of the body at the level of genes, proteins and other molecules, and developing ways to intervene in the disease process sooner and more effectively than is possible today.

A Better Tool Box

Scientists are relying on sophisticated new tools such as powerful computers and mathematical models to decipher the vast amounts of data generated through basic research and clinical studies. With new imaging tools and techniques, researchers can detect single molecule events in living cells and scientists can dramatically increase resolution of images in real time. Medical schools and teaching hospitals are major participants in these efforts and have developed important imaging and genomics tools that have contributed to the accelerated pace of medical discovery. For example:

- The DNA microarray, developed in 1995 at Stanford University Medical School, lets scientists study thousands of genes at a time. These “DNA chips” are created with miniscule amounts of hundreds or thousands of gene sequences on a single microscope slide to reveal detailed snapshots of which genes are active inside the cell.

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potential to make extraordinary contributions; and novel partnerships that will bring together the public and private sectors to accomplish what neither can do alone.

The third theme undertakes the most important challenge identified in the NIH Roadmap process: exploring ways to transform basic science discoveries into preventive measures, diagnostics, drugs or treatments. Under this initiative, the NIH will establish better-integrated networks of academic centers, including medical schools and teaching hospitals, which work together on clinical trials and include community-based practitioners who care for large groups of patients. This area also focuses on efforts to expand the clinical research workforce by supporting the education and career development of young investigators from many disciplines, and inspiring them to join the teams needed to conquer illness and disease in this country. Recently, the NIH announced a major Roadmap initiative, through the National Center for Research Resources, to catalyze the reinvigoration of clinical translational sciences at the nation's medical schools and major teaching hospitals. The goal is to foster an academic "home" and the integrated resources needed to support and advance this discipline through the collaborative efforts of the NIH, medical schools and teaching hospitals.

The NIH Roadmap initiatives foster the efforts of scientists at medical schools, teaching hospitals and other institutions to develop the research tools of the future, to build the networks necessary to tackle the most complex questions in biology, and to make the next leaps in medical discovery.

For more information, go to:
www.nihroadmap.nih.gov

- In 2004, scientists at the University of Pittsburgh School of Medicine completed the first human studies of a new chemical that enables positron emission tomography or PET scanning to reveal the memory-stealing amyloid plaques that are the hallmark of Alzheimer's disease. This new technique should help researchers learn how and when the disease originates and to evaluate new therapies.
- In 1995, researchers at Johns Hopkins University School of Medicine in Baltimore, Maryland, developed a computer model that helps to predict how complicated proteins "fold," a technology that will help determine the function of newly discovered genes.
- In 1993, researchers at University of Minnesota Medical School were the first to use an imaging technique called functional MRI to localize thought processes in the brain.

Team Science

Today's medical research, which relies so heavily on technology, calls for interdisciplinary teamwork. Scientists, engineers, and mathematicians are crossing traditional disciplinary lines to answer complex questions that no one field of study can address alone. Infrastructure is being put in place to enhance tool and data sharing across research areas and among researchers at different institutions with shared aims. Some examples:

- The Broad Institute in Cambridge, Massachusetts is a first-time collaboration by three institutions: Harvard Medical School and affiliated hospitals, Massachusetts Institute of Technology, and the Whitehead Institute for Biomedical Research to create and apply cutting-edge tools for genomics research to "propel the understanding and treatment of disease."
- The University of Texas Medical School in Houston will make available new facilities at its Functional Genomics and Proteomics Research Center to researchers and clinicians who treat patients at the University of Texas Health Science Center and Texas Medical Center. The center will provide core laboratories in various technologies and disciplines that identify how genes work, study the structure and function of proteins encoded by the human genome, and develop mathematical tools and models to analyze the genome.
- The NIH-supported Michigan Proteome Consortium is a partnership among the University of Michigan Medical School, Wayne State University Medical School, Michigan State University and Van Andel Research Institute to develop specialized laboratories in the fast-moving field of proteomics, the study of proteins and their functions.

To learn more about how medical schools, teaching hospitals and the NIH are working together to fulfill the promise of medical research, go to www.aamc.org/ftp.