Building Blocks, Biological Pathways and Networks

In the human body, all biological components—from individual genes to entire organs—work together to promote normal development and sustain health. This amazing feat of biological teamwork is made possible by an array of intricate and interconnected pathways that facilitate communication among genes, molecules, and cells.

While some of these biological pathways have already been discovered, many more remain to be found. Further research is also needed to understand how these pathways are integrated in humans and other complex organisms, as well as to determine how disturbances in these pathways may lead to disease and what might be done to restore disturbed pathways to their normal functions.

In this set of NIH Roadmap initiatives, researchers will focus on the development of new technologies to accelerate discovery and facilitate comprehensive study of biological pathways and networks. One of the central components of such networks is the set of proteins encoded by an organism's genome, commonly referred to as the "proteome." To better understand the proteome, innovative tools must be developed that will enable researchers to determine in real time the amounts, locations and interactions of large numbers of individual proteins within a single cell. NIH is establishing a series of National Technology Centers for Networks and Pathways to promote the development of new proteomic technologies. Such capability is crucial to expanding the identification of biological pathways and developing treatments for diseases involving such pathways.

Another critical focus is providing researchers with novel analytical tools to better understand the metabolic components and networks within the cell, which are commonly referred to as the "metabolome." In particular, researchers are eager for technologies that will enable them to measure local concentrations of carbohydrates, lipids, amino acids, and other metabolites within a single cell or even a specific part of a single cell. Specific areas of research emphasis include approaches that will address the widely fluctuating range of metabolite concentrations and complexity of metabolite mixtures, the vast number of unidentified compounds present within single samples, and the dynamic nature of the cell's entire set of metabolites. This type of comprehensive information may pave the way for the development of better methods to detect metabolic differences between normal and diseased cells.

This new set of tools for studying biological building blocks and pathways will lay the foundation for even more complex future projects. These may include the complete mapping of an organism's protein and metabolism networks, as well as the creation of biological models that can help predict the human body's response to disease, injury or infection. Ultimately, NIH

expects that data generated by these initiatives will be used in biomedical research aimed at earlier and more precise diagnosis, prevention, and treatment of a wide variety of diseases.

The URL for the NIH Roadmap web site is nihroadmap.nih.gov. For more information on the Building Blocks, and Pathways initiatives, contact Geoff Spencer, Communications Specialist, National Human Genome Research Institute, (301) 402-0911, spencerg@mail.nih.gov. Further information about NIH can be found at its Web site: www.nih.gov.