

## Novel Imaging Technologies “Illuminate” Environmental Health Science Research

Extraordinary advances in the visualization of biologic structures have been achieved within the past five years. Improvements in imaging platforms, reporters, and detectors have provided markedly enhanced spatial and temporal resolution of biologic events in living systems. The recent tremendous rise in computer power and data-handling capacity has supplied the foundation for progress in diverse imaging modalities, ranging from light microscopy of signaling elements in single cells to functional brain mapping with magnetic resonance imaging.

Some of the most stunning innovations have occurred in the area of optical imaging. The continued development and refinement of genetically encodable fluorescent probes has enabled tracking of subcellular translocation of proteins, visualization of physical interactions among multiple proteins, and, in some cases, measurement of conformational changes in a single protein. A further considerable and ongoing development is in the area of physiologic indicators, including nanoscale biosensors that provide optical readout of cellular pH and calcium. Targeting of fluoroprobes to specific cellular compartments is now possible. Development and refinement of technologies to visualize events in three-dimensional living tissues, organs, and whole organisms is well under way. Optically based technologies have become increasingly popular for drug discovery, and their translation into toxicologic arenas now appears feasible.

These advances illustrate the unprecedented opportunities now available for harnessing imaging technologies for the study of environmental influences on biologic processes. These opportunities were the focus of an NIEHS-sponsored workshop held in Research Triangle Park, North Carolina, on 14 July 2000, and were a thematic topic for a subsequent science planning retreat for the Division of Extramural Research and Training held 4–5 December 2000. These program activities provide a foundation for anticipated future efforts of the NIEHS directed toward encouraging the development of novel imaging technologies and the use of these emerging technologies to identify and elucidate environment–disease linkages.