NATIONAL CENTER FOR
RESEARCH RESOURCES
NATIONAL INSTITUTES OF HEALTH
DEPARTMENT OF HEALTH
AND HUMAN SERVICES

Biomedical Technology Resource Centers

Biomedical Technology (BT) Resource Centers support the discovery, development, and dissemination of powerful, leading-edge technologies that have broad applications to the study of biology and medicine. The centers serve as a hub for both multidisciplinary and interdisciplinary research, which ultimately introduces new technologies and tools to the biomedical community.

The National Center for Research Resources ensures that essential tools and research resources are readily available to NIH-supported investigators nationwide. NCRR-supported resources—a comprehensive range of human, animal, technology, and more—enable biomedical research advances.

The Division for Biomedical Technology Research and Research Resources at the National Center for Research Resources (NCRR) supports more than 40 specialized BT Resource Centers across the country, primarily at major academic institutions. Each center either focuses on a specific technological area, such as magnetic resonance imaging, or integrates a variety of technologies and methods for tackling complex biological issues, such as analyzing all the chemical interactions required for the maintenance and reproduction of living cells.

The centers serve as both technological and intellectual resources. They are technological resources in that they provide the scientific community with access to state-of-the-art instruments, innovative methodologies, and computational tools that are not broadly available. They are intellectual resources in that they are staffed with scientists who have expertise in technology and biology, which makes the centers uniquely suited for creating new tools and identifying applications for these tools. The synergy between technology development and biological problem-solving gives the BT Resource Centers a fundamentally different character from the laboratories of individual researchers or centers with more narrowly defined goals.

To best serve the scientific community and maximize use of biotechnology resources, all BT Resource Centers are composed of five components:

1) *Technological Research and Development (R&D):*
Research projects conducted at each center involve the development of new technologies, improvement of existing technologies, or discovery of new uses for existing technologies. These investigations are at the cutting edge of the technological field and sometimes involve a degree of calculated risk, with the potential for producing significant gains in the health-related sciences. The R&D projects often are designed to address emerging needs in the biomedical research community.

2) *Collaborative Research:*
The staff, who are experts in the centers' technologies, collaborate with outside investigators who specialize in particular biomedical fields and are likely to become routine users of the technologies under development. These collaborations with potential end-users help to refine technological tools and methodologies and also identify new applications to biomedical research. Through this feedback process, technologies ultimately may be developed to the point that they are ready for widespread dissemination.

3) *Service:*
BT Resource Centers also provide outside investigators with access to resources for studies that do not involve collaborations with a center's staff. In these cases, center personnel offer consultation and technical assistance but generally do not share authorship on resulting papers or patents. Nevertheless, resource users are expected to acknowledge use of the center in papers resulting from their projects.

4) *Training:*
Center personnel offer training in the use of the center's technologies and methods to collaborators, service users, and others in the biomedical community. On a regular basis, the centers provide lectures, seminars, and hands-on laboratory experience. Centers also conduct occasional short courses and workshops, sometimes in conjunction with scientific meetings attended by the user community.

5) *Dissemination:*
To ensure that developed technologies and tools reach the broadest possible scientific user group, resource centers engage in outreach activities, such as presenting research results at meetings, conducting conferences, and producing newsletters or Web sites. Centers that develop and disseminate software place emphasis on making the software portable, well-documented, and user-friendly. Each center maintains an up-to-date Web site that provides information about its research activities and technologies.

Biomedical Informatics Research Network

Some of the BT Resource Centers that focus on magnetic resonance imaging and microscopy are partners in the Biomedical Informatics Research Network (BIRN), an NCRR-funded initiative that links biomedical laboratories around the country in a high-performance computer network. BIRN allows researchers to pool subjects and data from multiple laboratories, thereby facilitating, for example, studies of rare disorders. The network also enables data integration at multiple levels and scales, from events occurring at the whole-organ level to corresponding activities at the molecular and cellular levels. Although BIRN initially will concentrate on neuroimaging studies, the research infrastructure developed for BIRN ultimately will be transferable to a wide variety of scientific disciplines. Additional information about BIRN can be accessed at www.ncrr.nih.gov/biotech/btbirn.asp.

Core Technologies at BT Resource Centers

Each BT Resource Center specializes in a particular core technology, categorized into the eight broad areas listed below.

Integrated Technologies	These centers develop and integrate diverse technologies in pursuit of particular goals, such as characterizing carbohydrate-protein interactions or measuring molecular transport across cell membranes. Some centers focus on developing novel strategies for processing brain images in order to identify brain changes over time or facilitate neurosurgery.
Laser Applications	At these centers, scientists use a variety of laser-based spectroscopic techniques to study the structure and dynamics of biomolecules, cells, and tissues. Research at these centers aids development of minimally invasive procedures for diagnosing diseases, including cancer and atherosclerosis.
Magnetic Resonance Imaging	Investigators at these centers push the boundaries of magnetic resonance imaging—for example, using higher magnetic field strengths to obtain microscopic images of structures as small as neurons.
Magnetic Resonance Spectroscopy	These centers use nuclear magnetic resonance (NMR) and electron spin resonance (ESR) to study chemical and dynamic properties of biomolecules. Projects include assessing liver metabolism in humans by ^{13}C NMR of body fluids and developing high-resolution ESR microscopy.
Mass Spectrometry	At these centers, researchers use mass spectrometry to study proteins, carbohydrates, and other biomolecules. These centers develop new instrumentation as well as methods for exploiting mass spectrometry in new research areas.
Microscopy	Projects at these centers include developing methods for producing three-dimensional images of structures ranging from macromolecules to cells; automating cryoelectron microscopic procedures to solve macromolecular structures; and using laser microsurgery to deactivate particular cellular components.
Simulation and Computation	Projects at these centers include visualizing electric fields emanating from the heart and brain, identifying genetic components that underlie disease susceptibility, and modeling structural changes in proteins and nucleic acids.
Synchrotron Radiation	These resources provide access to beamlines at major U.S. synchrotron facilities. The brilliant synchrotron X-rays that emanate from these beamlines are used for macromolecular crystallography, X-ray absorption spectroscopy, small-angle X-ray scattering, and other techniques.

Integrated Centers for Proteomics and Glycomics

Another NCRR-funded initiative supports BT Resource Centers devoted to new technologies in the emerging fields of proteomics and glycomics. NCRR is building on its long-term investments in protein (proteomics) and carbohydrate (glycomics) analysis to develop a series of integrated centers that strengthen research infrastructure in these important areas. These centers bring together expertise in biology, analytical chemistry, and informatics to accelerate the creation of novel, integrated methods. The special focus on glycomics emphasizes the importance of analyzing not only protein sequences, but also the post-translational modifications that add so much to the structural and functional diversity of proteins. Large-scale analysis of complex, heterogeneous protein glycosylation demands an additional suite of technologies rivaling the complexity of mainstream proteomics.

Investigator Access to BT Resource Centers

Each year, nearly 6,000 biomedical investigators use the BT Resource Centers or collaborate on research projects at these centers. Investigators who are eligible to use the centers include those whose projects are supported by NIH, other Federal government agencies, or the private sector. However, priority is given to NIH-supported researchers.

Investigators interested in gaining access to a BT Resource Center should consult the *Biomedical Technology Resources Directory* for the names and contact information of key staff members. The directory is available online at www.ncrr.nih.gov/ncrrprog/btdir/btdirectory.asp. Copies of the directory also can be obtained from NCRR. (See contact for general NCRR information.)

Establishing a BT Resource Center

NCRR supports the Biomedical Technology Resource Centers Program through five-year, competitive P41 grants. Applicants for new P41 grants are expected to have active R&D technology and collaborative research projects already in place and to detail their plans for expanding these projects, as well as establishing the service, training and dissemination components required of a BT Resource Center. Both profit and nonprofit organizations in the United States are eligible to apply for P41 grants.

Institutions interested in establishing a BT Resource Center should first consult the *Biomedical Technology Program Guidelines*, available at www.ncrr.nih.gov/biotech/btguide2.pdf. Prospective grantees are strongly encouraged to discuss the proposed resource grant application and budget with NCRR program staff in advance of the application deadline. These discussions provide applicants with a clearer understanding of current program policies and any newly instituted guidelines.

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Prepared: December 2003