Center for Translational Neuroimaging

Tools and techniques to increase understanding of the human brain

Purpose:

Develop and apply brain-imaging tools and methods to increase understanding of the human brain

Sponsors:

Office of Biological & Environmental Research within the U.S. Department of Energy's Office of Science

National Institutes of Health (e.g., National Institute on Drug Abuse, National Institute on Alcohol Abuse and Alcoholism, National Institute on Mental Health, National Institute of Biomedical Imaging and Bioengineering)

Office of National Drug Control Policy

New York State Office of Science, Technology and Academic Research

Research tools:

- Two cyclotrons for producing radioisotopes
- Laboratories for radiotracer synthesis
- Two whole-body PET scanners
- MicroPET scanner
- 4-tesla whole-body MRI scanner
- 9.4-tesla microMRI scanner
- Microdialysis and behavior labs
- Optical imaging laboratory

Partners:

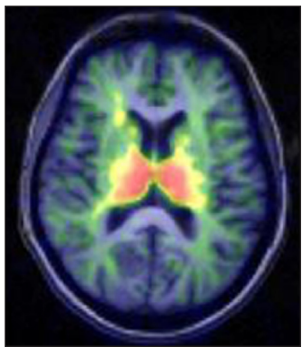
Researchers from academia and the National Institutes of Health. In addition, Brookhaven scientists hold joint appointments and mentor graduate students from Stony Brook University.

www.bnl.gov/CTN

Brookhaven Lab Addiction Symposium @ AAAS

Feb. 16, 2007, San Francisco

Scientists have made great advances in understanding how the brain works at the cellular level. But translating this knowledge to understanding human behavior and treating brain diseases has lagged behind.



Combined PET/MRI scans overlay anatomical and biochemical data.

Brookhaven Lab's Center for Translational Neuroimaging is bridging this gap by using complementary brain-imaging tools — including positron emission tomography (PET), magnetic resonance imaging (MRI), and optical imaging — to improve our understanding of how the human brain is affected by a range of conditions and diseases, and how this information can be used to advance diagnosis and treatment. Brookhaven scientists are actively pursuing brain-imaging studies to understand drug addiction, obesity, attention deficit disorder, and aggression.

These brain-imaging studies are a direct outgrowth of the Department of Energy's (DOE's) long-standing support of basic physics and chemistry research. Both MRI and PET owe their existence to insights gained through the construction of particle accelerators and detectors for investigations into the fundamental nature of matter and energy. Brookhaven's imaging scientists also build on knowledge gained through DOE's interest in chemistry and physics to develop the radiotracers used with PET.

Milestones to date

- First imaging studies identifying the brain circuits disrupted in addiction.
- Development of fluorine-18-labeled deoxyglucose, the most widely used radiotracer for studying the brain and managing cancer and other diseases.
- Development of gamma vinyl-GABA (GVG) as a novel addiction treatment.
- Discovery of pleasure/reward circuit deficiencies in obesity that are similar to those found in drug abuse.
- Discovery of how Ritalin changes brain chemistry and improves attention.
- Demonstration that increasing brain receptors can modify alcohol abuse in animals.
- Creation of a 3-D digital atlas of the mouse brain with web-based visualization tools.

Facilities

The center's facilities include: cyclotrons for producing radioisotopes; radiotracer synthesis laboratories; PET and MRI scanners; microPET and microMRI scanners; an optical imaging laboratory; a microdialysis laboratory; and a Clinical Research Center for translational imaging studies in humans.

Ongoing research goals

- Develop new radiotracers and other imaging technologies and analysis methods to study how brain chemistry is altered in depression, autism, Alzheimer's and other neurodegenerative disorders.
- Develop imaging methods to understand the regulation of eating behavior and why some people continue to eat even when their stomachs are full.
- Use multiple imaging techniques to advance knowledge of the adolescent brain to understand why people of this age are more vulnerable to drug abuse and other brain disorders.
- Image changes in brain blood flow to determine patterns of brain activation and study the circuits involved in emotion, reward, and aggression.
- Develop PET and MRI instruments for imaging subjects in motion.
- Develop methods for imaging nanoparticles in the living body.

Interdisciplinary impact

The neuroimaging research at Brookhaven Lab is a prime example of how DOE's national laboratories bring together the expertise of chemists, physicists, and medical scientists to develop new scientific tools and ways to apply them to improve human health. These facilities also help to train the imaging scientists who will drive advances in these fields for years to come.

(2/07)