Center for Translational Neuroimaging

Tools and techniques to increase understanding of the human brain

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.

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

The center’s facilities include: cyclotrons for producing radioisotopes; radiotracer synthesis laboratories; PET and MRI scanners; microPET and microMRI scanners; laboratories for radiotracer synthesis; two cyclotrons for producing radioisotopes; laboratories for radiotracer synthesis; two whole-body PET scanners; microPET scanner; two whole-body MRI scanners; microMRI scanner; laboratories for radiotracer synthesis; and optical imaging laboratory.

Research goals:
- Develop methods for imaging subjects in motion.
- 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.

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.

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.