

## Life Sciences at Brookhaven Lab

*Understanding the biological processes at work within and around us*

### Purpose:

To understand the biological processes at work within and around us

### Sponsors:

The Office of Biological and Environmental Research within the U.S. Department of Energy's Office of Science, the National Institutes of Health

### Facilities:

#### National Synchrotron Light Source

High intensity x-ray, ultra-violet, and infrared beamlines for probing molecular structures and mechanisms

#### Center for Translational Neuroimaging

Multimodal imaging technologies for studying brain diseases, treatments

#### Brookhaven Linac Isotope Producer

Creates radioisotopes for research, diagnosis, and treatment

#### Scanning Transmission Electron Microscope

Reveals architecture and function of large macromolecular structures

#### Cryo-Electron Microscope

Tool for deciphering protein structures

#### NASA Space Radiation Laboratory

Simulates space radiation environment to assess risks and test protective measures for astronauts, spacecraft

### Accomplishments:

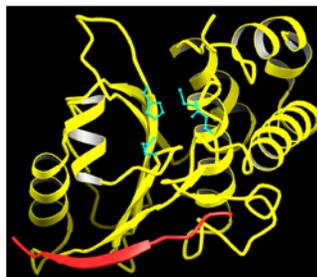
- Development of radiotracers to diagnose cancer, brain disease, and heart disease
- L-dopa for Parkinson's disease
- Synthesis of human insulin
- Use of plants to monitor environmental hazards
- System to make proteins for research, medicine, industry
- Potential treatment for addiction

[www.biology.bnl.gov/](http://www.biology.bnl.gov/)  
[www.bnl.gov/medical/](http://www.bnl.gov/medical/)



Addiction scientists analyze data

From basic studies on DNA and proteins to sophisticated imaging techniques and biomedical and environmental applications, Brookhaven National Laboratory has a distinguished history and a promising future in life sciences research. Funded by the U.S. Department of Energy's (DOE) Office of Science, the National Institutes of Health, and other agencies, these studies offer many potential benefits to human health and society.



Molecular structure of a viral enzyme

### Molecular Machines

By probing the properties of proteins and nucleic acids, Brookhaven biologists are gaining new insights into the structure, function, and self-assembly of biological systems. This work could have profound impacts on energy production, the environment, homeland security, medicine, and quality of life. For example, x-ray beams at the National Synchrotron Light Source (NSLS) help scientists decipher the molecular structures of proteins — one key to designing new drugs, vaccines, sensors, or treatments. Structures solved include proteins associated with AIDS, the common cold, botulism, and Lyme disease.

### DNA Damage and Repair

Studies of the mechanisms by which DNA can be damaged by natural phenomena, such as sunlight and cosmic rays, or environmental agents — and how cells repair or respond to the damage — may lead to new cancer therapies and a more scientific basis for regulating exposures. At Brookhaven's NASA Space Radiation Laboratory (NSRL), studies using high-energy ion beams to simulate the cosmic rays of outer space may lead to new ways to protect astronauts.

### Brain Imaging

Using magnetic resonance imaging (MRI), positron emission tomography (PET), and optical imaging, Brookhaven scientists are investigating how the human brain is affected by conditions such as drug addiction, obesity,

attention deficit disorder, depression, and aggression — and how this information can be used to advance treatment. This work has led to a new understanding of the biochemistry of drug addiction and promising potential treatments.

### From Genes to Plant Systems

Studies of gene expression and regulation in complex living systems — from communities of microbes to plants — is helping Brookhaven biologists meet challenges in toxic-waste cleanup, energy production, and global climate change. The main thrust of the program is to understand the system biology in which microbes interact with plants to break down cellulose, which then can be converted to ethanol for fuel. Studies of genes, proteins, and molecular interactions in plants may also improve our ability to clean up environmental contamination, soak up carbon dioxide from the atmosphere, or produce useful products such as more healthful foods or raw materials that decrease our nation's dependence on oil. Genomic studies of agricultural crops may also yield more bountiful harvests for a hungry world.

### Computational Biology

Information technology specialists are developing new tools to manage, analyze, and visualize vast amounts of biological data, and simulate the complex structures and processes of living systems.