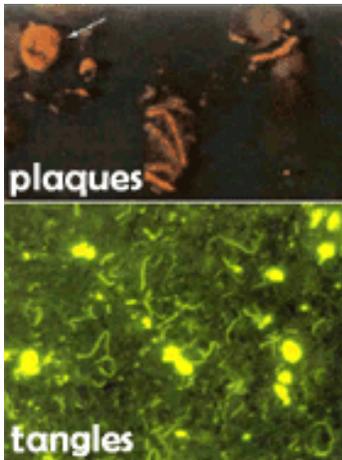


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The National Synchrotron Light Source at Brookhaven is one of the most prolific scientific facilities in the world. Each year, about 2,500 scientists from more than 400 universities and companies use the Light Source for a wide variety of research, including studies related to the following medical topics.

Alzheimer's Disease



Microscopic images of the plaques and tangles found in Alzheimer's diseased brain

- Alzheimer's disease is a progressive, degenerative disease of the brain. Its cause is not very well understood. However, we know that as it progresses, nerve cells die in particular regions of the brain.
- The brains of people who have died from Alzheimer's disease have a very characteristic appearance. In particular, 'tangles' and 'plaques' made from fragments of protein are observed in damaged areas of the brain.
- Brookhaven researchers are collaborating with scientists from Switzerland to understand the structures of the plaques and tangles in the hope of developing ways to prevent them from forming, thus preventing progression of the disease.
- The scientists are studying plaques and tangles found in other organs to see whether or not these structures are related to those found in the brain. This understanding may someday help prevent progress of the disease.

Breast Cancer

- Early detection and prompt treatment are key to curing breast cancer. Mammography, along with physical examination by the patient and by her/his physician, are the best approach to early detection.
- In conventional mammograms, differences in the densities and composition of tissues show up as contrasting areas reflecting differences in x-ray absorption, thereby allowing doctors to see tumors or changes in the tissue. However, the differences between healthy and cancerous tissues are very small, and scattering of the x-rays can blur the image and even lower the contrast, making it difficult to detect small tumors.
- Researchers at the Laboratory have developed a new technique, called diffraction-enhanced imaging (DEI), which uses ultra-brilliant x-rays to provide a dramatic contrast between normal tissues and tumors.
- Researchers say this radiography technique could be used in experimental clinical trials within five years and, possibly, in routine mammography in ten years. The technology also has potential applications in other tissues and organs with low contrast, such as kidneys.

(over)

Osteoarthritis

- Osteoarthritis is the most common type of arthritis, particularly in adults over 65 years old. The pain in osteoarthritis arises from erosion of cartilage. Without the protective cartilage cushion in a joint, the space in the joint narrows and bones rub against each other.
- X-rays are considered the “gold standard” for diagnosing osteoarthritis, but radiographic changes in the body are evident only relatively late in the disease. There is a great need for an imaging method or biological marker that would enable physicians to diagnose osteoarthritis much earlier.
- Applying the diffraction-enhanced imaging (DEI) technique to osteoarthritis, Brookhaven scientists have been able to get high-contrast images of joint cartilage. One day, this research might lead to methods of preventing and treating the disease.



A knee joint of a patient with osteoarthritis, showing significant cartilage loss.

HIV / AIDS

- HIV (human immunodeficiency virus) causes AIDS (acquired immune deficiency syndrome) by weakening the body's defense system until it can no longer fight off illnesses such as pneumonia, tuberculosis, and cancerous tumors. There is still no cure or vaccine for AIDS. New drug treatments, however, can help people with HIV stay healthy longer and can delay the onset of AIDS.
- At the Light Source, scientists are studying the structures of proteins to find cures for various diseases, such as the common cold, Lyme disease, and AIDS. Protein crystals are put into a focused x-ray beam, causing the x-rays to diffract. Using that x-ray diffraction pattern, the structure of the protein can be determined. This structure provides scientists with information that they can use for developing drugs to treat disease.
- Researchers led by Chris Hill, University of Utah, have solved an important protein structure involved in the HIV virus. The structure reveals details of capsid dimer formation, which functions in the formation of infectious HIV-1 virions. They have also shown that mutations that weaken dimer formation greatly reduce the formation of infectious virions.

Upcoming Events Open to the Public

Earth Day Run, April 19. Brookhaven's annual four-mile Earth Day Run is on April 19, starting at 9:30 a.m. To register, call 631 344-5660 or go online to <http://www.bnl.gov/eday>.

The Stony Brook Opera, April 23, Noon, Berkner Hall. Professor David Lawton of Stony Brook's Music Department will present staged excerpts from Mozart's popular opera *Don Giovanni*. Free.

Tomoko Fujita and Kimball Gallagher, May 21, Noon, Berkner Hall. Cellist Tomoko Fujita has participated in programs at the Juilliard School, Tanglewood Music Center, and Aspen Music School and Festival. Pianist Kimball Gallagher has given recitals in Houston and Boston. He is now a graduate student at the Juilliard School. Free.

Due to heightened security, everyone 16 and older who enters the Laboratory site must have a photo ID.