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Science and Technology Highlights from the DOE National Laboratories

Number 214

July 24, 2006

Research Highlights . . .

Technology detects foreign objects in process streams

A new, patented ultrasonic technology developed at DOE's [Pacific Northwest National Laboratory](#) can be used to assure quality in food such as ice cream, pureed baby foods and tomato paste. Originally developed to look for bone fragments and foreign materials in chicken breasts, the method, using both acoustics and optics technology, can also detect cartilage, metal and plastic—essentially anything that shouldn't be in the product. Developers believe the new method is inherently safer and more effective than inspecting certain types of process streams manually.

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ANITA sheds light at SLAC

Last month, researchers at [SLAC's](#) End Station A conducted a series of experiments intended to test NASA's Antarctic Impulsive Transient Antenna (ANITA). For nearly a week, the ANITA collaborators fired the linac beam into a 10-ton block of ice to create radiowaves, which were used to calibrate the detector. Shooting the ice with pulses from the linac produced a spectrum of "Cherenkov radiation" that, in addition to radiowaves, also created bright blue flashes of visible light. This phenomenon occurs when a charged particle moves faster than light can through a dense medium, such as ice. ([Click here](#) for a streaming video of the ice experiment showing pulses of the visible blue Cherenkov light.) The antenna array, which stands more than 20 feet tall, will fly aboard a high-altitude balloon that will circle above Antarctica for two months in late 2006, searching for evidence of ultra-high energy cosmic neutrinos that generate radiowaves when they strike the ice.

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Hybrid material clones bones

Life for the 2.2 million people worldwide needing bone grafts could get a lot better if a new hybrid material developed by researchers from DOE's [Oak Ridge National Laboratory](#) and the University of Tennessee lives up to expectations. While conventional synthetic bone graft materials offer several advantages over donor bone and negate the need for the patient to undergo a second operation, all suffer from significant shortcomings. The beauty of the gel-like substance is that it mimics the way bone grows in the body. Grafting with this material could improve healing around surgically implanted devices such as artificial joints or dental implants. Properties of the material are described fully in a paper published on line in the journal *Biomaterials*.

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Probable cause for Parkinson's?

A collaboration between DOE's [Pacific Northwest National Laboratory](#) and UCLA links the damage of Parkinson's, Alzheimer's and other brain diseases to a natural byproduct of metabolism and oxidative stress called nitration. Researchers surveyed nearly 8,000 proteins in a healthy mouse brain and found nitration on 31 sites along 29 different proteins, half of which had been previously implicated in several neurodegenerative diseases. The research, conducted mainly at the PNNL-based W.R. Wiley Environmental Molecular Sciences Laboratory, suggests that many neurodegenerative diseases leave a biochemical calling card, or biomarker, that could be used to predict the earliest stages of disease. Detecting disease conditions before symptoms occur is a key to reversing many as-yet-incurable diseases.

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DOE Pulse highlights work being done at the [Department of Energy's](#) national laboratories. [DOE's laboratories](#) house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. *DOE Pulse* (www.ornl.gov/news/pulse/) is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

ORNL research probes plaque-Alzheimer's link

Hearing the word plaque would send anyone running from the dentist. The accretion of too much bacteria or even protein in one place, however, plays a major role in other serious diseases, specifically Alzheimer's disease. In this neurodegenerative disease, brain tissue and, consequently, cognitive abilities disintegrate; unlike dental plaque, however, doctors cannot scrape away the brain's build-up of a protein plaque called amyloid beta, as a dentist can. Alzheimer's researchers are not even sure whether the plaque build-up is the cause or result of the disease, they just know that the plaque grows among the cells.

Amyloid beta is a fragmented piece of Amyloid Precursor Protein, which naturally occurs in the human tongue, liver, spleen, kidneys, heart and brain. Despite the bodies natural coding for this protein, the key to understanding any type of amyloid-related disease lies in quantifying how much of the protein and protein plaque are in the organs, says Justin Baba, a scientist at DOE's [Oak Ridge National Laboratory](#).

Baba is a biomedical engineer specializing in anatomical and physiological imaging. Working in collaboration with John Wall of the UT Graduate School of Medicine, Baba is using mice models suffering from amyloidosis, a disease-causing build-up of amyloid plaque, to try to correlate the level of plaque deposition with the severity of the disease.

"There are two types of imaging that we run. The MicroCT scan is a high resolution x-ray scan that gives us anatomical data, it shows where the tissue and bones are," Baba says. The second type of imaging is a functional SPECT, single photon emission computed tomography, scan where scientists tag the protein plaque and figure out the area of highest buildup.

"We inject an iodine-125, a gamma emitter, labeled antibody into the mouse model and it binds to the plaque. The functional imaging shows the physiology. We see where the gamma lights up, and then that becomes our area of interest," he says.

Combining the two scans, Baba can isolate the area of activity and quantify the intensity counts of the scanned image. Wall then analyzes the mouse model's organs and counts the amount of radioactive substance in the corresponding organs. Together the scientists are working on correlating the real counts with the computer images to determine the amount of plaque deposited in the organs and to relate that to the amyloid disease. They hope to be successful in quantifying the degree of the amyloidosis disease based on this information. Eventually, scientists want to be able to analyze the human brain with a similar method.

—Ashley Yeager

Submitted by DOE's [Oak Ridge National Laboratory](#)

BERKELEYS SAUL PERLMUTTER SEEKS ANSWERS TO COSMOLOGICAL QUESTIONS

To his string of awards Saul Perlmutter of [Berkeley Lab's Physics Division](#) has added the prestigious [2006 Shaw Prize in Astronomy](#), established by Hong Kong media mogul and philanthropist Sir Run Run Shaw. Perlmutter shares the \$1 million dollar prize with Adam Riess of Johns Hopkins University and Brian Schmidt of the Australian National University.



Saul Perlmutter

Beginning in the 1980s, and despite the skepticism and resistance of top astronomers, Perlmutter and his fledgling [Supernova Cosmology Project](#) invented and perfected practical methods for finding enough superbright, remarkably uniform Type Ia supernovae to measure the expansion of the universe. By 1994 they had scrounged enough telescope time to prove they could find large numbers of "supernovae on demand."

Their success inspired competition. The High-Z Supernova Search Team, led by Shaw Prize co-winner Schmidt, with co-winner Riess as a member, joined the race for finding enough supernova "standard candles" to answer cosmological questions. The climax came in 1998, when both groups announced that the expansion of the universe is not slowing down, as everyone had expected, but is accelerating instead.

The cause has a name, dark energy, but nothing is known about it except that it accounts for three-quarters of the density of the universe. Perlmutter proposed a satellite called [SNAP, the SuperNova/ Acceleration Probe](#), to study the nature of dark energy by finding thousands of distant supernovae while simultaneously measuring galactic weak lensing, thus inspiring DOE and NASA's Joint Dark Energy Mission.

"What is true about the world no matter where, no matter when?" is the question that has fascinated Perlmutter since before he graduated in physics, magna cum laude, from Harvard in 1981 or earned his Ph.D. from UC Berkeley in 1986. He and his wife, anthropologist Laura Nelson, are taking pains to pass on the legacy of wonder to their three-year-old daughter, Noa.

Submitted by DOE's [Lawrence Berkeley National Laboratory](#)