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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

SLAC is the first to test self-contained data center

The Stanford Linear Accelerator Center's newest computing center—a standard 8-foot wide, 20-foot long shipping container—arrived by truck on July 14. SLAC is the first customer to test Sun Microsystems' largely self-contained data center, called the Blackbox Project. SLAC's box, painted white to stay cooler, contains about a million dollars of computing equipment, including 252 Sun servers. It will increase the lab's scientific computing capacity by a third without requiring a new building. Now all that remains is to plug the box into the nearby electrical substation, hook up 10-gigabit networking fibers from the Computer Building, and connect a chiller that will pump water into the box's internal cooling system.

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Microbal genome data system available to public

DOE's Joint Genome Institute has made Version 2.2 of the Integrated Microbial Genomes (IMG) data management system available to the public. The new version of IMG contains a total of 2,815 genomes consisting of 687 bacteria, 41 archaea, 24 eukaryotes, 1,661 bacterial phages, and 402 plasmids not associated with a specific microbial genome sequencing project. Among these genomes, 2,558 are finished and 257 are draft genomes. IMG 2.2 contains 227 microbial genomes sequenced at JGI, consisting of 131 finished and 96 draft genomes. IMG 2.2 also features enhanced data exploration and analysis capabilities, including extended Analysis Carts.

IMG is the result of a collaboration between the DOE JGI and Lawrence Berkeley National Laboratory.

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Sandia pilots arsenic water removal system

Casa Angelica, a home for developmentally disabled children and young adults in Albuquerque, is the site of a Sandia National Laboratories water treatment system known as "in tank filtration," designed to remove arsenic from drinking water. The DOE lab's project is an experiment to help small water systems inexpensively lower arsenic levels to meet new EPA standards. The revised regulations, which went into effect in 2006, reduce the maximum arsenic water contaminant level from 50 to 10 micrograms per liter. Sandia's "in-tank filtration" technology uses a small pump to continuously circulate stored drinking water through a small vessel containing commercially available arsenic adsorption media.

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Patented SRNL device enhances glass melter operations

A newly patented Savannah River National Laboratory invention has already proven itself highly valuable for enhancing operation of the Savannah River Site[1]s facility for immobilizing high-level radioactive waste. The Recirculation Bubbler for Glass Melter Apparatus has allowed the SRS Defense Waste Processing Facility to increase by as much as 10 percent the rate at which it converts radioactive waste to a stable glass form for permanent disposal. By circulating the hot molten glass from the bottom of the melter, the Bubbler effects more efficient melting of the waste and mixing with the glass. This enhancement could be useful for various other waste glassification applications.

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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).

Bay Area-based DOE bioenergy center announced

A partnership of three DOE national laboratories —Sandia, Lawrence Berkeley, and Lawrence Livermore — and three research universities in the San Francisco Bay Area has been chosen to host one of three national bioenergy research centers, Secretary of Energy Samuel Bodman announced recently.

The center will be funded by DOE through its Biological and Environmental Research Genomics: GTL research program in the Office of Science.

Lawrence Berkeley National Laboratory will lead the new center, which will be known as the DOE Joint BioEnergy Institute. It is expected to receive $125 million in DOE funding over its first five years.

The DOE JBEI's other partners are Lawrence Livermore National Laboratory, the University of California campuses in Berkeley and Davis, and Stanford University. Plans call for the center to be headquartered in a leased building in the East Bay area, central to all partners. Initial work will take place at the West Berkeley Biocenter in Berkeley.

Research at the institute will focus on biofuels — liquid fuels derived from the solar energy stored in plant biomass. Harnessing even a tiny fraction of the total solar energy available each year could meet most if not all of the nation's annual transportation energy needs.

Scientific studies have consistently ranked biofuels among the top candidates for meeting large-scale energy needs, particularly in the transportation sector. However, the commercial-scale production of clean, efficient, cost-effective bio-fuels will require technology-transforming scientific breakthroughs.

Researchers at the DOE JBEI intend to meet this challenge through the conversion of lignocellulosic biomass into biofuels. Lignocellulose, the most abundant organic material on the planet, is a mix of complex sugars and lignin that gives strength and structure to plant cell walls.

In addition to maintaining an Industry Partnership Program, research at the center will be guided by an Industry Advisory Board whose membership will come from key sectors, including feedstocks, enzymes, fuels production, biotechnology, genetics, and chemistry.

The other two DOE Bioenergy Research Centers are the DOE BioEnergy Research Center, led by the Oak Ridge National Laboratory in Oak Ridge, Tenn., and the DOE Great Lakes Bioenergy Research Center, led by the University of Wisconsin in Madison, Wisc., in close collaboration with Michigan State University in East Lansing, Mich.

For more information on DOE JBEI, visit www.jbei.org.

Submitted by DOE's Sandia National Laboratories

Bridging fields to understand the brain

Wynne K. Schiffer

Wynne K. Schiffer embodies the interdisciplinary tradition of DOE's Brookhaven National Laboratory: Her research in brain imaging draws on the expertise of biologists, chemists, and physicists to develop new instruments and techniques to "see" the inner workings of the brain. Her studies have led to advances in imaging technology and our understanding of human health issues such as drug addiction.

Recently, Schiffer pioneered an effort to label nanoparticles — particles measuring billionths of a meter — with positron-emitting radioactive isotopes. When attached to nanoparticles, these radioactive "tags" can be used to monitor the particles' location and concentration in real time and space inside a living organism. Schiffer and her colleagues have developed ways to manipulate the nanoparticles, generating a new family of imaging probes for use with positron emission tomography (PET), a technique that has yielded many advances in the study of human disease.

Schiffer has also used microPET imaging to relate changes in the brain directly to changes in behavior in animal models of drug abuse. In humans, exposure to environments or cues linked to drug abuse activates brain regions associated with attention, emotion, memory, and motivation. This is thought to underlie relapse. Using PET, Schiffer showed that presenting animals with a drug-associated environment produced a similar pattern of brain activation, providing evidence that links an animal model of relapse to the human condition. The work validates the use of "conditioned place preference" in animals as a model for drug-seeking behavior.

Schiffer's research draws on her undergraduate work in psychology at Colorado College and her graduate studies in neurobiology and behavior at Stony Brook University, where she earned her M.S. and Ph.D. She takes time out from her research to address a wide range of audiences — from school kids to community groups to law-enforcement officers — about the important role of nuclear medicine in diagnosing and treating diseases such as mental illness and drug abuse.

Submitted by DOE's Brookhaven National Laboratory