NETL's Christopher Matranga

Page 2

DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Blackout prevention effort launched

A new integrated data network may help the aging electrical transmission system weather the hot summer days without another massive blackout like the Eastern U.S. and Canada experienced last August 14. The Eastern Interconnection Phasor Project is now providing the first real-time, system-wide data to utilities and transmission operators within the Eastern power grid. It allows operators to see grid conditions outside of their own boundaries. Awareness of a disruption or failure occurring elsewhere in the region allows operators to take actions to potentially prevent cascading loss of power from one system to the next. DOE's Pacific Northwest National Laboratory manages the project for DOE as part of the Consortium for Electric Reliability Technology Solutions and includes utilities, system operators, vendors and power system reliability councils working together to put the integrated network in place.

[Susan Bauer, 509/375-3688; susan.bauer@pnl.gov]

Location, location, location

Scientists at DOE's Brookhaven Lab have altered the function of an enzyme simply by changing where it operates in plant cells. So instead of waiting for multiple mutations to produce a new function—a slow process scientists had thought was necessary for enzymes to evolve new functions—one simple change of an "address signal," a single mutation, changed the enzyme's product instantaneously. Such location-based enzyme function shifting could substantially expand the diversity of metabolic products available to a plant, thereby increasing its adaptability. It may also offer scientists new ways to tailor plant products, such as growing crops that make healthier oils.

[Karen McNulty Walsh, 631/344-8350; kmcnulty@bnl.gov]

Jefferson Lab detector technology aiding biomedical research

Thomas Jefferson National Accelerator Facility scientists have built a small animal medical imager that's helping researchers develop a gene therapy technique for cystic fibrosis. DOE's Jefferson Lab develops cutting-edge particle detectors to study the atomic nucleus, and those same technologies can be used in nuclear medicine to image cell function. Case Western Reserve University (CWRU) scientists are using images taken with a JLab planar gamma scintigraphy system to measure the effectiveness of a gene therapy technique they're developing to replace the defective gene that causes cystic fibrosis, a deadly disease which has no known cure.

[Kandice Carter, 757/269-7263; kcarter@jlab.org]

Argonne biologists 'illuminate' protein structures

Researchers in the Biosciences Division at DOE's Argonne National Laboratory are automating and accelerating the complex processes that coax a protein to reveal its structure so they can learn the role Nature assigned it. Argonne is working to convert data from the Human Genome Project into three-dimensional images that reveal how proteins function. This information can help prevent or cure diseases in humans. Using DOE's Advanced Photon Source at Argonne, the nation's most brilliant source of research X-rays, Argonne biologists determined and deposited in the Protein Data Bank 157 structures—as of Aug. 1, 2004—in less than four years of operation.

[Catherine Foster, 630/252-5580; cfoster@anl.gov]

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).

Diagnosing disease before symptoms

Doctors may some day be able to tell whether individuals have been exposed to a disease-causing pathogen well before they develop symptoms.

Rapid diagnosis of infection one to two days after exposure, rather than waiting days to weeks for symptoms to appear, is the aim of a new national security research initiative at DOE's Lawrence Livermore National Laboratory.

This new approach to disease detection, called "pathomics," is the focus of a multi-million dollar Livermore research effort that spans seven directorates and several disciplines.

Pathomics is, in effect, the study of the molecular basis of infectious disease. It focuses on the changes in protein levels and other molecules that occur when a body has been exposed to a pathogen.

"We don't have any technology right now to detect the presence of anthrax before you're essentially too sick to help," said project co-leader Fred Milanovich, who founded the Lab's Chemical and Biological National Security Program (CBNP) in 1996.

Pathomics was conceived in late 2001 as a strategic vision for the Laboratory's CBNP by Milanovich, current CBNP leader Pat Fitch and Ken Turteltaub, head of Biology's Biodefense Division.

Lawrence Livermore's collaborators in early disease detection research are the University of New Mexico Health Sciences Center and the Center for Biomedical Inventions at The University of Texas Southwestern Medical School at Dallas.

"The premise of pathomics is that before the onset of illness, there is a molecular indication of disease in human blood," Milanovich explained.

Faster disease detection, followed by more rapid treatment, could help save the lives of people exposed to bioterrorist agents such as anthrax and plague.

Now more than one year old, Livermore's pathomics project has been funded as a strategic initiative by the Laboratory's Directed Research and Development Program.

In their initial studies, the researchers are evaluating the baseline status of people's blood when they are healthy.

The 15-person research team is checking the blood of humans and animals to identify the thousands of components, such as nucleic acids and proteins, that constitute normal blood.

"We're examining the changes in these components, from increased or reduced concentrations to the appearance of new ones," said Turteltaub, who is also a project co-leader. Bill Colston, associate leader for Physics' Medical Physics and Biophysics Division, is the team's third project co-leader.

"It's in these changes, brought on by the presence of the pathogen, that the team believes they can find an early diagnostic tool to detect the presence of disease before you even have symptoms," Turteltaub explained.

One of the project's major challenges, according to Milanovich, is bioinfomatics—the acquisition and analysis of large amounts of biological data from diverse sources.

"We anticipate making measurements or gathering biological statistics that will generate more than 80 million different pieces of data," Milanovich noted.

Submitted by DOE's Lawrence Livermore National Laboratory

Rookie' Scientist Honored for Nanotube Research

For someone who has just begun a career with the federal government, Dr. Christopher Matranga, research scientist in the Fuels and Process Chemistry Division at DOE's National Energy Technology Laboratory, has certainly made an impressive start by studying tiny particles.

In his first year of federal service, he has captured the Pittsburgh Federal Executive Board's silver Rookie of the Year award for excellence in government.

Christopher Matranga

Dr. Matranga's work looks at novel ways of separating and storing hydrogen and carbon dioxide, both important to the Administration's energy agenda of protecting the environment while producing more energy to meet a growing demand.

Specifically, Dr. Matranga's research focuses on storing and separating gas molecules in microscopic carbon nanotubes. Dr. Matranga is particularly interested in the separation of hydrogen and carbon dioxide, both of which are products of the water-gas shift reaction.

Nanotubes have been recently shown to successfully separate liquid-phase molecules; Researchers in the Fuels and Process Chemistry Division are evaluating how well they separate gas-phase molecules. Where the gas molecules reside in the nanotube bundle is an important issue, says Dr. Matranga, because that "…will help determine whether these materials can be used for gas storage and separation."

When looking down on a nanotube sample through a special microscope, the viewer sees what looks like a group of drinking straws bundled together. Molecules can be lodged inside the pores and in the spaces between them in what is a very strong, light-weight container. Nanotubes are a cousin to the fullerene, another microscopic pure-carbon vessel with a structure that resembles a soccer ball.

A native of Houston, Texas, who graduated from the University of Chicago, Dr. Matranga has completed two years of nanotube research at NETL.

Submitted by DOE's National Energy Technology Laboratory