Tammy Taylor

Page 2

DOE Pulse

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Research Highlights . . .

New maps reveal expanded geothermal energy potential

Through DOE's GeoPowering the West activity and 30 years of experience in geothermal research, the Idaho National Engineering and Environmental Laboratory has produced first-of-their-kind geothermal resource maps. These maps show the extensive nature of geothermal energy resources that exist in 13 Western states. INEEL scientists applied GIS technology to "layer" spatial information from independent databases to show land ownership, existing geothermal resources and potential areas for residential and commercial direct use applications. This new database offers a great visual summary of resources and can be used to educate individuals, planners and businesses about locating, developing and using geothermal energy. Regional and state geothermal resource maps are online at http://geothermal.id.doe.gov/maps-software.

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Marine plankton may have a hold on modern climate

A trio of scientists including DOE's Lawrence Livermore National Laboratory climate scientist Ken Caldeira, has found that modern climate may be due, in part, to marine plankton. A computer model of atmospheric carbon dioxide found that during the Ice Age, the oceans would suck carbon dioxide from the atmosphere, promoting even colder temperatures. When marine plankton with carbonate skeletons was added to the model, ocean chemistry was buffered. As the organisms died, their carbonate skeletons dissolved on the ocean floor, helping to regulate the ocean's chemistry and atmospheric carbon dioxide, and thus, warming the Earth.

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Thar's gold in them thar genomes

Researchers led by Eddy Rubin, director of the DOE's Joint Genome Institute and Lawrence Berkeley National Laboratory's Genomics Division, have confirmed that vast regions of the human genome thought to be genetic "deserts," consisting mainly of repetitive DNA, contain nuggets of genetic gold. They compared 2.5 million bases of noncoding DNA flanking the human DACH1 gene, involved in the development of the brain, limbs and sensory organs, to similar regions in the mouse. Of a thousand common sequences, 32 were also conserved in frogs and fish. Among these were seven long-range gene enhancers, buried in the "deserts" adjoining the human DACH1 gene.

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Desert nitrates - more than we thought?

At DOE's Los Alamos National Laboratory a scientist, in collaboration with researchers from the U.S. Geological Survey, New Mexico Tech, the University of Nevada, the University of Arkansas and Desert Research Institute in Nevada, has found evidence of significantly more nitrogen—in the form of nitrates—than previously estimated in desert landscapes. The discovery of the subsoil nitrate reservoirs could raise previous estimates of nitrogen inventories in warm deserts and arid shrub lands by as much as 71 percent. The nitrate reservoirs could have implications for groundwater quality in arid/semi-arid environments worldwide as high nitrate concentrations in drinking water have been linked to a blood disease called methaemoglobinaemia, miscarriages and non-Hodgkin's lymphoma.

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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 researchers designing high-speed dedicated network

Big science requires big computers that generate vast amounts of data that must be shared efficiently, so the DOE's Office of Science has awarded Oak Ridge National Laboratory $4.5 million to design a network up to the task.

The prototype dedicated high-speed network, called the Science UltraNet, will support high-performance computing facilities at DOE and universities. The Science UltraNet will fulfill a critical need because collaborative large-scale projects typical today make it essential for scientists to transfer large amounts of data quickly. With conventional networks, that is impossible because they do not have adequate capacity and are shared by many users who compete for limited bandwidth.

"With today's networks, data generated by the terascale supernova initiative in two days would take two years to transfer to collaborators at Florida Atlantic University," said Nageswara Rao of ORNL's Computer Science and Mathematics Division.

Obviously, Rao said, that isn't acceptable, and he, Bill Wing and Tom Dunigan of ORNL's Computer Science and Mathematics Division are heading the three-year project that could revolutionize the business of transferring large amounts of data. Equally important, the new UltraNet will allow for remote computational steering, distributed collaborative visualization and remote instrument control. Remote computational steering allows scientists to control and guide computations being run on supercomputers from their offices.

"These requirements place different types of demands on the network and make this task far more challenging than if we were designing a system solely for the purpose of transferring data," Rao said. "The data transmittal requirement plus the control requirements will demand quantum leaps in the functionality of current network infrastructure and networking technologies."

A number of disciplines, including high-energy physics, climate modeling, nanotechnology, fusion energy, astrophysics and genomics will benefit from the UltraNet.

ORNL's task is to take advantage of current optical networking technologies to build a network infrastructure and develop scheduling and signaling technologies that process requests from users and optimize the system. The UltraNet will operate at 10 gigabits to 40 gigabits per second, which is about 200,000 to 800,000 times faster than the fastest dial-up connection.

The network will support the research and development of ultra-high-speed network technologies, high-performance components optimized for very large-scale scientific undertakings. Researchers will develop, test and optimize networking components and eventually make them part of Science UltraNet.

The plan is to set up a testbed network from ORNL to Atlanta, Chicago and Sunnyville, Calif.

"Eventually, what we'll have is a special-purpose network that connects DOE laboratories and collaborating universities and institutions around the country," Rao said. "And this will provide them with dedicated on-demand access to data. This has been the dream of researchers for many years."

Submitted by Oak Ridge National Laboratory

Tammy Taylor brings new energy to an old mission

Tammy Taylor

Although the nuclear threat reduction mission of DOE's Los Alamos National Laboratory is almost as old at the Laboratory itself, a spate of early career Laboratory scientists like Tammy Taylor who have joined the radiological and nuclear threat reduction effort since 9/11 are bringing with them fresh perspectives, enthusiasm and a familiar kind of dedication.

For the past 18 months, Taylor, a technical staff member in the Chemistry Division, has been cooperating with the Center for Homeland Security at Los Alamos to develop new program initiatives related to radiological and nuclear countermeasures for a variety of government agencies. Her goal has been to ferret out existing and emerging technologies for potential nuclear threat reduction and homeland security applications.

"Like a lot of my fellow Laboratory scientists," says Taylor, "I'm committed to making a difference in the world and ensuring that the excellent research that is performed at Los Alamos gets out to the people who need it where it can hopefully makes a difference."

After receiving her B.A. in Civil Engineering at New Mexico State University, and her Masters and Ph.D. in Environmental Engineering at the Georgia Institute of Technology, Taylor spent two years as a Director's Postdoctoral Fellow. After being hired as a regular staff member in 2001, Taylor could have chosen any number of career paths or research directions, but her interest in health risks mitigation led to work in support of the Laboratory's Materials Control Project that included beryllium risk assessments, safety analysis reports and research in advance beryllium detection capabilities. Taylor has also worked in support of LANL's commitment to remediating groundwater issues.

As Los Alamos continues to develop technologies to enhance global security and reduce threats from weapons of mass destruction, scientists like Taylor will help the Laboratory lead the way.

Submitted by Los Alamos National Laboratory