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Research Highlights . . .



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Uranium 'pearls' before slime

Soluble uranium is trouble. It moves easily through soil and is a groundwater-contamination threat at nuclear waste sites. Its solid chemical cousin, uranium dioxide, sticks to soil, preventing contamination from reaching streams. The microbe *Shewanella oneidensis* has interested researchers for its ability to convert soluble uranium into uranium dioxide, or uraninite. This chemical transformation was known to take place in uranium that got inside the cell, but researchers had no proof that it took place outside where the uranium resides. Researchers at DOE's [Pacific Northwest National Laboratory](#) report in the journal *PLoS Biology* that they have found 5-nanometer spheres of uraninite "pearls" outside the cell in the carpet of slime the bacterium secretes. They now hope to learn whether the uraninite spheres originated from inside the cell or were actually made outside the secretions.

[Bill Cannon, 509/375-3732,
cannon@pnl.gov]

Denver Zoo to install biomass gasification system in new exhibit

DOE's [National Renewable Energy Laboratory](#)'s work with the Denver Zoo has resulted in the design of a new, environmentally sound exhibit called Asian Tropics. NREL researchers assisted the Denver Zoo by organizing and hosting a two-day design charrette in April of 2005. During the charrette, the group discussed environmental design criteria, energy loads, strategies to reduce and manage energy demands and energy supply opportunities. An exceptional component of the exhibit will be the installation of a biomass gasification system designed to convert the zoo's solid waste materials into electricity to power the facilities. Asian Tropics is expected take about three years to build.

[Sarah Holmes Barba, 303/275-3023,
sarah_barba@nrel.gov]

Researchers forecast precision climate modeling

Climate modeling of tomorrow will feature precision and scale only imagined just a few years ago, say researchers at DOE's [Oak Ridge National Laboratory](#). The tremendous computational capabilities at the [Leadership Computing Facility](#) combined with other software tools now make it possible for researchers to create models that take into account the complete carbon cycle, terrestrial biology, El Niños and hundreds of other factors. With computing power over 50 teraflops, the climate models can be far more sophisticated. The goal is to provide what scientists call a fully integrated Earth system model that can be simulated every 15 minutes for centuries.

[Ron Walli, 865/576-0226,
wallira@ornl.gov]

MRI on the cheap and on the go

Researchers with the U.S. Department of Energy's [Lawrence Berkeley National Laboratory \(Berkeley Lab\)](#) have successfully tested a laser-based MRI technique that would make the technology compact and portable, relatively cheap, and quiet. In place of a large and expensive cryogenic magnet used in conventional MRI, the Berkeley Lab technique is based on optical atomic magnetometry. A laser beam "pumps" the atoms in a sample so that their nuclear spins are polarized, then "probes" the polarized atoms for an MRI signal. Instead of the multimillion dollar costs of conventional MRI, this alternative costs only a few thousand dollars.

[Lynn Yarris, 510/486-5375,
lyyarris@lbl.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).

First tree genome published: Poplar holds promise as renewable bioenergy

Wood from a common tree may factor prominently in meeting transportation fuel needs, according to scientists whose research on the fast-growing poplar tree is featured on the cover of the September 15 edition of the journal *Science*.

The article, highlighting the analysis of the first complete DNA sequence of a tree, the black cottonwood or *Populus trichocarpa*, lays the groundwork for the development of trees as a “feedstock” for a new generation of biofuels such as cellulosic ethanol. The research is the result of a four-year scientific and technical effort, led by DOE’s [Joint Genome Institute \(DOE JGI\)](#) and [Oak Ridge National Laboratory \(ORNL\)](#), uniting the efforts of 34 institutions from around the world.



“Biofuels are not only attractive for their potential to cut reliance on oil imports but also their reduced environmental impact,” said Dr. Gerald A. Tuskan, ORNL and DOE JGI researcher and lead author of the *SCIENCE* study. “Poplar and related plants are vital managers of atmospheric carbon, storing captured carbon dioxide in their leaves, branches, stems, and roots. This natural

process provides opportunities to improve carbon removal from the air by producing trees that effectively shuttle and store more carbon below ground in their roots and the soil. Moreover, bioenergy crops re-absorb carbon dioxide emitted when biofuels are consumed, creating a cycle that is essentially carbon neutral.”

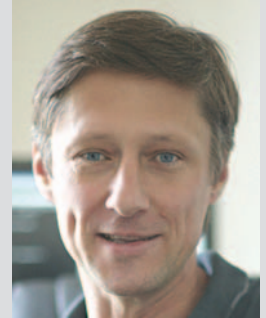
Poplar’s extraordinarily rapid growth, and its relatively compact genome size of 480 million nucleotide units, 40 times smaller than the genome of pine, are among the many features that led researchers to target poplar as a model crop for biofuels production.

Poplar is the most complex genome to be sequenced and assembled by a single public sequencing facility and only the third plant to date to have its genome completely sequenced and published.

Submitted by DOE’s [Joint Genome Institute](#)

DAGOTTO JOINS THE CONDENSED-MATTER BUZZ

The espresso maker is Elbio Dagotto’s most trusted piece of equipment when it comes to creating sparks for scientific theory. The condensed matter physicist at DOE’s [Oak Ridge National Laboratory](#) swears by the coffee machine so much that he bought several when he moved to Tennessee.



Elbio Dagotto

He needed one for home, one for the [Spallation Neutron Source](#) and one for his office at the [University of Tennessee](#). He just needed one wherever he was going to be.

“You never know where you are going to get good ideas. You could be at home, in a plane or in your office,” Dagotto, says. “But a lot of good ideas come from talking with researchers from around the world, usually informally over a cup of coffee or something.”

The future espresso breaks at the SNS excite Dagotto because he says that at least a fraction of the 2,000 users that the facility expects to host each year will share his research interests. As a condensed matter theorist, Dagotto finds himself trying to understand the properties of high-temperature superconductors, colossal magnetic resistance materials and nanomaterials. He says the new facility will not only bring beneficial collaboration for science and technology, but also intellectual expansion.

Two other ORNL facilities also interested him—the [Center for Nanophase Materials Sciences](#) and the [Center for Computational Sciences](#).

Dagotto says his work, in very simple terms, centers on simulating what electrons are doing inside different materials, but because these particles act so exotically at the atomic level, that explanation is basic. He works on computer simulations to mimic how materials self-organize, or arrange electrons in unusual patterns; why at lower temperatures materials act as superconductors; and why some materials are sensitive to magnetic fields.

As a jointly appointed researcher at ORNL and UT, Dagotto has access to many labs and scientists to satisfy his intellectual curiosity as he attempts to understand the nature of materials.—*Ashley Yeager*

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