Madhavi Martin

Research Highlights . . .

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California microbes shed light on complex world

A microbial community thriving under bizarre natural conditions in California could be a gold mine to researchers in their quest to understand the complex biological relationships and how these inner workings might apply on a grander scale. Researchers from DOE's Oak Ridge National Laboratory and the University of California Berkeley have described a bacterial community that flourishes in the iron sulfide-rich runoff of the Richmond Mine near Redding. The work is significant on a number of levels, according to the research team, which noted that while microbial communities play key roles in the Earth's bio-geochemical cycles, scientists know little about the structure and activities within these communities.

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

Earth lightens up

Earth's surface has been getting brighter for more than a decade, a reversal from a 30-year dimming trend. The brightening may accelerate warming at the surface and unmask the full effect of greenhouse warming, according to an exhaustive new study in the May 6 Science of the solar energy that reaches land. DOE's Pacific Northwest National Laboratory, working under the auspices of DOE's Atmospheric Radiation Measurement (ARM) program, contributed to the study, led by the Swiss Federal Institute of Technology in Zurich. Data analysis capabilities developed by ARM research were crucial in the discovery, revealing the planet's surface has brightened by about 4 percent the past decade after three decades of dimming of 4 to 6 percent. The report's authors can not yet attribute a cause to the cycle of surface dimming and brightening.

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

JGI announces '06 CSP Portfolio

Embedded in the language of DNA, the common link among all living things, are lessons for interpreting the complex systems that regulate the health of planet Earth. Now, rounding out this global lesson plan are more than 40 new genome projects, representing a cornucopia of life forms, from the important grain sorghum, to catfish, crustaceans, and a host of extreme lifestyle microbes, slated for DNA sequencing by DOE's Joint Genome Institute.The JGI is poised to add significantly to this total and to the scientific literature through its Community Sequencing Program (CSP). With the 2006 CSP allocation, DOE JGI will be making freely available to the greater scientific community 20 billion letters of genetic code (bases), roughly the equivalent of nearly seven human genomes of information.

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Nanotechnology provides path for greater solar cell efficiency

Researchers at DOE's National Renewable Energy Laboratory have found that tiny "nanocrystals," also known as "quantum dots," produce as many as three electrons from one high-energy photon of sunlight. This discovery may greatly increase the amount of electricity produced by solar cells. When today's photovoltaic solar cells absorb a photon of sunlight, the energy gets converted to at most one electron, and the rest is lost as heat. The recent research demonstrates the potential for solar cells that reduce wasteful heat and maximize the amount of the sun's energy converted to electricity - a key step toward making solar energy more cost-competitive with conventional power sources.

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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).

Nano-probes allow an inside look at cell nuclei

Nanotechnology may be in its infancy, but biologists may soon use it to watch the inner workings of a living cell like never before. Scientists at DOE's Lawrence Berkeley National Laboratory (Berkeley Lab) and Lawrence Livermore National Laboratory have developed a way to sneak nano-sized probes inside cell nuclei where they can track life's fundamental processes, such as DNA repair, for hours on end.

"Our work represents the first time a biologist can image long-term phenomena within the nuclei of living cells," says Fanqing Chen of Berkeley Lab's Life Sciences Division, who developed the technique with Daniele Gerion of Lawrence Livermore National Laboratory.

Their success lies in specially prepared crystalline semiconductors composed of a few hundred or thousand atoms that emit different colors of light when illuminated by a laser. Because these fluorescent probes are stable and nontoxic, they have the ability to remain in a cell's nucleus — without harming the cell or fading out — much longer than conventional fluorescent labels. This could give biologists a ringside seat to nuclear processes that span several hours or days, such as DNA replication, genomic alterations, and cell cycle control. The long-lived probes may also allow researchers to track the effectiveness of disease-fighting drugs that target these processes.

"We could determine whether a drug has arrived where it is supposed to, and if it is having the desired impact," says Chen.

The first enduring look into the secret lives of cell nuclei comes by way of a strong collaboration between biologists and chemists. For the past four years, Chen and Gerion have worked closely with members of the lab of Paul Alivisatos, a Berkeley Lab chemist in the Materials Sciences Division and Associate Laboratory Director who helped pioneer the development of nano-sized crystals of semiconductor materials. Called quantum dots, these microscopic crystals have shown promise in such wide-ranging applications as solar cells, computer design, and biology. In 1998, for example, Alivisatos developed a way to fashion inorganic nanocrystals composed of cadmium selenide and cadmium sulfide into fluorescent probes suitable for the study of living cells. This technology has been licensed to the Hayward, California-based Quantum Dot Corporation for use in biological assays.

"We took the tool Paul developed and applied it to a problem faced by biologists every day — getting inside the nucleus, a desirable target because the cell's genetic information resides there," says Chen.

Submitted by DOE's Lawrence Berkeley National Laboratory

ORNL's Madhavi Martin pushes tech into 'odd' places

Madhavi Martin

Madhavi Martin is the first to admit she is a little out of place. Although she belongs to the Environmental Sciences Division at DOE's Oak Ridge National Laboratory, she is the division's only physicist by trade.

Her role in that mostly organic organization actually speaks to the lab's increasingly interdisciplinary nature of research.

"I'm trained in doing laser spectroscopy on semiconductors, but in ESD we have been using it for purposes such as detecting contaminants in environmental situations, for example, in soil and wastewater stream pollution," Martin says. "Now we're moving into forensics."

In fact, Martin's work was recently featured in Analytical Chemistry magazine. Working with Henri Grissino-Mayer at the University of Tennessee, her laser-induced breakdown spectroscopy techniques helped tie a murder suspect to a critical piece of evidence.

Martin, a native of India, received her doctorate at the University of California, Los Angeles. It was there that she met her husband, Rodger.

"He was in nuclear engineering, and he got a job at the best place for that, which is ORNL," Martin says.

After spending some time as a postdoc, she joined him at ORNL two years later.

Martin is an advocate of furthering careers of women in science and recently participated in a poster session showcasing the research of more than 30 women scientists at ORNL representing a dozen divisions.

Her hobbies include batik printing, an Indian craft that is similar to tie-dye. She and Rodger have two children.

When at work, she spends her time applying her laser spectroscopy techniques to new uses.

"I'm kind of an oddball, using my expertise for different applications," she says. The odder the better, if that's the case.

Submitted by DOE's Oak Ridge National Laboratory