Biophysicist seeks genetic secrets.

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Major fusion issue resolved

Researchers from DOE's Sandia National Laboratories, General Atomics, and the University of California at San Diego have resolved one of many issues impeding successful magnetic confinement fusion. The team discovered a way to keep the fusion plasma from eroding divertor walls inside tokamak fusion machines. Divertor walls are the region in a tokamak where material surfaces are in direct contact with the energy-producing fusion plasma. The researchers used the DIII-D tokamak magnetic fusion machine at General Atomics in San Diego and the Divertor Materials Evaluation System (DiMES) to conduct experiments that showed erosion is eliminated during operation with detached plasmas.

[Howard Kercheval, 505/844-7842, hckerch@sandia.gov]

Mighty magnets

Researchers have discovered a way to make rare earth magnets—the kinds used in computer hard drives and motors—more powerful, durable, and inexpensive. Materials scientist Dan Branagan, of DOE's Idaho National Engineering and Environmental Laboratory, found that two important steps created significantly stronger magnets that can also withstand higher manufacturing temperatures. Branagan and his colleagues added additional elements to the formula for these high-end magnets, then formed a metallic glass during processing to create a nanocomposite structure. The extra elements form non-metallic compounds that control grain size. Branagan collaborated with researchers from Ames Laboratory and Brookhaven National Laboratory.

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Sensors will save lives on the battlefield

Many soldiers who die in battle could perhaps be saved if outfitted with a sensor system that could capture and identify noises generated within the chest. Researchers at DOE's Oak Ridge National Laboratory are developing a sensor built into a soldier's helmet that would capture and classify acoustic signals from the thoracic region and alert medics to a life-threatening condition. A significant number of wounded soldiers die from the presence of air, gas or blood in their chest. Once detected, treatment is relatively simple with the medic or corpsman placing a needle into the affected region in the chest to release the pressure.

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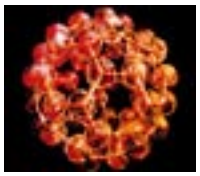
Transistors from lone buckyballs

The first transistors to be fashioned from a single "buckyball"—a molecule of carbon-60—have been reported by scientists with DOE's Lawrence Berkeley National Laboratory. By sending a large electrical current through a pair of physically connected gold electrodes, the scientists created nanometer-sized fissures between the electrodes that could accommodate the insertion of a single buckyball. This created molecular-sized electronic devices that permit only one electron at a time to move through them. Electronic devices made from individual molecules have the potential to dramatically shrink the silicon-based microelectronic systems of today.



Buckyball

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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).

From Kazakhstan: The 'good' bacteria

Scientists from the Kazakhstan Academy of Sciences' Ministry of Education and Science in Almaty are working with scientists from DOE's Oak Ridge National Laboratory and the Department of Agriculture's Agricultural Research Service to ensure the safety of our diet.

The biotechnological approach to preserving food and preventing food poisoning would work by using "good" bacteria to thwart "bad" bacteria that spoils and poisons food. It's part of the DOE's Initiatives for Proliferation Prevention program to create non-weapons-related work for scientists of the former Soviet Union.

Enjoy in good health.

"Contamination of food and drinking water by 'bad' bacteria can result in serious illness and even death, especially in children and senior citizens," says ORNL's Jonathan Woodward. "This research, guided by U.S. industry, is aimed at generating bioproducts—called probiotics—that can be used to prevent contamination of food by pathogenic, or 'bad,' bacteria."

Examples of "bad" bacteria, Woodwards says, include strains of *E. coli, Salmonella* and *Campylobacter* species.

Probiotics can be considered "good" bacteria. Scientists in Kazakhstan have identified several strains of *Lactobacillus*, or the lactic acid bacteria commonly found in yogurt, and *other* sources that can prevent the growth of the "bad" bacteria.

Probiotics—a general term for all the "good" bacteria normally in human beings' intestines—are essential in aiding normal digestion and also as a first line of defense against invading viruses, yeasts, parasites and pathogenic bacteria.

"As they help us digest our food, they secrete certain acidic end products that are lethal to unfriendly organisms but beneficial to us in normal amounts," Woodward says. "Our friendly probiotic bacteria are depleted by antibiotics we've taken, chemicals in our food or water—especially chlorine—or even by the large amounts of antibiotics and other chemicals present in meats and poultry. Until we replace the probiotic bacteria, we've left ourselves vulnerable for more yeast, viral and bacterial infections."

Probiotics could be introduced into the diet by means as simple as sprinkling them onto food. They also offer an alternative to the use of antibiotics in animal feed to ward off infectious diseases or to prevent spoilage.

"A menacing feature of disease control emerging worldwide is the mounting resistance of pathogenic microorganisms to traditional antibiotics," Woodward says. "In this cooperative project, probiotics are being identified, and also the molecular entities they synthesize, to keep pathogens at bay. This constitutes the prime project focus."

Kazakhstan scientists have accumulated a rich and so far untapped resource of microorganisms that have antibacterial properties, which could prove very valuable to food safety R&D in the United States.

Submitted by DOE's Oak Ridge National Laboratory

Los Alamos biophysicist seeks genetic secrets

Xian Chen's pursuit of research into gene function has brought accolades as one of the nation's leading young scientists in one of the world's fastest growing fields of research.

The biophysicist at DOE's Los Alamos National Laboratory is one of the initiators of Los Alamos' Biological Mass Spectrometry Program. His current research focuses on functional genomics—how genes function and interact with each other—an integral component of the Human Genome Project. Chen is involved in developing new analytical methods using biological mass spectrometry for determining gene products and their functions.

Xian Chen

Chen was recently received a Presidential Early Career Award from the National Science and Technology Council, a cabinet-level agency that coordinates federal research and development in science, technology and space. The Early Career Award the highest honor given to young scientists and engineers by the U.S. government. It recognizes those who show exceptional potential for science excellence and leadership in their respective fields. Winning researchers also receive funding for their research for five years.

Chen began his journey to Los Alamos by earning his bachelors' degree in chemistry from Peking (now Beijing) University in 1985. He received his doctorate in organic chemistry from Penn State University in 1991. Chen then worked as a postdoctoral associate at the University of Florida Medical School before being named a postdoctoral fellow at Los Alamos in November 1993.

Chen has patents pending on three new analytical techniques, including a method of stable-isotope-assisted mass spectrometry that verifies DNA sequencing data, detects genetic variations within the human genome and helps researchers identify massive gene products. He also has authored or co-authored more than 20 scientific papers.

Submitted by DOE's Los Alamos National Laboratory