



*James Hainfeld  
meets the  
heavy-metal  
demand.*

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## Research Highlights . . .



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### **Danger from arsenic in coal**

Arsenic is a trace element in coal of concern to environmental and health care professionals. In coal combustion, arsenic is both volatile and potentially toxic and research in this area can help prevent potential illness and accidents. Typically, arsenic is present in U.S. coals with a mean of 16 parts per million, although in some exceptional coals, the amount can be as high as 2,000 ppm. Research done at the Synchrotron Division of DOE's Stanford Linear Accelerator Center, in conjunction with scientists from the University of Kentucky, traced the oxidation process of arsenic in coals using x-ray absorption spectroscopy (XAFS).

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### **'Doctored up' cotton for improved healing**

Innovative methods of altering cotton gauze to enhance the healing of chronic wounds are being developed by researchers at DOE's Pacific Northwest National Laboratory, the U.S. Department of Agriculture and Virginia Commonwealth University's Medical College of Virginia Hospitals. Approximately two million Americans suffer from non-healing wounds. Studies show a link between chronic wounds and elevated levels of the enzyme elastase, which is known to degrade proteins required for tissue repair. To reduce elastase levels in cotton dressings, researchers have synthesized a peptide "recognition site" on the cotton surface that absorbs the degradative enzyme away from the wound. The modified dressings are scheduled to enter clinical trials in spring 2000.

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### **Israeli, Palestinian environment researchers collaborate**

Israeli and Palestinian environmental researchers are collaborating and sharing information through a year-old project initiated by the Cooperative Monitoring Center at DOE's Sandia National Laboratories. The cross-border collaboration brings the scientists together to study ways to help maintain shared sustainable grazing and agricultural systems important to the future of both Israel and the Palestinian Authority. Members of the team are collecting meteorological data at four ecological research sites located along a 60-mile-long ecological gradient in the northern Negev Desert. Two of the stations are in Palestinian-controlled areas of the West Bank and two are in Israel.

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### **NSTX milestone reached**

On December 14, the National Spherical Torus Experiment (NSTX) at the DOE's Princeton Plasma Physics Laboratory produced a one million ampere plasma current - a new world record for a spherical torus (ST) device. This achievement sets the stage for the Laboratory to create and study plasma conditions that are relevant to the production of fusion energy. Secretary of Energy Bill Richardson said, "I'm delighted that NSTX has met this technical milestone nine months ahead of schedule. We can now begin the scientific investigations that the machine is designed to do." NSTX began operation in February, 1999. It is studying the physics of ST plasmas. This could lead to smaller, more economical fusion power plants.

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## DOE's newest national lab: "Greener-sooner"

About 70 percent of the electricity generated in the U.S. is fueled by coal, natural gas, and oil. As promising as renewable and other alternative fuels are, several decades will be required before they approach the energy contributions of our traditional fuels.

On December 10, 1999, Energy Secretary Bill Richardson elevated the Federal Energy Technology Center, with campuses in Morgantown, W.V. and Pittsburgh, Pa., to national laboratory status as the DOE's 15th national laboratory. In naming the National Energy Technology Laboratory, Richardson noted that the two sites "have been at the forefront of advancements in fossil fuel and environmental technologies" for much of this century. The certificate of designation states that this move will "include it as a full-fledged member in the most comprehensive research system of its kind in the world, while at the same time retaining its unique government-owned, government-operated status."

Along with the designation as a national lab, the Secretary declared NETL to be the Department's Strategic Center for Natural Gas. After citing the continuing importance of natural gas as a fuel for current and future energy markets, he explained that NETL would be the center that "looks at the big picture and devises the bold ideas that allow the full potential of natural gas to be achieved".

The lab has adopted a "greener-sooner" motto—"we don't have to wait." By applying scientific advances, we can continue to improve environmental quality and reap the economic benefits of the fuels we count on most while alternative energy resources move into the market. As Energy Secretary Richardson said recently, "There is just as much opportunity for high-tech innovation in fossil fuels as there is for solar, wind, or any other energy resource".

NETL is structuring its research resources around four centers of excellence in fossil energy science. NETL's Centers of Excellence are:

**Center for Computational Energy Science:** This center will provide high performance computational modeling and simulation research into advanced energy plants. In collaboration with partners, the Center's activities will result in the eventual creation of a dynamic plant simulator for testing of advanced technologies.

**Center for Carbon Sequestration Science:** This center will provide scientific insights leading to options for the long-term stabilization of CO<sub>2</sub> and other greenhouse gases in the atmosphere.

**Center for Combustion and Gas Energy System Dynamics:** This center will work to enhance the availability of clean, low-cost energy by resolving scientific issues of natural gas-based technology for electricity generation and useful heat production, provide a scientific basis to foster the development of technologies for dispersed and central power applications, transfer 'green' technologies to military and civilian applications and resolve scientific and technical challenges associated with the natural gas infrastructure.

**Center for Ultra-Clean Fuel Science and Technology:** The center will conduct scientific research to determine the mechanisms and processes associated with fuels chemistry.

For more information on NETL, check out their Web site at [www.netl.doe.gov](http://www.netl.doe.gov) or contact Larry C. Headley, associate director of the Office of Science and Technology, 304/285-4314.

*Submitted by DOE's National Energy Technology Laboratory*

## A GOLDEN OPPORTUNITY FOR JAMES HAINFELD

When other researchers asked James Hainfeld how they could get their hands on the gold cluster molecules he'd created to label antibodies, the biophysicist at DOE's Brookhaven National Laboratory faced a dilemma: "To stop research and go into production was not really feasible," he said. So



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Hainfeld started a business to meet the demand.

Founded in 1990, the company, Nanoprobes Inc., now rents lab and office space maintained by a small-business "incubator" at the State University of New York at Stony Brook. "We have to pay, but the facilities are readily available and we have access to the libraries and other university resources," Hainfeld says.

Nanoprobes' eight employees supply researchers around the world with a variety of heavy metal cluster molecules that can be tailor-made to label proteins, peptides, oligonucleotides, small molecules and lipids. Many of the labeling molecules were first developed by Hainfeld at Brookhaven. These molecular "tags," used in conjunction with electron microscopy and other imaging techniques, help researchers diagnose disease, track the movement of drugs within cells, and decode molecular structures.

Right now, says Hainfeld, most orders are small. "The production work is labor-intensive, so the profit margin is very low. We're just breaking even." But the venture has been profitable in another way: by generating an additional base for research funding, including grants from the federal government's Small Business Innovative Research program.

And company president Hainfeld, who serves mainly as an advisor, still works full-time at Brookhaven, where he has been in the Biology Department since 1976. "We set up the company so it more or less runs itself," he says. He even had time to guest-edit September's special issue of the *Journal of Structural Biology*, which features work by Brookhaven scientists and others in the field of heavy metal cluster labeling.

*Submitted by DOE's Brookhaven National Laboratory*