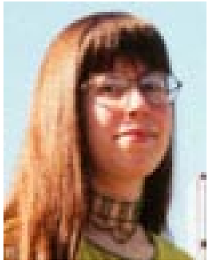

Alyssa Prinze seeks the elusive "millicharge" *Page 2.*

DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Asthma genes discovered at Berkeley Lab

Researchers at DOE's Lawrence Berkeley National Laboratory have announced the discovery of two genes that contribute to the development of asthma and could be used to help fight off asthma attacks. A team led by Dr. Edward Rubin and Derek Symula of Berkeley Lab's Life Sciences Division, working with transgenic mice (mice that carry human genes), found that even subtle changes in the activity of the interleukin genes IL4 and IL13 can reduce susceptibility to an ailment that affects more than 14 million people in the United States.

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Microdrilling, mega-savings

A microdilling techology developed at DOE's Los Alamos National Laboratory could fundamentally change the face of oil and gas exploration, a multi-billion-dollar a year global industry. The new technology allows for drilling holes up to 500 feet deep with all the equipment carried on a tandem-wheel trailer pulled by a standard pickup truck. When developed for depths to 10,000 feet, the technology will replace traditional deep drilling methods that use massive amounts of costly equipment, material and manpower, and could allow drilling deep enough to explore much of the world's potential oil and gas resources.

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NREL solar cell design achieves record efficiency

Solar cell efficiency took another step forward when scientists from DOE's National Renewable Energy Laboratory and Spectrolab constructed a photovoltaic cell that converts 32.3 percent of the sun's energy into electricity. Invented by NREL, the solar cell design was patented and transferred to Spectrolab and TECSTAR under licensing agreements last year. The record setting efficiency was achieved using a triple-junction gallium-indium-phosphide on gallium arsenide on germanium concentrator solar cell, which was grown at Spectrolab using production equipment and processed at NREL. The cells are well suited for concentrator systems that use relatively inexpensive lenses or mirrors to focus sunlight on the photovoltaics.

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Progress in gene therapy research

DOE's Lawrence Livermore National Laboratory reported an advance having the potential to improve gene therapy. Gene therapy is the introduction of new genes into the body to replace defective genes that may be causing disease. The advance involves design of a molecule that protects new genes while they are being inserted. The molecule helps conceal the genes from enzymes that otherwise would attack and destroy foreign agents in the body. The work, suggested by studies of sperm proteins that package DNA, was reported by Livermore researchers Rod Balhorn, Laurence Brewer and Michele Corzett in Science magazine.

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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).

NASA-sponsored DOE teams study the effects of cosmic rays

When the National Aeronautics & Space Administration (NASA) wants to conduct experiments on how radiation affects space travelers and their equipment, they come to the venerable Alternating Gradient Synchotron (AGS) at DOE's Brookhaven National Laboratory. The AGS is the only machine in the United States that can generate heavy ions to simulate cosmic radiation in outer space.

On November 10, NASA-sponsored researchers—including DOE teams from BNL and Lawrence Berkeley National Laboratory—began irradiating a variety of specimens, including fruit flies, worms, cultured cells from humans and mice, and DNA in solution, as well as industrial materials that may be used for space suits, space station walls and computer circuits.

Betsy Sutherland, a senior scientist from BNL's Biology Department, says, "If a person is on a Mars mission for a year, one-third of the person's nuclei in his or her cells would experience a hit by a heavy charged particle. We know we can't get rid of heavy charged particles in space, but with these experiments, we hope to understand the effects of radiation, which will pave the way for developing new countermeasures."

Taking data for NASA-sponsored radiobiology experiments at BNL are some of the researchers: (seated) Ken Frankel, LBNL; (standing, from left) Jack Miller, LBNL; Marcelo Vazquez, BNL; Betsy Sutherland, BNL; and Walter Schimmerling, NASA.

A goal of scientists working on industrial materials is to develop radiation-hardened circuits for space computers. The findings from these experiments also are expected to lead to the choice of the most radiation-resistant materials for the walls of the space shuttle and station. Future experiments may lead to the development of "smart circuits" for space computers. With a smart circuit, if one circuit received a potentially damaging hit, it would "know" to pass its function on to a backup circuit.

Teams from BNL's Medical and Biology Departments, LBNL and several private and public universities are conducting experiments now. NASA has also committed to building a permanent facility at BNL called the Booster Application Facility, an adjunct to the AGS where these experiments can be performed year-round.

Submitted by DOE's Brookhaven National Laboratory

EXPERIMENTALIST LOOKS FOR DARK MATTER

"Experimentalists want to do things that haven't been done before," says Stanford graduate student Alyssa Prinz. That's why Prinz has been doing research at DOE's Stanford Linear Accelerator Center on a project called the millicharge experiment.

Working with thesis advisor John Jaros, Prinz has been looking for subatomic particles with less than 1/1000th of an electron charge. If such particles exist, and have mass, then they may be a candidate for dark matter. Experimentalists like Prinz want to test some potentially interesting theories that allow for millicharges and are compatible with the ongoing attempt to construct a grand unified theory, the holy grail of physicists.

To search for these particles, Prinz helped design and build a millicharge detector that was then placed in a pit 20 feet below ground, about 100 yards behind the target used by SLAC's two-mile linear accelerator to make and collect positrons for other experiments. Computerized counting machines were set up in a nearby trailer to collect data, which were then analyzed.

Prinz presented her results in a talk at the American Physical Society and she published a paper in Physical Review Letters. A millicharged particle was not found in these experiments. "I'll write up the findings for my dissertation anyhow. Even a null response is important since it helps other scientists determine where not to go," says Prinz, who hopes to finish her doctorate in early 2000. The traditional path after graduation is to take on a post-doctoral assignment at another lab. She expresses some concern about funding in high-energy physics and the availability for jobs for soon-to-be post docs like herself. "While I would love to stay in particle physics, the Bay Area is a great place for other things like bio-tech and computing. I feel like I have lots of choices."

Submitted by DOE's Stanford Linear Accelerator Center