*Ames Lab's Surya Mallapragada*

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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# Research Highlights . . .

## Blocking the path to infection

*Brookhaven's Huilin Li is studying adhesive proteins' role in infections.*

How do you stop a urinary tract infection from taking hold? One approach might be to block a "door" found on the surface of E. coli bacteria that is used to secrete an adhesive protein. The sticky protein helps the bugs bind to human kidney cells in the early stages of infection. Researchers at DOE's Brookhaven Lab recently deciphered the structure of the "door," a membrane channel protein. The structure shows that the channel plays an active role in assembling the adhesive and guiding it out of the cell, which suggests that several steps could be targeted to block secretion – and infection.

*[Karen McNulty Walsh, 631/344-8350; kmcnulty@bnl.gov]*

## Neutron structure result puzzles scientists

To further understand the structure of the neutron, researchers have measured the neutron's generalized spin polarizabilities for the first time at DOE's Jefferson Lab. These are fundamental properties of protons and neutrons (nucleons) that characterize how the spin of the quarks inside nucleons changes in response to an electromagnetic field. The physicists found that the neutron spin response was much weaker than theoretical calculations suggested. Theorists are refining their calculations of the quantities to gain an improved understanding of both neutron structure and Quantum Chromodynamics - the theory that describes the force responsible for nucleon structure.

*[Kandice Carter, 757/269-7263; kcarter@jlab.org]*

## Nanomaterials in the marketplace

Built with particles just a few atoms across and measured in the billionths of a meter, nanomaterials are coming to the marketplace using technology developed at DOE's Argonne National Laboratory. The first, Nanophase Technologies Corp., was founded in the 1980s with an Argonne nanoproduction technology. Production of materials has increased from grams to tons, and costs are low enough that the materials are used in dozens of products. Advanced Diamond Technologies recently licensed the rights to Argonne's ultrananocrystalline diamond patents and is developing protective coatings for mechanical shaft seals used in many industries, as well as for biomedical implants and biosensors.

*[Catherine Foster, 630/252-5580; cfoster@anl.gov]*

## Chemical movies capture corrosion's mysterious beginnings

Corrosion costs the U.S. about $275 billion each year and indiscriminately destroys structures from breweries to nuclear waste tanks. Corrosion eats away at scientists, too, because details of the formation and growth of its damaging craters is still puzzling. Researchers at DOE's Idaho National Engineering and Environmental Laboratory have developed a new microscope that creates "chemical movies" of corrosion. Scientists can zoom in to follow new pits as they deepen or heal themselves and watch years' worth of damage in a single day. INEEL researchers are using the device to study metals that may end up enclosing spent nuclear fuel for more than 10,000 years.

*[Regina Nuzzo, 208/526-3176; nuzzrl@inel.gov]*

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# El Paso police, Sandia work together on high-tech law enforcement

"El Paso Crime Scene Investigations" may not have the glitter of "CSI: Miami," but it has some technology and an approach to technology that many in law enforcement very much admire. Through the help of the Border Research and Technology Center (BRTC) — operated by DOE's Sandia National Laboratories from offices in San Diego — and some strong local initiative, that department in a city of 600,000 citizens is providing national leadership.

"In the area of teleforensics, the El Paso Police Department is the pathfinding agency," says Sandia's Chris Aldridge, who is BRTC director. Aldridge and the center, with National Institute of Justice funding, helped the El Paso department get started with some equipment in 1999. From there, Commander Michael Czerwinsky and his team have taken the project to new levels.

*El Paso Police tech up*

"Our old equipment was bulky, hard to hide, costly, and expensive to maintain," says Sgt. Darwin Armitage, who worked with Sandia's Richard Sparks to put the so-called "Investigators Toolkit" into use. "The new equipment had all the pieces — time-and-date stamps, recording units, cameras, transmitters; and everything was off the shelf," he said.

The vice team put the equipment to work with a bang. In its first test, a detective transmitted a conversation at a bar with a tiny camera hidden in a pager, while Armitage sat in the lobby nearby and watched and recorded the entire transaction for evidence using a briefcase full of equipment, including a small monitor.

Subsequently, the resulting improved evidentiary tapes drastically curtailed (by about 50 percent) the number of vice cases going to court, generating instead an increase in plea bargain cases. "This had a direct impact on our operations," says Czerwinsky. "From there things just snowballed."

For Aldridge, the BRTC is a way to work with a multitude of law enforcement and legal agencies to strengthen technology capabilities and awareness. The BRTC is part of the National Law Enforcement and Corrections Technology Center system, a program of the research and development arm of the Department of Justice. The work in El Paso is a success story for the effort.

***Submitted by DOE's Sandia National Laboratories***

# Ames Lab researcher taking cues from Mother Nature

*Mallapragada*

Bioinspired polymers intrigue Ames Laboratory chemist Surya Mallapragada. In the past couple of years, she's lectured at conferences all over this country and abroad on her research into self-assembling block copolymers. She's also looked at using polymers as a drug delivery system and as a means to promote nerve regeneration. So it's no wonder that she's literally writing the book on the subject, editing the Handbook of Biodegradable Polymeric Materials and their Applications, due out early next year.

"It's extremely important to learn from nature," says Mallapragada, who recently took over as director of the newly renamed Materials Chemistry and Biomolecular Materials program within DOE's Ames Laboratory. "Through collaborative study, we hope to create a new body of knowledge, both experimental and theoretical, to answer several important questions at the intersection of materials, nanotechnology and biology and use those answers to design new bioinspired materials."

Mallapragada, who is also an associate professor of chemical engineering at Iowa State University, developed an interest in chemistry from her father, who bought her chemistry sets as a child so they could do the experiments together. She turned that interest and a love of math into a chemical engineering degree at Bombay's Indian Institute of Technology, then left her native India to pursue a Ph.D. at Purdue University.

In 2002, she was named by MIT's Technology Review as one of the "Top 100 Young Innovators" and won a Global Indus Technovators Award in 2003.

Her affiliation with Ames Laboratory began as an associate with a biomedical grant. Subsequently, she worked on other projects supported by Basic Energy Sciences and eventually took on leadership of the renamed research program.

"The name change reflects DOE's commitment to the field of biomolecular research," Mallapragada says, "and hopefully we can build on the strong nucleus of research that was already taking place here to make significant strides in this new, expanding area."

***Submitted by DOE's Ames Laboratory***