NETL's David Tucker

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Research Highlights . . .

DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

Number 233 April 23, 2007

Combination Lyme disease vaccine proteins

Scientists at DOE's Brookhaven Lab and Stony Brook University have genetically engineered "chimeric" proteins that combine pieces of two proteins normally present on the surface of the bacterium that causes Lyme disease, but at different parts of the organism's life cycle. Combining pieces of these two proteins into a single protein could advance the development of a more effective vaccine against Lyme disease, the most common vector-borne disease in the U.S. The chimeric proteins could also be used as diagnostic reagents that distinguish disease-causing strains of bacteria from relatively harmless ones, as well as in assays that help assess the severity of an infection.

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

International collaboration enhances weapons detector

An international collaboration between DOE's Idaho National Laboratory, Russia and General Electric has led to the development of powerful sensors that will enhance the capabilities of the INL-developed concealed weapons detector. The detector uses 16 passive magnetic sensors to replicate the Earth's ambient magnetic field. As contraband items pass through the field, they are rapidly detected and their location is pinpointed on a computer monitor. The concealed weapons detector has been installed nationwide in courthouses, federal buildings and high schools. The sensors were developed through the DOE's Global Initiatives for Proliferation Prevention program which provides the opportunity for foreign Cold War-era weapons scientists to use their science background and knowledge to work on important peaceful, nonmilitary projects.

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Flexible electronics

Flexible electronic structures with the potential to bend, expand and manipulate electronic devices are being developed by researchers at Argonne National Laboratory and the University of Illinois at Urbana-Champaign. These flexible structures could find useful applications as electronic devices that can be integrated into artificial muscles or biological tissues. The flexible electronics are also important for energy technology as flexible and accurate sensors for hydrogen. The concept focuses on forming single-crystalline semiconductor nanoribbons in stretchable geometrical configurations with emphasis on the materials and surface chemistries used in their fabrication and the mechanics of their response to applied strains.

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MiniBooNE results resolve long-standing neutrino question

Scientists of the MiniBooNE neutrino experiment at DOE's Fermilab have resolved a key question raised by observations from the Liquid Scintillator Neutrino Detector at DOE's Los Alamos Lab in the 1990s, which appeared to contradict findings of other neutrino experiments worldwide. MiniBooNE researchers showed conclusively that the LSND results could not be due to simple neutrino oscillation, a phenomenon in which one type of neutrino transforms into another type and back again. The announcement of MiniBooNE's first result, from data collected from 2002 through December 2005, significantly clarifies the overall picture of how neutrinos behave.

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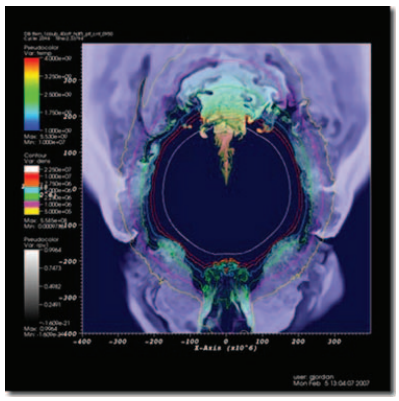
DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***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).

Supercomputing's stellar role in simulation

Lawrence Livermore National Laboratory's supercomputing expertise has helped University of Chicago scientists take an important step toward revealing the secrets of dark energy by blowing up a white dwarf star in a three dimensional simulation of unprecedented detail.



The 3D simulation was conducted by a team at the University of Chicago's Center for Astrophysical Thermonuclear Flashes (Flash Center) with the assistance of Laboratory computer scientists with the National Nuclear Security Administration's (NNSA) Advanced Simulation and Computing (ASC) Program.

The simulations were run on high performance computers at DOE's Lawrence Livermore and Lawrence Berkeley national laboratories. The Chicago team reported that just one of the jobs ran for 75 hours on 768 computer processors for a total of 58,000 processor hours.

Significant computing resources and funding was provided principally by NNSA's ASC Academic Strategic Alliance Program with support from the DOE Office of Science's Innovative and Novel Computation Impact on Theory and Experiment program.

"This exciting scientific and computing achievement dramatically illustrates the importance of multidisciplinary teamwork within and across institutions in making breakthrough science possible," said Dona Crawford, LLNL's associate director for Computation.

Understanding the physics of thermonuclear burn, such as that in supernovae, is of great interest to NNSA scientists responsible for ensuring the safety, security and reliability of the nation's nuclear stockpile in the absence of underground nuclear testing. NNSA supports science relevant to its national security missions through academic alliances, notably in the area of computation.

ASC's Academic Alliance Program has established centers for advancing simulation science at Caltech, Stanford University, the University of Illinois Champaign/Urbana, and Utah in addition to the University of Chicago.

Submitted by DOE's Lawrence Livermore National Laboratory

Adventurous NETL researcher likes exploring

David Tucker's life plays like an Indiana Jones movie: world travel, adventures, narrow escapes. Toss in quiet, multilingual chemistry professor turned researcher at DOE's National Energy Technology Laboratory, and the "Indy" Jones picture is complete.

David Tucker

Tucker's circuitous path winds through his California birthplace and growing-up years in Washington and Alaska, meanders through Alabama long enough to complete a doctorate in physical chemistry at the University of Alabama and teach a while at the University of West Alabama, and eventually arrives at NETL in 2001. Tucker is heavily involved in the Hybrid Performance Project, an Office of Research and Development effort to study fuel cell turbine hybrids.

The soft-spoken scientist has traveled to Africa 15 or 16 times, as well as through Europe, learning Swahili, Lingala, French, and Arabic along the way. He has studied Spanish, too, but confessed he's not fluent.

Tucker earned his pilot's license at age 20 and then flew some friends to Africa, where they planned to open a gold and diamond mining business. War broke out and the friends took commercial flights home, leaving Tucker to recover from malaria, regain his strength, and fly the plane out of Africa.

"I like exploring," Tucker explained. "I like using the scientific method to study the world." His adventuresome spirit and deep interest in his work animated Tucker as he described the apparatus he and his colleagues have built. "I am discovering things nobody else knows," Tucker said. "That's what keeps me interested in my work."

An educator at heart—years earlier he had considered joining the Jesuits, the Catholic Church's teaching order—he prefers hands-on work and mentoring graduate students at NETL as they pursue their careers.

Tucker and his wife, Helen, are the parents of a six-year-old daughter and a two-year-old son. They are expecting their third child in August.

Submitted by DOE's National Energy Technology Laboratory