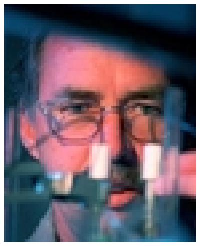

Redden gets down to earth.

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Brain-imaging study offers clues to inhalant abuse

Inspired by schoolchildren who wanted to know more about "huffing" (inhalant abuse), scientists at DOE's Brookhaven National Laboratory have produced the first positron emission tomography images showing where toluene, a commonly inhaled solvent, goes in the brain and body. The PET scans in experimental animals show that toluene moves into the brain rapidly, initially affecting the same areas as cocaine and other abused drugs, and then spreads to the entire brain before clearing the body via the kidneys. This affinity for brain regions associated with reward and pleasure, as well as the quick uptake and clearance, may help to explain why inhalants are so commonly abused.

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

Largest database is larger still

The world's largest database has gotten even bigger. In March, a database at DOE's Stanford Linear Accelerator Center reached an astonishing 500,000 Gigabytes, a milestone in data storage. Printed out, that's enough information to fill nearly 1 billion books. The database stores information from a SLAC project called BaBar, which studies subatomic particle collisions. Scientists from SLAC and the Lawrence Berkeley National Laboratory build the database using object oriented database. It took the scientists two years to customize, but today the database can add more than 1,000 GigaBytes of information every day. It will continue collecting data until 2010.

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Detecting upward bound muon marks a MINOS first

On March 26, 2002, the MINOS detector saw its first upward-going muon, which was traveling through the earth after being generated by cosmic rays in the atmosphere. The MINOS collaboration at DOE's Fermilab is building the detector a half-mile underground in a former iron mine in Soudan, Minnesota. When MINOS begins operations in 2004, it will detect neutrinos sent to Minnesota from the Fermilab Main Injector. The unfinished detector proved it could already find a needle-the track of an upward-going muon-in a haystack of about 10,000 tracks of muons moving downward from the sky.

[Mike Perricone, 630/840-5678, mikep@fnal.gov]

With membranes, hydrogen may replace gasoline

If hydrogen fuel cells are ever to replace gasoline engines in cars, they will need a cheap source of high-purity hydrogen - and technology from DOE's Argonne National Laboratory could provide one. Argonne researchers have developed a ceramic membrane that can extract hydrogen from methane, the chief component of natural gas. The membranes are made of a composite of iron, oxygen, cobalt and strontium, so dense that only electrons and individual ions can pass through it, which is why membranes can produce such pure hydrogen. Ceramic membranes could be a key development in DOE's "Vision 21" program, which seeks to develop efficient power technologies that discharge no pollutants.

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

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).

Fermilab, Iowa schools team up for science

Corn and soybeans top Iowa's list of homegrown commodities, but physicists from the University of Iowa and Iowa State University represent a solid investment in Hawkeye State futures.

Group from Iowa University

At the DOE's Fermilab, graduate students from the University of Iowa are working on data from the SELEX (Segmented Large X baryon Spectrometer) fixed target experiment, studying charm baryons. The Iowa group is also a strong contributor in silicon systems, working on development of radiation-hardened pixel detectors for BTeV (B physics at the Tevatron) and other experiments at Fermilab, and for CERN, the European Particle Physics Laboratory in Switzerland. When the pixel detectors were placed in the test beam, Charles Newsom, professor of physics and astronomy, said the Iowa group wrote an analysis so quickly after information was released by the data acquisition system, "it almost seemed like an online analysis program."

The Iowa group is also working on something called "fuzzy carbon," a material for use in close proximity with the colliding beam.

"We've been at the forefront of this development, and it's a lot of fun," said Newsom.

Group from Iowa State University

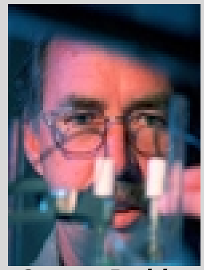
Iowa State University's German Valencia and Fabrizzio Gabbiani are working in theoretical physics at Fermilab, researching CP violation in baryon systems and b-meson systems. Valencia recently published an article in the Particle Data Group's Review of Particle Physics. David Atwood has contributed a section to The Higgs Hunters' Guide (J.F. Gunion, et al., published by Addison Wesley, Reading, Mass.).

A the DZero collider detector, John Krane is co-convener of the collaboration's QCD (quantum chromodynamics) group, and spoke at a recent calorimeter conference at Cal Tech. John Hauptman, professor of physics and astronomy, is spending an entire year working on the DZero collaboration and shepherding his own group of students, including some from the Korea University. Hauptman has also worked closely with QuarkNet, the program coordinated by Fermilab's Education Office for mentoring high school students and teachers, giving them first-hand experience with experiments at Fermilab, SLAC at Stanford University and CERN in Europe.

Submitted by DOE's Fermi National Accelerator Laboratory

A DOWN-TO-EARTH SCIENTIST

One of the first scientists hired for DOE's Idaho National Engineering and Environmental Laboratory's Subsurface Science Initiative uses engineering, chemistry and some creative thinking to get under the earth's skin.



George Redden

George Redden hopes to plumb the depths of the subsurface using small synthetic particles into the groundwater, or taking advantage of particles that are already there. With a background in engineering, oceanography and chemistry, the INEEL subsurface scientist studies how particles, called colloids, can be used to better understand the complex nature of underground environments and potentially serve us in treating subsurface contaminant.

Colloids are small particles that mix the properties of a solid and something that is dissolved. One important property of a colloid is that it can stay suspended in groundwater without settling out due to gravity. Fine clay particles in murky water is one example. The other intriguing aspect of colloids is that their solid-phase properties change as they get smaller, and generally become much more reactive toward chemicals they encounter.

Since they can stay suspended underground, colloids will move with the subsurface water. They can pick up dissolved materials, drop off what they pick up, or stick to other surfaces. "Many scientists think colloids might help explain why underground pollutants move further than we predict. In some cases, the colloids themselves might be the pollutant in solid form, while in others the pollutant is hitching a ride," said Redden.

In the future, Redden envisions finding innovative ways to send colloids into contaminated soil carrying molecules that can break down pollutants—like sending a drug through the bloodstream to cure diseased tissue. In fact, this idea is already starting to be put into limited practice. Scientists could also use colloids to remove, immobilize or degrade things in the soil, such as metals, radionuclides or organic solvents.

Submitted by DOE's Idaho National Engineering and Environmental Laboratory