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PNNL research could ease pain for many, page 2

Research Highlights . . .

These "seashells" not sold at the seashore

A technique to produce thin, tough, seashell-like coatings that may prove useful for applications including automotive finishes and protecting implements and optical lenses has been announced by researchers at DOE's Sandia National Laboratories and the University of New Mexico (UNM). The rapid, efficient method of assembling diverse materials into coatings that mimic seashell structures as disclosed by Sandia researchers Jeff Brinker and Alan Sellinger and two UNM students in a July 16 Nature article. The coatings—laminations of alternating layers of flexible, cushioning biopolymers and hard calcium carbonate—are about twice as hard as the same materials mixed randomly and are crack resistant.

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Chemical Treatments for Environmental Remediation

Experiments at the DOE's Stanford Linear Accelerator Center Synchrotron Division are pointing the DOE to new directions in environmental remediation of uranium contaminated sites. Soil can act as a filter by adsorbing uranium-contaminated groundwater, a process in which particles cling to the soil surfaces. But the adsorption process is reversible, and in time the loaded soil could become the source of contamination. Knowledge about the adsorption process can help assess present and future risk at contaminated sites. With such information, researchers can design cost efficient chemical treatments to remove or immobilize uranium at the subsurface of contaminated sites.

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Dark matter

An international team from four continents, including researchers from DOE's Lawrence Livermore National Laboratory, has reported a possible solution to the problem of "dark matter" in our Milky Way Galaxy — the unseen material astronomers have spent decades searching for. Interpreting observations made at Australia's Mt. Stromlo Observatory, Dr. Charles Alcock of Livermore reported that the dark matter appears to be in small, unlit stars, whimsically called MACHOs, that are too far away to been seen by ordinary means. He noted that dark matter remains a topic of lively debate, however, with other scientific groups continue pursuing alternative explanations.

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Ames Lab technology to fight cancer

Scientists at DOE's Ames Laboratory may have found a way to take cancer down for the count. Capillary Electrophoresis-Fluorescence Line-Narrowing Spectroscopy (CE-FLNS) unites two established analytical methods, CE and FLNS, to quickly and accurately analyze the structure of molecular compounds, including the potent and cancer-causing polycyclic aromatic compounds. A 1998 R&D 100 award-winner, CE-FLNS may one day help scientists assess an individual's risk of getting cancer from chemical pollutants that damage cellular DNA. Besides packing a promising "one-two" punch against cancer, CE-FLNS has potential applications in other areas of biological research and forensics.

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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).

INEEL-developed technology benefits mankind

David Dahl's influence stretches to the far reaches of the solar system. Three instruments now hurtling toward Saturn aboard the spacecraft Cassini will analyze cosmic dust and the atmosphere of Titan, Saturn's largest moon. Dahl's award-winning ion motion simulation program, SIMION for the PC, helped design the instruments. Here on Earth, machines designed in part by SIMION analyze environmental contaminants, decode DNA, and test urine for illegal drugs. Moreover, SIMION has been used to analyze components used in semiconductor manufacturing, indirectly improving the very computers it runs on.

"It's kind of pervasive," said Dahl, a LMITCO consulting engineer/scientist in the Chemical and Biological Sciences Department of DOE's Idaho National Engineering and Environmental Laboratory.

Recognizing that "The application of SIMION has been invaluable to the design of mass spectrometers (the kinds of machines that SIMION simulates) for the last decade," the American Society for Mass Spectrometry awarded him its 1998 Award for a Distinguished Contribution in Mass Spectrometry.

Users say SIMION's beauty lies in its intuitiveness. The program makes ions coursing through electromagnetic fields as easy to visualize as golf balls rolling across a putting green. The simulated ions mimic real ions inside a mass spectrometer. Mystery ions, whether in cosmic dust, environmental contaminant samples, or a drug user's bodily fluids, can be identified by mass spectrometers based on how the particles move through the machine.

Dahl likes to think of SIMION as an "enabling technology." Because the program is so user-friendly and intuitive, people can design instruments creatively and explore options they may not have conceived of without SIMION's help. "This represents exactly the kind of thing a national lab ought to be doing," he said, "producing, developing and vigorously proliferating technology so that the maximum number of people will benefit from the taxpayer's investment."

Submitted by DOE's Idaho National Engineering and Environmental Laboratory

Scientist makes impact one hip at a time

The greatest discoveries often begin with the most fundamental questions—how and why.

Allison Campbell, now a scientist at DOE's Pacific Northwest National Laboratory, asked one of those simple questions more than 10 years ago in her doctorate thesis: how do surfaces within the body, such as bones, control the formation of minerals? By understanding the science behind calcification—the hardening of calcium salts into such things as kidney stones and dental plaque—Campbell believed she could simulate the process for new medical applications.

In 1992, as a new staff member at Pacific Northwest, Campbell began applying what she learned about calcification. She developed Surface Induced Mineralization, a method of depositing a calcium phosphate coating on the surfaces of implants. This coating stimulates growth of new bone cells, therefore grasping the implant more solidly and increasing its longevity.

This technology could ease the pain of hip implant patients who must return for a new implant after just 10 years. "As baby boomers grow older, more and more people will need implants," Campbell said. "They won't want to keep going back for more reconstruction."

"It's our hope that we can help create an implant that only needs to be inserted once," she adds. "Not only could it reduce the pain and suffering for people, this process could relieve the strain on the health care system." DOE's Office of Basic Energy Science funded the research. The project has served as a foundation for similar studies in how this bioactive coating could be used in dental implants and for bone reconstruction. Campbell leads Pacific Northwest's efforts in its Biomaterials Science and Engineering Laboratory.

"Our work is rewarding because it has the potential to directly affect the quality of a person's life," she said.

Submitted by DOE's Pacific Northwest National Laboratory