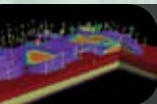


T2 INSIDE



Sandia's Diamond-like Films
Onboard NASA

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PNNL
Subsurface
Modeling

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Measuring the
Urban Forest

6

T2 EVENTS

NBIA's 23rd International
Conference on Business
Incubation
Kansas City, Mo.
April 19-22, 2009

•
FLC National Meeting
Charlotte, N.C.
May 4-7, 2009

•
Bio International 2009
Atlanta, Ga.
May 18-21, 2009

•
Photovoltaics Summit 2009
San Francisco, Calif.
June 1-3, 2009

•
FLC Mid-Atlantic
Regional Meeting
Gettysburg, Pa.
September 15-17, 2009

T2 FACT

Thomas Jennings, born in 1791, is believed to have been the first Black inventor to receive a patent for an invention. He was 30 years old when he was granted a patent for a dry cleaning process. Jennings was a free tradesman and operated a dry cleaning business in New York City. His income went mostly to his abolitionist activities. In 1831, he became assistant secretary for the First Annual Convention of the People of Color in Philadelphia, Pa.

- Mary Bellis, *About.com*

NELC NEWSLINK

March 2009

The Newsletter of the National Laboratory Consortium for Technology Transfer



From left, Phil Fresquez, Rhonda Robinson, Louis Naranjo, and Sherri Sherwood pull their nets from the water during this year's fish sample collection at Abiquiu Reservoir. This year, Fresquez and his team sampled lakes and rivers in an attempt to determine the source and migration of potential contaminants.

LOS ALAMOS KEEPS AN EYE ON THE ENVIRONMENT: *Monitoring Birds, Bees, Flowers, Trees ... and More*

by Ed Vigil, *Los Alamos National Laboratory*

Los Alamos National Laboratory (LANL) researcher Phil Fresquez's work often keeps him and his team out in the wild and down on the farm. Fresquez, of the Environmental Data and Analysis group, has been at LANL for nearly two decades. During those years, he and coworkers have kept a close eye on the northern New Mexico region, making sure

LANL remains a good neighbor and steward of the environment.

"I've been pretty much in the same environmental group that I joined when I was a post doc," said Fresquez. "What we do as part of the Environmental Surveillance Program is monitor the air, water, soil, foodstuffs, and biota, or animal and plant life of a particular region or

habitat, within and around the Laboratory. Our main objective is to determine whether laboratory operations are impacting human health and the environment."

Fresquez and other environmental researchers at LANL compile the data and information collected from the research,

See Eye on Environment, page 4

LONG-SOUGHT PROTEIN STRUCTURE MAY HELP REVEAL HOW "GENE SWITCH" WORKS

The bacterium behind one of mankind's deadliest scourges, tuberculosis, is helping researchers at the Commerce Department's National Institute of Standards and Technology (NIST) and the Department of Energy's Brookhaven National Laboratory (BNL) move closer to answering the decades-old question of what controls the switching on and off of genes that carry out all of life's functions.

In a recent *Journal of Biological Chemistry* the NIST/BNL team reports that it has defined—for the first time—the structure of a "metabolic switch" found inside most types of bacteria—the cyclic AMP (cAMP) receptor protein, or CRP—in its "off" state. CRP is the "binding site" (attachment point) for cAMP, a small molecule that, once attached, serves as the signal to throw the switch. This "on" state of CRP then turns on the genes that help a microbe survive in a human host.

See Gene Switch, page 4

NASA STENNIS PARTNERS WITH MISSISSIPPI FOR GEOSPATIAL TECH INDUSTRY CLUSTER

The NASA John C. Stennis Space Center (SSC) Innovative Partnerships Program (IPP) Office (and its predecessors) has worked in partnership with the Mississippi Enterprise for Technology, Inc. (MsET), a 501(c) 3 company, since its establishment in 1994 in supporting

See Stennis, page 5

FED LABS FLASH | NEWS FROM AROUND THE CONSORTIUM

NASA AND CALIFORNIA INSTITUTE OF TECHNOLOGY TEST STEEP-TERRAIN ROVER

Engineers from NASA's Jet Propulsion Laboratory (JPL) and students at the California Institute of Technology (Caltech) have designed and tested a versatile, low-mass robot that can rappel off cliffs, travel nimbly over steep and rocky terrain, and explore deep craters.

This prototype rover, called Axel, might help future robotic spacecraft better explore and investigate foreign worlds such as Mars. On Earth, Axel might assist with search-and-rescue operations.

"Axel extends our ability to explore terrains that we haven't been able to explore in the past, such as deep craters with vertically sloped promontories," said Axel's principal investigator, Issa A.D. Nesnas, of JPL's robotics and mobility section. "Also, because Axel is relatively low-mass, a mission may carry a number of Axel rovers. That would give us the opportunity to be

more aggressive with the terrain we would explore, while keeping the overall risk manageable."

The simple and elegant design of Axel, which can operate both upside down and right side up, uses only three motors: one to control each of its two wheels and a third to control a lever.

The lever contains a scoop to gather lunar or planetary material for scientists to study, and it also adjusts the robot's two stereo cameras, which can tilt 360 degrees.

Axel's cylindrical body has computing and wireless communications capabilities and an inertial sensor to operate autonomously. It also sports a tether that Axel can unreel to descend from a larger lander, rover or anchor point.

The rover can use different wheel types, from large foldable wheels to inflatable ones, which help the rover tolerate a hard landing and handle rocky terrain.

Nesnas co-leads the project with

Joel Burdick, a mechanical and bioengineering professor at Caltech, who supervises a handful of Caltech graduate and undergraduate students working on the rover system. Last fall, the JPL-Caltech team demonstrated Axel at the annual Smithsonian Folklife Festival in Washington, which showcased NASA for the agency's 50th anniversary.

"Collaboration with Caltech has been key to the success of this project," Nesnas said. "The students contributed significantly to the design of the tethered Axel. Their creative work enabled us to analyze, design and build new wheels, sampling tools and software. The students also played a key role in field-testing this robot. Without them, we would not have been able to accomplish such goals, given our limited resources."

JPL began developing Axel in 1999. The Axel project was funded through NASA's Exploration System Mission Directorate. Caltech manages JPL for NASA.

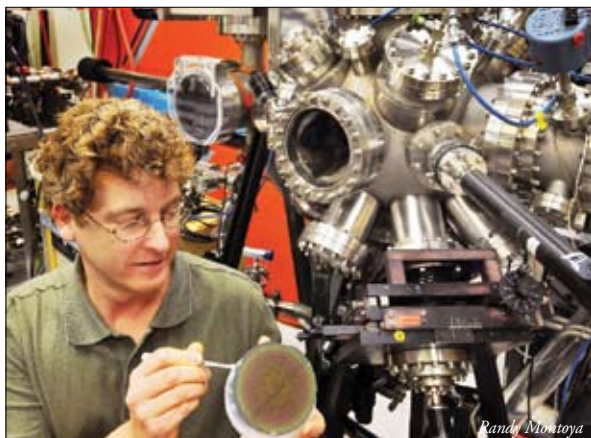
WU AND LIU AWARDED AFOSR GRANT FOR MEDIA FORENSICS

Institute for Systems Research (ISR)-affiliated Associate Professor Min Wu is the co-principal investigator (PI) for a three-year grant from the Air Force Office of Scientific Research (AFOSR) for theories and algorithms to perform nonintrusive forensic analysis on multimedia devices and digital content. Former ISR faculty member K.J. Ray Liu is the other PI.

As multimedia devices and digital content have become ubiquitous, a critical issue that must be addressed next is to ensure that content, devices, and intellectual property are being used by authorized users for legitimate purposes, and to be able to forensically prove with high confidence when the case is otherwise.

The faculty will exploit intrinsic fingerprints, which are inherent traces left by various processing steps when media data goes through acquisition devices and processing systems. The goal of this research effort is to develop a holistic forensic framework to gather traces of evidence and answer who has done what, when, where, and how.

SANDIA'S DIAMOND-LIKE FILMS ONBOARD NASA SATELLITE



Tom Friedmann checks out a sample diamond-like carbon film he created for the low-energy sensor (IBEX-Lo) onboard NASA's *Interstellar Boundary Explorer* (IBEX).

Diamond-like carbon films created at Sandia National Laboratories (SNL) are helping probe the far boundaries of the solar system as part of a NASA mission to study how the sun's solar wind interacts with the interstellar medium—the matter that exists between the stars within a galaxy.

The films are in the low-energy sensor (IBEX-Lo) onboard NASA's *Interstellar Boundary Explorer* (IBEX), which lifted off in October on a mission to study the farthest fringes of the solar system. IBEX's two bucket-sized sensors, covering high and low energy ranges, are designed to capture particles bouncing back toward Earth from the distant boundary between the hot wind from the sun and the cold wall of interstellar space.

The active conversion surface of the low-energy neutral atom detector is coated with SNL's diamond-like films created by Tom Friedmann.

"The primary purpose of the diamond-like carbon films is to provide a surface that will 'efficiently' ionize energetic neutral atoms," Friedmann said, "so they can then be detected. Smooth surfaces are required so that the scattered particles can be efficiently collected. If the surface is rough, scattered particles are lost, decreasing efficiency. The diamond-like carbon films have an average surface roughness that is about one angstrom. This is less than the diameter of a carbon atom."

Eric Hertzberg, from the Lockheed Martin Advanced Technology Center, approached Friedmann to create the films. Hertzberg is the lead engineer for the IBEX-Lo sensor. Bob Nemanich, Arizona State University, also played a key role in passivating the films. Friedmann said that SNL uses similar films in studies of electron field emission and in microelectromechanical systems (MEMS) devices.

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FLC Communications Co-Chairs:

Al Jordan & Sara Miller

Layout & Design: Tom Grayson

Copy Editor: Denise Bickmore

Staff Contributor: Lauren Pafumi

Subscriptions: tgrayson@utrs.com

Article submissions: tgrayson@utrs.com

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FLC Headquarters

1001 Connecticut Ave., NW, Suite 735
Washington, DC 20036
202-296-7201

FLC NewsLink

950 North Kings Highway, Suite 208
Cherry Hill, NJ 08034
856-667-7727 856-667-8009 fax
www.federallabs.org

TECH WATCH | LABORATORY TECHS READY FOR TRANSFER

NIH CANCER TREATMENT

National Institute of Allergy and Infectious Diseases inventors David Dorward, Vinod Nair, and Elizabeth Fischer have developed an advanced process for microwave-assisted freeze substitution of biological and biomedical samples (MWFS). Freeze substitution fixation (FS) of hydrated samples frozen in vitreous ice provides exceptional preservation of structure for light and electron microscopy, and enables immunological detection of thermo-labile antigens that otherwise are damaged/destroyed by processing at ambient or elevated temperatures.

Its use as a research tool or in clinical pathology has, however, been limited by the relatively lengthy periods required for passive diffusion of fixatives and organic solvents into the frozen hydrated material.

The invention utilizes controlled microwave (MW) irradiation to accelerate the FS process, and comprises systems, devices and methods for microwave-assisted processing of samples under cryo-conditions. The entire MWFS procedure has been accomplished in less than 4 hours as compared to the approximately 2-5 days required for FS.

Applications

- Provides superior preservation and rapid turnaround in research and high throughput clinical laboratory settings
- Applicable to a broad range of biological samples, hydrogels, and other hydrated materials
- Processing for light and electron microscopy
- Low-temperature synthetic and analytical chemistry

Licensing Contact: R.C. Tang, JD, LLM; 301-435-5031; tangrc@mail.nih.gov

PASSIVE COOLING SYSTEM FOR A VEHICLE

National Renewable Energy Laboratory (NREL) researchers Terry Joseph Hendricks and Thomas Thoensen have developed a passive cooling system for a vehicle that transfers heat from an overheated internal component, for example, an instrument panel, to an external portion of the vehicle, for example, a side body panel. The passive cooling system includes one or more heat pipes having an evaporator section embedded in the overheated internal component and a condenser section at the external portion of the vehicle. The evaporator and condenser sections are in fluid communication. The passive cooling system may also include a thermally conductive film for thermally connecting the evaporator sections of the heat pipes.

More info: Richard Bolin, 303-275-3028

PNNL SUBSURFACE MODELING

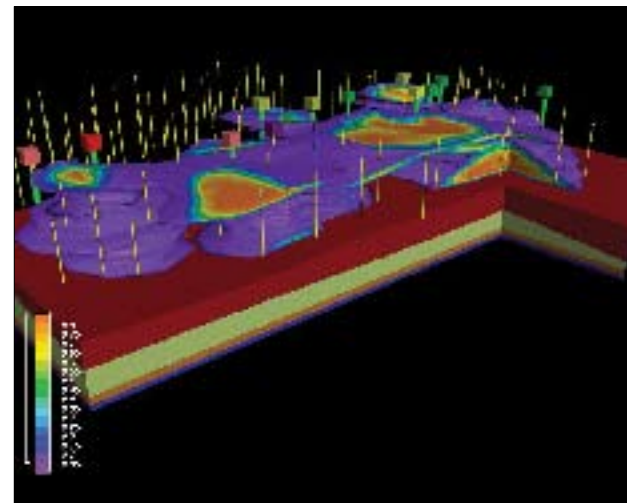
A software tool developed at Pacific Northwest National Laboratory (PNNL) over the past 16 years provides multidimensional modeling of subsurface flow and reactive transport phenomena for a growing list of applications of importance to the nation. STOMP—short for subsurface transport over multiple phases—was originally designed to support environmental remediation of subsurfaces contaminated with hazardous materials; it is now expanding into the energy field.

For example, scientists are applying the tool to better understand the performance and environmental impact of geologic sequestration of carbon dioxide and in-situ production of oil shales.

Further, STOMP is one of the few numerical simulators in the world capable of investigating the production of natural gas hydrates from geologic formations.

Scientists and engineers from various disciplines have used STOMP in their subsurface analyses, exploiting its ability to save time and reduce costs by efficiently providing critical information.

For example, the use of STOMP provided more effective recovery strategies for petroleum contaminants at the Brooklawn and Scenic sites near Baton Rouge,



Investigating pumping strategies for DNAPL recovery at the Brooklawn site, near Baton Rouge, Louisiana

Louisiana.

Advantages

- Experimentally verified and supported modeling of dense and light nonaqueous phase liquids (DNAPLs and LNAPLs)
- Unique capabilities for exploring innovative CO₂ exchange technologies for production of natural gas hydrates

More info: <http://availabletechnologies.pnl.gov/>





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Eye on Environment, from page 1

which is reported in the laboratory's annual Environmental Surveillance Report. That information provides a snapshot of possible impacts to human health and the environment and what trends may be at play. The data is looking very favorable as LANL continues working to mitigate its impact on the environment.

In addition to the Lab, oversight agencies, and area stakeholders, the information is shared with a broad audience.

"It is important that we share our data with local and regional peers, but it's also of value to an international audience, particularly those who are interested in how radionuclides move through the environment," said Fresquez.

One key audience interested in the information collected by Fresquez and his peers is the New Mexico Environment Department Oversight Bureau. "Our program is monitored by state and federal agencies, who have a stake in making sure that the environment is protected," said Fresquez.

Oftentimes, Fresquez and his colleagues are called upon to present their findings to various stakeholders, including area pueblos, the Northern New Mexico Citizens Advisory Board, environmental activists, and others interested in environmental issues.

To gather the data that LANL needs for environmental monitoring, Fresquez and his team go to great lengths to collect and analyze samples from different sources. One year, they may focus on soil and biota sampling, looking for contaminants from the lab and other sources. The next year, they may focus on foodstuffs like crops, goat milk, honey, elk, and deer. "We pay particular attention to the Lab's impact

on the human food chain," continued Fresquez. "The Laboratory and the surrounding region are home to a wide variety of domestic and wild foodstuffs. Elk and deer, for example, may graze through areas on Laboratory lands or drink from water catchments that may contain radioactive or chemical contamination," said Fresquez.

This year, Fresquez and his team sampled lakes and rivers in an attempt to determine the source and migration of potential contaminants. The researchers sampled trout, bass, pike, walleye, and bottom feeders, such as suckers, catfish and carp, from the region's Abiquiu and Cochiti reservoirs. In addition, fish were collected from the Rio Grande downstream of the laboratory at major canyon confluences.

"We are particularly interested in the bottom feeders," said Fresquez, "because most contaminants like radionuclides and organics bind with the sediments at the bottom. These fish tend to ingest the sediment along with their food source."

Contaminants that Fresquez and his coworkers look for in soil, foodstuffs, and biota include radionuclides, such as tritium and plutonium; heavy metals, such as beryllium and mercury; high explosives; and PCBs, or polychlorinated biphenyls. According to Fresquez, they also look for things that have a history of use at LANL and that are considered a hazard to the environment.

Because of Fresquez and his team's efforts, the data are looking very favorable as LANL continues working to mitigate its impact on the environment.

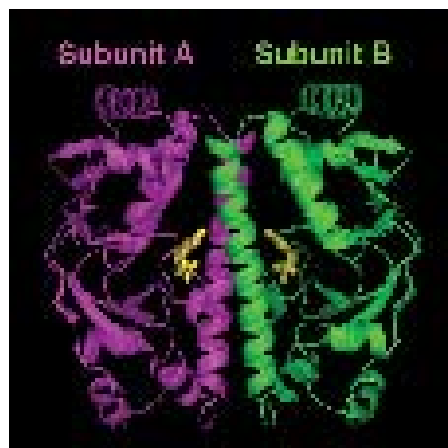
To that end, Fresquez and his colleagues will continue to till gardens, put out nets, and sift through soils, keeping an eye on nature.

Gene switch, from page 1

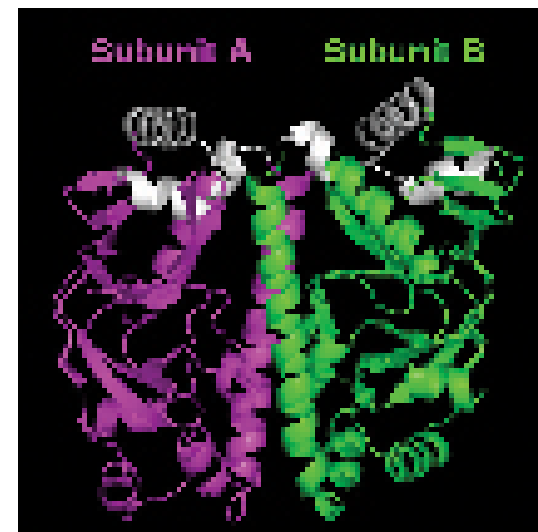
The researchers hope that once the switching mechanism is understood, the data can be used to develop new methods for preventing tuberculosis and other pathogenic bacterial diseases.

"We know that many pathogenic bacteria use cAMP as a signal for activating genes that keep the microbes thriving in adverse conditions, and therefore, remaining virulent," said NIST biochemist and lead author Travis Gallagher. "Blocking these processes might provide ways to shut down infections and save lives." Additionally, the researchers believe that learning how this specific protein switch works may provide insight into how genes in general are regulated.

The biochemical puzzle surrounding the CRP switch is the mechanism by which the protein binds cAMP at one end, then attaches to—and activates—a gene (DNA) at the other end. Believing that the protein somehow changes its overall shape after binding cAMP, researchers set out 25 years ago to study the structure of CRP in both its active



Computer model of the predicted structure for the "on" state of the cyclic AMP receptor protein (CRP) found in *Mycobacterium tuberculosis*. After binding cyclic AMP molecules (the yellow bodies in the center), the CRP is believed to change its structure so that the two subunits (colored purple on left and green on right) become symmetrical (identical in shape). It is this state of the CRP that binds a gene (DNA) and activate it to carry out functions necessary for the microbe's survival.



Computer model of the defined structure for the "off" state of the cyclic AMP receptor protein (CRP) found in *Mycobacterium tuberculosis*. The two subunits of the protein (colored purple on the left and green on the right) are genetically identical, but surprisingly were found to be asymmetric (different in shape) for the areas shown in white (top). This is the state of the CRP that is unable to activate genes necessary for the microbe's survival.

(with cAMP bound to it) and inactive states (without bound cAMP) to document where the morphing occurs.

Unfortunately, the task proved to be extremely difficult. Using CRP from the bacterium *Escherichia coli*, researchers were able to crystallize the protein in its active ("on") state and examine the structure using a technique called X-ray diffraction. However, the structure of the inactive ("off") *E. coli* CRP eluded them as attempts to crystallize it repeatedly failed. With only the structure of the "on" state defined, the genetic switching mechanism remained a mystery.

The breakthrough was achieved when Gallagher; NIST colleagues Prasad Reddy, Natasha Smith and Sook-Kyung Kim; and BNL's Howard Robinson substituted the CRP from *Mycobacterium tuberculosis* [the pathogen that causes tuberculosis] for the *E. coli* protein.

The team's initial success—obtaining crystals of CRP in the "off" state—was dramatic given that no one had accomplished the feat in nearly three decades of trying with *E. coli*. But the real excitement came when the crystals were examined with X-ray

See *Gene Switch*, page 8

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www.federallabs.org/meetings



Stennis, from page 1

technology maturation and technology transfer and application for economic development in Mississippi. SSC's partnership with MsET is based on a series of Space Act Agreements (SAA) between SSC and the State of Mississippi (for which MsET serves as its designated agent at SSC).

The SAAs have served as a basis from which a number of funded partnership activities have resulted, including a technology-based business incubator.

In 1998, SSC also joined with the State of Mississippi and the University of Mississippi to initiate and implement the Mississippi Space Commerce Initiative (MSCI), which created a statewide geospatial industry cluster focusing on remote sensing (RS) and geographic information system (GIS) technologies. By 2000, this initiative had grown to include RS and GIS application activities at all of the state universities and junior colleges, and had established a collaboration with MsET to form a geomatics industry cluster at SSC in its incubator.

The university and college projects sponsored through MSCI have resulted in more robust RS and GIS training experiences and curriculum improvements for college students, leading to additional and enhanced degree programs ranging from an A.S. through the Ph.D. level statewide.

These efforts have led to an increased and better skilled geo-technology workforce available in the state, which has enabled these companies to diversify and expand their services and product base.

SSC's IPP Office has provided workshops and other opportunities over the years for these MSCI and MsET geo-technology based companies to further develop their capabilities through a number of NASA programs.

Several companies have received NASA Small Business Innovative Research (SBIR) contracts (e.g., WorldWinds, Inc.; Diamond Data, Inc.; and NVision Solutions, Inc.) or NASA dual use awards (DataStar, Inc. and NVision). Due to SSC being a "federal city," with many other federal and state agencies co-located with NASA, the MSCI and MsET member companies have also been able to diversify their capabilities and successfully



compete for similar awards from the other SSC resident agencies.

NASA/SSC still has a relationship with MsET and, as an example, in light of recent Hurricane Katrina impacts to the area is presently supporting the development of geo-technology-based emergency management and decision support efforts.

Today, all four of the major Mississippi public universities support extensive ongoing RS and GIS projects involving millions of dollars of research or services annually. In addition, some 30 small commercial enterprises routinely perform novel cost-effective services for farmers, coastal operators, city/county governments, security operations, news organizations and others.

In 2007 the Enterprise for Innovative Geospatial Solutions (EIGS), formerly MSCI, reported (in addition to state university employment in the geo-technology areas) that the Mississippi geospatial industry included more than 30 companies and employed more than 680 people with investments of \$52 million and revenues of \$77 million.

For more information, see "Mississippi's Geospatial Cluster Excels in 2007 with Economic Growth, Collaborations, and Awards" at <http://www.eigs.olemiss.edu/newsroom/releases/071219-eigs.htm>.



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LAB IN THE SPOTLIGHT: NATIONAL ENERGY TECHNOLOGY LABORATORY

The National Energy Technology Laboratory (NETL) is one of the Department of Energy's (DOE) national laboratories. NETL manages and conducts research, development, and demonstration (RD&D) to:

- Enhance America's energy security
- Improve the environmental acceptability of energy production and use
- Increase the competitiveness and reliability of U.S. energy systems
- Ensure a robust U.S. energy future.

NETL is the only government-owned/government-operated national lab dedicated to energy RD&D from domestic energy resources. In addition to its diverse energy research and development expertise, NETL is experienced in contract and project management, analysis of energy systems, and international energy issues. NETL has research centers in Morgantown, West Virginia; Pittsburgh, Pennsylvania; and Albany, Oregon. External work is augmented by onsite research in the areas of computational and basic sciences, energy system dynamics, geological and environmental systems, and materials science. Together, these efforts focus a wealth of scientific and engineering talent on creating commercially viable solutions to national energy and environmental problems. NETL's primary thrusts are:

- Leading efforts to make today's coal power plants cleaner and to enable tomorrow's systems to perform with near-zero emissions.
- Advancing cost-effective technologies for finding and producing domestic fossil resources while meeting environmental requirements.
- Working on cost-effective ways to derive hydrogen from domestic coal, biomass and natural gas, and to utilize fuel cells for power generation.
- Providing a portfolio of technology options for capturing, sequestering, and monitoring greenhouse gases.
- Supporting DOE's Office of Energy Efficiency and Renewable Energy in managing research to make more efficient use of energy in buildings, transportation, and industry, and to accelerate renewable energy options.

NETL's current emphasis is leading the U.S. effort in carbon management—capturing and storing carbon dioxide (CO₂) to prevent its emission into the atmosphere, where it contributes to global climate change. DOE's carbon capture and storage (CCS) RD&D objectives are 1) reducing the cost and energy penalty associated with CO₂ capture from power plants; and 2) improving the understanding of factors affecting CO₂ storage permanence, capacity, and safety in geologic formations. Carbon management begins with the capture of CO₂ from power plants and other stationary CO₂ sources. At present, this process is costly and energy-intensive. However, NETL analysis shows the potential for cost reductions of no more than 10-percent increase in the cost of

See NETL, page 8

I-TREE: MEASURING THE URBAN FOREST



UFORE, developed by the U.S. Forest Service, is one of the main programs in the i-Tree suite. UFORE (Urban Forest Effects Model) uses field data to estimate the economic and ecosystem service impacts of trees in a neighborhood, city, county, or state.

The U.S. Forest Service has developed a set of free and easy-to-use software programs and protocols (together called i-Tree) that help urban foresters measure and understand their forest resources.

Used separately or together, the programs and tools in i-Tree can aid urban forest planning, management and budgeting, and allow comparisons between the urban forest resources in different communities or cities.

UFORE (which stands for Urban Forest Effects model) is one of the main programs in the i-Tree suite. UFORE uses field data to estimate the economic and ecosystem service impacts of trees in a neighborhood, city, county, or state. It utilizes standardized data collection protocol to gather on-the-ground information. For small study areas, all trees can be sampled, but it is more common to sample randomly located tenth-acre (0.1 acre) plots spread across a study area of any size. Field crews visit each plot and record canopy cover, land use, ground cover, and a range of measurements for trees and shrubs in the plot. The UFORE

modeling program uses these data to describe the structure of the urban forest, including estimated tree species counts and composition, diameter size class distribution, diversity, and canopy cover. UFORE also estimates the urban forest's net impacts on energy use, carbon storage, and air pollution using scientifically derived and tested equations.

STRATUM (Street Tree Management Tool for Urban Forest Managers) is a similar inventory and analysis tool that focuses on street trees and tree management issues. Like UFORE, STRATUM can use existing or newly sampled data to describe the structure and composition of the street tree population. STRATUM also analyzes the trees' environmental benefits and contrasts these benefits with maintenance costs.

Three other simpler programs are also available in i-Tree. The Mobile Community Tree Inventory (MCTI) software helps users produce a basic inventory and analysis of local forest resources. The Storm Damage Assessment Protocol offers simple and efficient methods for collect-

ing tree damage information after a severe weather event. Finally, a new stand-alone Species Selector Utility helps users decide which tree species to plant based on desired environmental effects like stormwater management, wind protection, or air pollutant removal.

A range of support tools is available to i-Tree users. A software program is available to generate randomly located plots for UFORE and STRATUM. Another support tool facilitates data entry directly into handheld personal data assistants (PDAs) for UFORE, STRATUM, and MCTI. Contact information for real person support is available on the website, and there is a forum that invites users to share ideas and experiences or seek solutions to common data collection or analysis problems. The new i-Tree Bug Reporting and Tracking System, also available on the website, collects user feedback for the software developers to help them improve future versions of the programs.

More information and order forms for free copies of the i-Tree program are available at www.itreetools.org.



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NIH CANCER TREATMENT

Detecting cancer prior to metastasis greatly increases the efficacy of treatment and the chances of patient survival. Although numerous biomarkers have been reported to identify aggressive tumor types and predict prognosis, each biomarker is specific for a particular type of cancer, and no universal marker that can predict metastasis in a number of cancers has been identified. In addition, due to a lack of reliability, several markers are typically required to determine the prognosis and course of therapy. National Institutes of Health (NIH) inventors, led by Y. Peng Loh, discovered a novel CPE splice variant designated CPE-ΔN and found that its expression levels increase according to the presence of cancer and metastasis wherein this variant is upregulated in tumors and further increased in metastatic cancer.

More info: Jennifer Wong, 301-435-4633, wongje@mail.nih.gov

DIAMOND COATINGS

Lawrence Livermore National Laboratory (LLNL) researchers have been able to create amorphous diamond coatings and free-standing films with significantly reduced intrinsic stress, while allowing manipulation of the hardness, toughness, adhesion, and wear resistance. Amorphous diamond, or hydrogen-free diamond-like carbon (DLC), is a form of carbon that can be characterized as extremely hard, chemically inert, optically transparent, low friction and a semiconductor. LLNL has used the process for real-world applications.

More info: Randall Elder, 925-422-9914, elder3@llnl.gov

PRODUCING H₂

The United States uses nine million tons of hydrogen annually. There are several drivers for the high cost of hydrogen, including the cost of production as well as compression and/or liquefaction required to increase the density of hydrogen to the point that it can be economically transported.

Idaho National Laboratory (INL) researchers have developed a method and apparatus to generate pressurized hydrogen using water and a variety of carbon-rich compounds.

The purpose of the invention is to provide hydrogen in a format that is usable and affordable for virtually any application.

More info: David R. Anderson, 208-526-0837

O₂ LINE CLEANING

The Oxygen Line-Cleaning Unit, developed and patented by the Naval Air Warfare Center Aircraft Division, Patuxent River (NAWCADPAX), was showcased at the annual World's Best Technologies, held in Arlington, Texas, March 26-27, 2008. This portable, inexpensive, and easy-to-use apparatus and method for cleaning aircraft oxygen conduits also can be used for marine and medical applications where there is a need to convey oxygen or hydraulic fluids. Additionally, the new process allows the user to meet EPA requirements by eliminating the use of the Class I ozone depleting substance CFC-113 "freon" solvent. The oxygen technology keeps conduits free of contamination or foreign substance buildup that results from normal use, malfunction, or poor/improper maintenance. The Navy is seeking a partner in industry or academia to work with its scientists to prototype an oxygen line-cleaning unit.

More info: Paul Fritz, 301-342-5586

BIOMARKERS

Researchers at Pacific Northwest National Laboratory (PNNL) have discovered a new method for potentially predicting the onset of type 1 diabetes with more consistency. Until now, the best method for predicting who will develop this disease has been through the identification of three specific autoantibodies produced by the human body against the pancreas, the organ that produces insulin. Now researchers have identified a specific set of proteins, together or as individuals, that may provide the same early precursor information.

More info: Lisa Teske, 509-372-6850, 509-375-2631, lisa.teske@pnl.gov

EARLY DIAGNOSIS OF DIABETES

Researchers at Pacific Northwest National Laboratory (PNNL) have applied advanced proteomics methods to identify potential new biomarkers of pre-diabetes and type 2 diabetes mellitus, both of which are characterized by high blood glucose and are associated with obesity. The new biomarkers may result in a more accurate test for both disorders.

The current gold standard for diagnosing pre-diabetes and type 2 diabetes is the oral glucose tolerance test (OGTT), which is used to determine patients' blood glucose levels before and after glucose intake. However, the OGTT is inconvenient, requires fasting, and is not highly reproducible. With more development, scientists believe that the biomarkers identified in this work may hold the key to earlier detection of pre-diabetes and type 2 diabetes. Advantages include improved accuracy in diagnosing pre-diabetes and type 2 diabetes.

More info: ron.thomas@pnl.gov

TRACKING DEVICES

Scientists at the National Institute of Standards and Technology (NIST) have developed software that improves the accuracy of tracking devices in its immersive, or virtual, research environment by at least 700 percent. The software can be used by scientists in other immersive environments, with slight modifications for their individual laboratories. This advance is a step forward in transforming immersive technology that has traditionally been a qualitative tool into a scientific instrument with which precision measurements can be made. Using these devices, the researcher can walk around and interact with the virtual world.

More info: Evelyn Brown, evelyn.brown@nist.gov, 301-975-5661

CESIUM EXTRACTION

Idaho National Laboratory (INL) has developed a method for co-extraction of cesium and strontium from acidic solutions using a mixture of commercially available crown ether and calixarene extractants that exhibit high radiation and chemical stability. This is an efficient solvent extraction process for the simultaneous removal of cesium and strontium from dissolved spent nuclear fuel and acidic nuclear waste streams. Combined use of these two extractants in one process represents a novel approach to partitioning these elements. Simultaneous solvent extraction of these radioactive elements is desirable for waste management concerns because the process provides purified cesium and strontium in a form easily concentrated or solidified, high levels of decontamination, high removal factors and a simplified chemical scheme.

More info: Gary W. Smith, 208-526-3780

Gene switch, from page 4

diffraction.

“Although the M. tuberculosis protein in the ‘off’ state consists of two subunits that are genetically identical, we were surprised to see that the subunits were not structurally symmetrical as well,” Gallagher said. “In most two-subunit proteins, each subunit has the same conformation as the other.”

Gallagher says that the NIST/BNL team theorizes that it is the asymmetry in the absence of cAMP that prevents the protein from attaching to DNA. This, in turn, keeps CRP from activating genes when they are not needed.

“Our next step is to crystallize M. tuberculosis CRP in the active state and define its structure,” Gallagher said. “When that is accomplished, we’ll be able to see the identical protein from the same organism in both states, which may give us the means to explain how CRP switches from its asymmetric form [inactive state] to its symmetrical [active state] form.”

The work detailed in the *Journal of Biological Chemistry* paper was performed at the University of Maryland Biotechnology Institute’s (UMBI) Center for Advanced Research in Biotechnology (CARB), a partnership among UMBI, NIST and Montgomery County, Md., that advances biotechnology by integrating chemical, physical and biomolecular sciences through research on biomolecular structure and function, systems biology and biometrology, and the development of new technologies for measurement, analysis and design.

NETL, from page 5

electricity for pre-combustion systems and 35 percent for post-combustion and oxy-combustion systems while capturing at least 90 percent of CO₂ in the process or effluent stream. Post-combustion capture can be used to retrofit existing plants by capturing CO₂ from flue gas streams or burning coal with oxygen to isolate the CO₂.

Pre-combustion capture will be used in next-generation power plants using gasification.

In gasifiers, CO₂ is more highly concentrated and at higher pressure, making capture easier.

Onsite and collaborative R&D efforts are exploring novel approaches to improve efficiency and reduce costs of CO₂ capture. Once captured, the CO₂ must be transported by pipeline to the geologic sequestration site.

NETL is working with industry in seven Regional Carbon Sequestration Partnerships that consist of over 350 unique organizations in over 42 states to determine the best ways to accomplish sequestration in various geologic formations and geographical areas.

In addition to experimental research, NETL’s scientists are

developing computer simulations of gasification processes and the workings of entire power plants, using two *R&D 100* award-winning computing technologies. Insights obtained from these simulations are being used to drive developments in CO₂ capture.

To verify that the sequestered CO₂ is not leaking into the atmosphere, NETL has developed an R&D 100 Award-winning technology called SEQUIRE™ to monitor sequestration sites.

NETL is committed to developing new energy technologies and carbon management into low cost, realistic solutions to our energy security and global climate change challenges.



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