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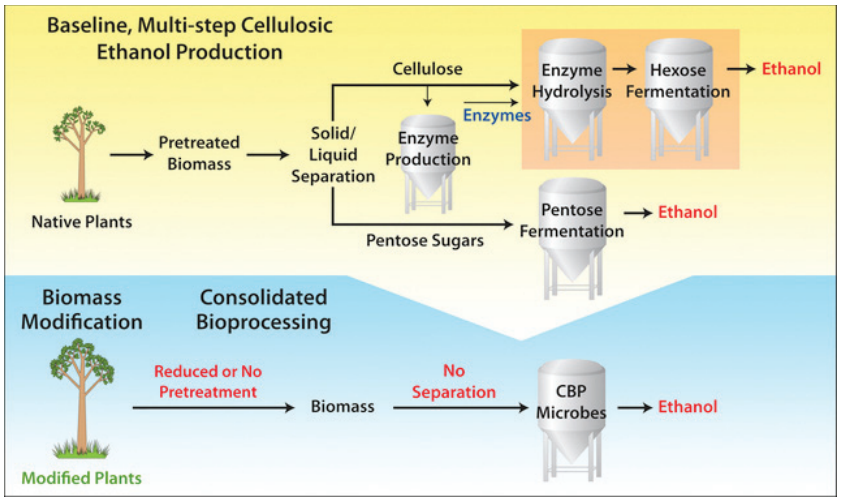
BESC microbe clears way for isobutanol production



U.S. Department of Energy Secretary Steven Chu has publicly praised BioEnergy Science Center (BESC) researchers for developing a strain of a native cellulose-degrading microbe that for the first time converted plant matter directly into isobutanol – a fuel with a heat value higher than ethanol and similar to gasoline.

"This is a perfect example of the promising opportunity we have to create a major new industry based on bio-material such as wheat and rice straw, corn stover, lumber wastes, and plants specifically developed for biofuel production that require far less fertilizer and other energy inputs," Chu posted on a DOE blog in March.

ORNL Biosciences Division's Yongchao Li and Yunfeng Yang were members of the team, which was led by James Liao from the University of California at Los Angeles. "In nature, no microorganisms have been identified that possess all of the characteristics necessary for the ideal consolidated bioprocessing strain, so we knew we had to genetically engineer a strain for this purpose," Yongchao said. While there were many possible microbial candidates, the research team ultimately chose Clostridium cellulolyticum, which was originally isolated from decayed grass.

Application of the microbe reveals across-the-board savings opportunities in processing costs and time. Isobutanol is miscible with gasoline and it has properties closer to gasoline and thus may be more compatible with tanks and pipelines than ethanol. In addition, isobutanol may possibly be used in current engines without modifications, although EPA regulations currently limit its content in gasoline to about 11%.

Research results have been published in a paper entitled "Metabolic Engineering of Clostridium cellulolyticum for Isobutanol Production from Cellulose" that is available online at http://aem.asm.org/. This work was supported in part by BESC at ORNL and the UCLA-DOE Institute for Genomics and Proteomics.

ORNL hosts Cummins Inc.

More than 80 technical experts from Cummins Inc. spent a day with ORNL experts in May. Representing nine countries, the visitors toured facilities on campus and at NTRC to learn about new research and development activities and explore future partnership opportunities. ORNL-Cummins collaborations date back several decades and have produced a wealth of technological developments and commercial applications that are making an impact on today's transportation. Cummins is a global corporation of complementary business units that design, manufacture, distribute, and service engines and related technologies, including fuel systems, controls, air handling, filtration, emission solutions, and electrical power generation systems. Headquartered in Indiana, Cummins serves customers in approximately 190 countries.

Inside this issue

In the spotlight…..pg 2
Iris recognition……pg 5
Fish tale…….pg 9

In the spotlight

Meet Ben Preston, a senior research scientist studying the societal impacts of climate change and the role of adaptation in reducing climate risk. His research involves the development of empirical and process models as well as the application of geographic analysis tools to estimate climate impacts and, in particular, characterize the many interactions between climatic and socioeconomic change.

Ben's interest in environmental science originated from a simple curiosity regarding how humans influence their environment and, subsequently, the role that public policy plays in mediating that influence. He notes that while science has become increasingly important to informing policy, there is often a divide between the two that he likes to help bridge.

"I've built a career around working at the science/policy interface, which necessitates an understanding of science and the valuable role that it can play in facilitating decision-making and an appreciation for the fact that very few decisions are made based upon science alone."

As leader of the Impacts, Adaptation, and Vulnerability Analysis research theme within the Climate Change Science Institute (CCSI), Ben believes CCSI is a conduit through which a much broader range of ORNL's science and technology R&D can be directed toward understanding climate change, its consequences, and solutions.

"I have high hopes for CCSI becoming the leader in demonstrating how high-quality science can be harnessed to generate knowledge, products, and tools that have practical utility for those who ultimately will manage the risks posed by climate change."

A native of Atlanta, Ben received a BS in biology from the College of William and Mary and a PhD in environmental biology from the Georgia Institute of Techology, where he also minored in public policy. He subsequently worked as a postdoctoral fellow with the Carolina Environmental Program

Ben Preston

at the University of North Carolina-Chapel Hill where he developed his interest in applications of geographic information systems to investigate spatial and temporal relationships among environmental pressures and outcomes. His interest in making science relevant to decision-making then drove him to Washington, D.C., where he worked as a senior research fellow at the Pew Center on Global Change. Prior to joining ORNL in 2010, Ben spent five years working as a research scientist in Australia with the Commonwealth Scientific and Industrial Research Organization.

Fuel tax evasion field tests successful

Members of the Fuel Tax Evasion team traveled to the Transportation Research Center in East Liberty, OH, in April to conduct vehicle-based proof-of-concept testing on hardware, software, and systems to detect fuel tax evasion for the Federal Highway Administration (FHWA). The testing was conducted using a Pilot Travel Center's tanker tractor-trailer, a fuel marker dye studied and selected by ORNL, an ORNL-developed fuel marker sensor, a trailer-to-tractor communications unit specified by and built for ORNL, an ORNL-designed data acquisition system and telematics device, and an Evidential Reasoning algorithm developed by ORNL. The testing was observed by FHWA headquarters staff based in Washington, D.C.

According to team lead Gary Capps, Energy and Transportation Science Division (ETSD), the field operation tests were successful. "We have validated that we can track a fuel delivery vehicle and monitor in real time the output of the various sensors that measure weight, valve position, and fuel marker concentration. This allows us to determine if any felonious activities are occurring, such as thief of fuel or cross-jurisdictional fuel tax evasion."

The team is currently preparing a detailed analysis of the data and will draft a final report. Gary said, "We will make recommendations to the Federal Highway Administration relative to the next steps, which include hardening this prototype system and mapping it over to a working fleet to allow data collection in a real-world environment."

> "....we can track a fuel delivery vehicle and monitor in real time the output of the various sensors that measure weight, valve position, and fuel marker concentration...."

In addition to Gary, team members at the test track included ETSD's Mary Beth Lascurain, Ho-Ling Hwang, and Shih-Miao Chin and Measurement Science and Systems Engineering Division's (MSSED) Duncan Earl. ETSD's Sheila Moore, Oscar Franzese, and Maggie Connatser, and MSSED's David West supported the testing from ORNL.

MSSED's Duncan Earl calibrates fuel marker sensor using a calibration vial filled with #2 diesel fuel and fuel marker dye.

Reaching new heights

Since receiving the 2008 R&D 100 award, ORNL-developed superhydrophobic material (SH) continues to evolve, with partnership opportunities being explored in a growing number of applications that range from the high tech, to the familiar, to the truly out of this world.

In April, NASA hosted a group of Northwest Nazarene University students who conducted space-age research on how SH material reacts with water in zero-gravity and hyper-gravity. NASA selected "Team Super-Hydro" to participate in their Microgravity University program in order to produce useful data for determining the feasibility of using SH materials as coatings inside future spacecraft plumbing systems.

The students conducted the tests under simulated conditions aboard NASA's zero-gravity plane. Thirty-two times the plane climbed to 32,000 feet and nosed over to create roughly 30 seconds of zero-gravity, then plunged to 24,000 feet and pulled up to create 30 seconds or so of hyper-gravity.

"It's exciting to see the enthusiasm of young researchers who recognize the technology's potential," said Measurement Science and Systems Engineering Division's (MSSED) John Simpson, adding, "It will be interesting to find out what the results may mean to NASA researchers."

The students asked for permission to test the SH material after attending a lecture and demonstration of the material by John last October. He and fellow MSSED researchers Brian D'Urso, Scott Hunter, and Steve McNeany developed the technology that makes coatings completely water repellant by forming a microscopic air gap between the treated surface and water.

In addition to catching NASA's attention, Southwire, one of the nation's largest cable manufacturers, recently entered into a Cooperative Research and Development Agreement with ORNL to develop SH and anti-icing coatings for high-voltage cables. A small development program also has been initiated for development of SH and anti-icing coatings for unattended aerial vehicles wing and dome structures manufactured by Isitu, Inc. VeloxFlow has licensed SH diatomaceous fabrication technology to manufacture SH diatomaceous powders for reducing drag in plumbing applications, while consumer-favorite Mars Incorporated signed a Work for Others agreement to develop SH and anti-sticking coatings for liquid and slurry ejection nozzles in their candy manufacturing business.

New facets of SH technology continue to be uncovered. Earlier this year, John and Scott completed evaluations of the technology's anti-corrosive capabilities, demonstrating that easy-to-apply spray-on SH coatings can be used to isolate and protect electrical instruments that are susceptible to electrical and/or corrosion failures from moisture or high-saline-content environments.

"These are capabilities that may help improve efficiency and reliability of coastal power lines and power system electronics, and offshore structures and systems such as wind turbine generators and controls," said John. "It's just another example of the diversity of superhydrophobic material and its impact on today's world and our future. We're only scratching the surface."

Water drops roll off a screen door treated with one of ORNL's new superhydrophobic powder coatings. Even though the mesh is very porous to air, the drops do not pass through due to the extreme water repellency of the powder coating.

A Northwest Nazarene University student researcher floats in midair while gathering data on how ORNL-developed superhydrophobic material reacts with water while in zero-gravity.

Narrowing the field for biofuels production

BioEnergy Science Center (BESC) scientists have identified new clues about plant structure, helping narrow a large collection of poplar trees to those more likely to be feedstocks for future biofuels.

Team members included Biosciences Division's Gerald Tuskan and Brian Davison, Energy and Environmental Sciences Associate Laboratory Director Martin Keller, and researchers from National Renewable Energy Laboratory and the Bourns College of Engineering's Center for Environmental Research and Technology at the University of California Riverside.

Using a high-throughput screening method, the team rapidly analyzed an unprecedented number of poplar core samples in their search to understand the chemical factors that drive sugar yields and the traits that lead to better sugar release.

They determined that the amount and composition of lignin in the plant's cell wall interact to influence release of sugar from the plant. Lignin, a complex chemical compound, forms strong bonds with a plant's sugars and can limit extraction of the sugars contained in cellulose and hemicelluloses that are needed for conversion to transportation fuels. Research findings indicate a need for deeper understanding of cell wall structure before plants can be rationally engineered for efficient biofuels production.

The team discovered an uncoupling of lignin concentration and composition, such that lignin concentration does not affect sugar yields at a composition ratio of 2 or higher. The team also identified certain poplar samples that produced unusually high sugar yields with no pretreatment. Biofuel production typically requires various pretreatments, such as applying high temperature and pressure to the biomass. Reducing pretreatment would represent a substantial decrease in the price of liquid transportation fuels produced from lignocellulosic feedstocks like poplar.

From this work, superior poplar cultivars may soon be available for commercial testing and propagation, yielding plant materials that will contribute to reducing the nation's dependence on fossil-fuel-based transportation fuels. This research was published as an article entitled "Lignin content in natural Populus variants affects sugar release" in the *Proceedings of the National Academy of Sciences*.

BESC scientists tested core samples from poplar trees to identify key characteristics that influence how the plants can be more effectively processed into biofuels.

Focused on improving iris recognition

You may remember the buzz about the 2002 movie *Minority Report*, when Tom Cruise's character is scanned by a futuristic iris recognition system.

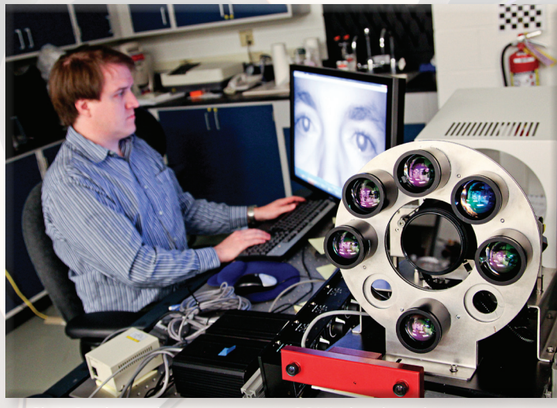
Less than ten years later, ORNL researchers are helping advance this very real form of biometric identification that is spreading in commercial and government use around the world.

"Iris recognition systems that use high-quality images can be extremely accurate, helping differentiate between billions of people," said Measurement Science and Systems Engineering Division's (MSSED) Chris Boehnen, adding, "Our challenge is to make their current capabilities even better."

Chris and fellow MSSED researchers Trent Nichols, Ryan Kerekes, and Vincent Paquit recently launched an 18-month project funded by the Biometrics Identification Management Agency (BIMA) to improve iris recognition accuracy by helping correct distortions caused by non-ideal off-angle images and pupil dilation. BIMA leads the Department of Defense (DOD) activities to program, integrate, and synchronize biometric technologies and capabilities. They also operate and maintain DOD's authoritative biometric database to support the National Security Strategy.

"Our first step is to produce an anatomically and optically correct model of the human eye using the most recent information from the vision and ophthalmology communities," said Chris. Compared to models currently available, the new version will provide improved texture mapping of realistic iris patterns and corneal surfaces, and allow for natural and surgical variation in the shape of the eyeball.

The team will then gather optical data under varying conditions from as many as 50 volunteers. Experiments will be carried out at ORNL using an array of technologies, including a video imaging device previously created in-house through a SEED-funded project. The device follows a volunteer's movement, capturing 30 iris images per second from a distance of 25 feet. It can be used in tandem with a dual spectrum imager capable of simultaneous visible light and near-infrared imaging.



Chris Boehnen demonstrates an ORNL-developed video imaging device that can follow an individual's movement, capturing 30 iris images per second from a distance of 25 feet.

Finally, the researchers will validate the model versus experimental data and produce a database of images from multiple angles and at various stages of dilation for image processing and pattern recognition algorithm development. BIMA will receive access to the images and datasets, along with a Windows graphical user interface, in order to experiment and demonstrate improved system recognition capabilities.

Crack-detecting technology could lead to healthier vehicles and emissions

A cooperative research and development agreement between ORNL and Cummins Inc. has produced a newly patented technology for diagnosing the health of a vehicle's emissions management system.

The apparatus helps detect cracks in the diesel particulate filter, a device designed to remove soot and particulates in diesel exhaust. Periodically, the filters are "cleaned" through high-temperature oxidation. Cracking may occur during cleaning, start-up, shutdown, or from unforeseen transients during operation.

"The cracks typically provide a path for the gas to escape, compromising the functionality of the filter. Most often, the cracks cannot be repaired and the filter must be replaced," explained research team member Amit Shyam, Materials Science and Technology Division (MSTD). Other team members include MSTD's Edgar Lara-Curzio and Cummins' Randall Stafford and Thomas Yonushonis.

Developed using ORNL High Temperature Materials Laboratory resources and the team's propulsion materials expertise, the new technology includes sensors that consist of embedded conduction paths on the filter's exterior. The sensors measure increases in electrical resistance across conduction paths to detect the cracks and the extent of damage.

"If potential problems are identified, these can be reported during regular service intervals, enabling individual drivers to remain compliant with EPA regulations," said Randall.

Project funding was provided by Cummins and the DOE Energy Efficiency and Renewable Energy Vehicle Technologies Program. Cummins is a global leader in the design, manufacturing, distribution, and service of engines and related technologies, including fuel systems, filtration, emission solutions, and electrical power generation systems.

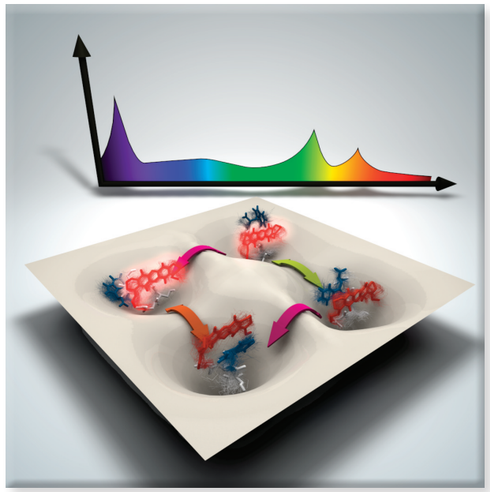
"Fingerprinting" technique reveals molecular secrets

A theoretical technique developed at ORNL is bringing supercomputer simulations and experiments closer together by identifying common "fingerprints" that reveal new information on molecular activity.

"Experiments tend to produce relatively simple and smooth-looking signals, as they only 'see' a molecule's motions at low resolution," said Biosciences Division's Jeremy Smith, who directs ORNL's Center for Molecular Biophysics and holds a Governor's Chair at the University of Tennessee. "In contrast, data from a supercomputer simulation are complex and difficult to analyze, as the atoms move around in the simulation in a multitude of jumps, wiggles, and jiggles. How to reconcile these different views of the same phenomenon has been a long-standing problem."

Conceived by former graduate student Frank Noe, the technique solves the problem by calculating peaks within the simulated and experimental data. The two datasets are linked to reveal a layer of complex information missing from many experiments, providing researchers a more thorough understanding of how molecules move and interact as they tackle scientific challenges such as biofuels research, drug development, and materials design.

A collaborative effort, Jeremy worked with researchers from Italy, Germany, and the University of California at Berkeley. Their findings were published in the *Proceedings of the National Academy of Sciences*. The research was funded in part by an award from the Biological and Environmental Research and Advanced Scientific Computing Research divisions of the DOE Office of Science.



As a molecule jumps between structural states (below), it creates "dynamical fingerprints" (top spectra) that can tie together high-performance simulation and experiments.

"When we started the research, we had hoped to find a way to use computer simulation to tell us which molecular motions the experiment actually sees," Jeremy said. "When we were finished, we got much more – a method that could tell us which other experiments should be done to see all the other motions present in the simulation."

R&D 100 battery technology wins additional funding

DOE Energy Efficiency and Renewable Energy Vehicle Technologies Program is providing $570,000 in phase one funding over the course of two years for the continued development of the R&D 100 Award-winning technology Sulfur-Carbon Nanocomposite Cathode Material and Additives for Lithium-Sulfur Batteries. The invention has the potential to aid in the harnessing, storage, and use of electricity from renewable energy sources, enabling a more reliable, safer, and longer lasting battery system.

Developed by Physical Science Directorate's Chengdu Liang, Nancy Dudney, and Jane Howe, the technology offers a more functional sulfur-carbon nanocomposite cathode and halide additives to the electrolyte to solve problems inherent in existing lithium-ion battery technology. Researchers hope the lithium-sulfur battery system can improve the energy density of current technologies by a factor of five. The project originated in 2007 with funding provided by ORNL's Laboratory Directed Research and Development Program.

Top from left, Chengdu Liang and Jane Howe; Nancy Dudney is seated.

Energy & Environmental Sciences

Rookie high school team competes nationally, wows ORNL mentors

In late April, a team of students from Hardin Valley Academy participated in the 2011 FIRST Robotics Competition in St. Louis. As the sole team from Tennessee in this national competition, the "RoHawktics" finished in the top 20 percent, 59th of 300 teams, bringing an exciting close to what their ORNL mentors recognize as a winning experience for these first-time competitors.

"It was amazing to witness the growth of these young inventors as they immersed themselves in engineering and learned to find solutions through teamwork," said Measurement Science and Systems Engineering Division's Lonnie Love. "The outstanding finish is a testimony to their efforts and a good indication of what we can expect from the RoHawktics in the future."

To prepare for competition, Lonnie and fellow mentors from ORNL, the school, and other organizations worked with the students for six weeks as they transformed a box of random parts into two functioning robots. Other ORNL mentors included Martin Keller, Associate Laboratory Director, Energy and Environmental Sciences Directorate; Energy Materials Program's Craig Blue; and Biosciences Division's Tommy Phelps. Energy Partnership's Ray Boeman also provided support, helping secure ORNL sponsorship funding.

The RoHawktics secured a spot in St. Louis after being named top rookie team at the Smoky Mountain Regional FIRST Robotics Competition. They were one of only four teams out of 50 who advanced to the national level.

Founded by Segway® inventor Dean Kamen, FIRST Robotics combines the excitement of sport with the rigors of science and technology to create a unique varsity Sport for the Mind™. Worldwide, more than 52,000 students and 2,000 teams participated in the 2011 competition.

SMOKY MOUNTAIN REGIONAL FIRST ROBOTICS COMPETITION

The team from Hardin Valley Academy caused some excitement Friday when their robot nearly turned over during one of the competition heats at the Smoky Mountain Regional FIRST Robotics Competition at the Knoxville Convention Center.

PHOTOS BY MICHAEL PATRICK/NEWS SENTINEL

MESHING MIND, METAL

Local students compete with machines they build

BY REBECCA B. WILLIAMS
Knoxville News Sentinel

A Knoxville-built robot called Hawktimus Prime slipped back and forth erratically slammed into the playing field well into a match Friday at the Smoky Mountain Regional FIRST Robotics Competition at the Knoxville Convention Center.

Named for the Transformer Marvel Comic series character Optimus Prime, who was fond of saying, "Let's roll," the robot couldn't even budge the rest of the round.

"Something's wrong. I'm not sure. It looks like maybe our gyroscope got messed up," said Noah Pumers II, a senior at Hardin Valley Academy and a member of the school's RoHawktics team.

Robot drama is rampant at the competition, which is free and open to the public today. Forty-six teams from New Hampshire to Florida are competing to qualify for the world festival April 27 in St. Louis. In addition to Hardin Valley,

ON KNOXNEWS.COM

SLideshow: Robots in competition at the Smoky Mountain Regionals.

See ROBOTICS on A10

Ian Pumers, left, and John Simmins from Catholic High School carry their robot off the staging area after competing in the 2011 Smoky Mountain Regional FIRST Robotics Competition. Teams built robots that must grasp and hang inflated plastic rings on overhead hooks.

ORNL-mentored robotics team makes Knoxville News Sentinel *front page.*

Phase I complete on second building at NTRC

Construction of a second building at the National Transportation Research Center (NTRC) is on schedule, with office space nearing completion and laboratory space taking shape.

"The new building will house unique expertise and technologies to enable ongoing integration of ORNL transportation research conducted at NTRC and the main campus," said Energy and Transportation Science Division Director Johney Green.

Approximately 40 ORNL employees, a mix of current NTRC and main campus residents, are expected to occupy the new building this summer. Plans call for staggered implementation of several research laboratories, including a vehicle systems integration laboratory and a transportation analysis and visualization (TRAVL) center. Construction is expected to continue through 2012.

Nearly 200 ORNL employees are currently based at NTRC, generating approximately one-half of the Lab's transportation research. ORNL resources at NTRC include the Center for Transportation Analysis; Fuels, Engines, and Emissions Research Center; Power Electronics and Electrical Power Systems Research Center; Sustainable Transportation Program office; and the Packaging Research Facility.

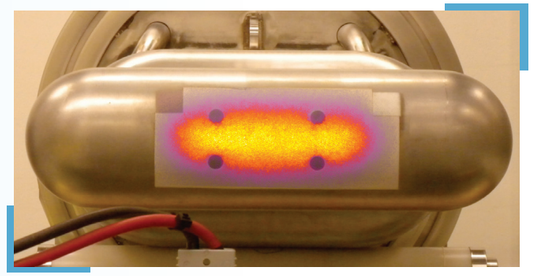
Approximately 50 University of Tennessee employees also work inside NTRC, where they operate several transportation laboratories and occasionally collaborate with ORNL. The new building will be occupied solely by ORNL.

New device captures first SNS target image

An improved high-resolution target imaging device co-developed by Energy and Transportation Science Division's Curt Maxey has acquired its first image of the Spallation Neutron Source proton beam.

Pictured at right, the image of an 840 MeV proton beam is overlaid on a photograph of the target. The beam is about 200 mm wide. Light is produced when the protons pass through a luminescent coating on the target surface. With a complex, radiation-hardened optical system, this light is transported through about 5 meters of steel shielding to the camera. With nearly a megawatt of beam power, the radiation environment near the target is similar to that of an operating nuclear reactor core, but the environment near the camera is safe for human occupation. Compared to the prior imaging system, the image has substantially improved resolution.

According to Neutron Sciences Research Accelerator Division's Tom Shea, "Thanks to Curt's improved optics, we are now able to calibrate the system without interrupting SNS operations, and we can use it as the primary diagnostic to center the powerful beam onto the target."



Digging progress

Construction of the future Carbon Fiber Technology Facility is now under way at the Horizon Center. Designed to foster collaborations with industry and academia, the 40,000-square-foot facility will operate at a pilot scale and demonstrate the scalability of technology for lowering the cost of carbon fiber and making affordable the use of carbon fiber in applications such as vehicle and wind energy technologies. The facility is projected to be operational by late 2012.

Alumina-forming austenitic alloy family licensed

Carpenter Technology Corporation has licensed an alumina-forming austenitic (AFA) stainless steel alloy family developed under ORNL's Fossil Energy Program. Unlike most stainless steels, the AFA family forms an alumina surface oxide and has better high-temperature oxidation resistance in many combustion, steam, and carburizing environments. Increased deployment of AFA steels can lead to heat exchangers for combined heat and power turbines that are able to operate reliably at higher temperature, thereby increasing efficiency without the use of more expensive nickel-based alloys. A 2009 R&D 100 Award winner, the AFA alloys are also candidates for other turbine components and tubing materials for fossil-fired steam plants and chemical/petrochemical processing. Scale-up and commercialization efforts for AFA have received follow-up funding from the DOE Energy Efficiency and Renewable Energy (EERE) Industrial Technologies Program and the EERE Commercialization and Deployment Fund.

ORNL Director Thom Mason, left, and Carpenter Technology's Tim Armstrong.

Team uncovers clue to mercury mystery

Certain naturally occurring bacteria can transform mercury into the more harmful methylmercury. A team of researchers led by Biosciences Division's Steven Brown has sequenced a bacterial genome that could contain clues as to how microorganisms can enable this transformation.

Conducted in collaboration with the California-based DOE Joint Genome Institute with findings published in the *Journal of Bacteriology*, the study has determined the genome sequence for a bacterium called Desulfovibrio desulfuricans strain ND132 that is capable of methylating mercury.

"Mercury is a global contaminant of concern that primarily stems from industrial processes and the burning of fossil fuels," said Steven.

"Until now, we have not known of a gene or protein that allows the bacteria to mediate transformation. If we can identify the genes involved in mercury methylation, from these new findings, we hope to go to the local environment and understand more about the function and the ecology of the organisms and their gene products that mediate this transformation."

"Until now, we have not known of a gene or protein that allows the bacteria to mediate transformation..."

Steven Brown

Award winner's story is no fish tale

Mike Ryon

Environmental Sciences Division's Mike Ryon has received the 2011 ORNL Community Sustainability Award for work that has improved a neighborhood, a community, and a natural habitat.

More than ten years ago, Mike took steps to transform the "typically urban" stream that ran through his neighborhood into a more ideal environment for the minnows that lived there. At the time, no trees or shrubs grew along the banks, just non-native fescue grass that was kept very short.

An aquatic ecologist, Mike explained, "Streams in East Tennessee need to have a buffer of trees and shrubs in order to function naturally. The vegetation helps shade the water keeping it cooler; tree and shrub roots (because they are more complex and longer than fescue roots) filter out contaminants (e.g., pesticides or oils) and silt; the roots also armor the bank to keep it from eroding away. The vegetation provides food, either directly through leaf fall or as growing areas for insects. A buffer of trees and shrubs also helps terrestrial animals like migrant birds and mammals by providing habitat for them."

With approval from the homeowners' association and a $2,500 watershed grant from TVA, Mike developed a riparian buffer between the lawns and the stream using native trees, shrubs, and non-woody plants. Over the years, neighbors and the homeowners' association have helped with improvements and maintenance, and Boy Scouts have removed invasive, non-native plants and landscaped a trail near the stream. The neighborhood has taken responsibility for maintenance, and clean-up days are scheduled periodically. A protective zone (25 to 100 feet wide) on each side of the stream has produced a valuable habitat and made the stream representative of good East Tennessee waterways. Mike is looking forward to helping with ongoing improvements being planned for the future.

Making Connections

ORNL hosts ALCOA Global Energy Summit

Summit attendees at ORNL Conference Center

ORNL hosted the ALCOA 2011 Global Energy Summit in March, supporting ALCOA's involvement in the DOE Industrial Technologies Program's (ITP) Save Energy Now LEADERS Program and their internal efforts at energy conservation. The first two days of the meeting were held at ORNL and included Lab tours, information sharing related to industrial heat recovery, and ORNL's ITP research and technology delivery activities. On the final day of the event, ALCOA hosted ORNL representatives on a tour of the company's rolling mill and can reclamation facilities.

Staff helps deliver process heating workshops in India

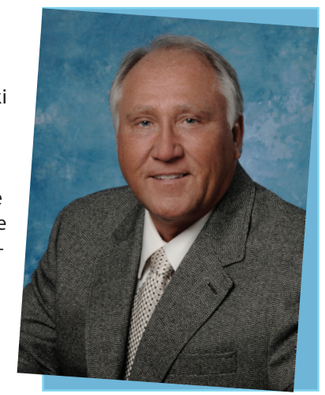
DOE Industrial Technologies Program and ORNL, in partnership with the Confederation of Indian Industry, delivered two workshops in March on energy efficiency improvements in industrial process heating systems in India. Energy and Transportation Science Division's Sachin Nimbalkar and Safety Services Division's Mark Baldwin helped lead the workshops, which included classroom instruction on process heating energy efficiency and DOE's process heating software tool.

Climate on the Hill

Environmental Sciences Division's Ben Preston participated in Climate Science Day on the Hill in February. The event was organized by 10 scientific societies as a non-partisan opportunity for scientists of many disciplines to build relationships and provide members of Congress access to the best possible climate science. Ben met with staff from five offices including Tennessee State Representatives Rob Wittman and Stephen Fincher and Senator Bob Corker.

Olszewski member of NATO team

Energy and Transportation Science Division's Mitch Olszewski has been appointed to a multinational North Atlantic Treaty Organization (NATO) working group charged with assessing the rare earth materials situation. The impact of rare earth material scarcity on the development of next-generation electric motor power systems, military platforms, and weapon technologies will be the focus of the group's research.



Mitch Olszewski

Marlino participates in ARPA-E presentation to Chu

Energy and Transportation Science Division's Laura Marlino participated in a presentation to DOE Secretary Steven Chu and ARPA-E Director Arun Majumdar at DOE's Advanced Research Projects Agency - Energy (ARPA-E) Energy Innovation Summit. The discussion with Secretary Chu highlighted the ongoing work being performed under an ARPA-E award by Delphi, International Rectifier, and ORNL. Delphi leads the $8.4 million project to apply gallium nitride on silicon power semiconductor technology to the switch modules in inverters for hybrid and electric vehicles.

Employee Excellence

Sujit Das

Energy and Transportation Science Division's Sujit Das has been reappointed to serve on the Transportation Research Board (TRB) Committees for an additional three-year term on Transportation Economics, ABE20 and on Alternative Transportation Fuels and Technologies, ADC80. TRB is a division of the National Research Council (NRC), a private, nonprofit institution that provides expertise in science and technology to the government, the public, and the scientific and engineering communities. The NRC is jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

Energy and Transportation Science Division's Zhenhong Lin and David Greene have received a 2011 DOE Vehicle Technologies Program R&D Award for developing the Market Acceptance of Advanced Automotive Technologies (MA3T) model, a market simulation model that was developed to project plug-in electric vehicle demand and its impact on energy and the environment. MA3T features 36 vehicle technologies, including conventional gasoline, diesel, hybrid electric, plug-in hybrid electric, battery electric, and fuel cell; 1,458 different market segments within the United States; multiple inputs such as fuel prices, vehicle performance, charging infrastructure, and various types of policy incentives; and application flexibility. The model can provide oil displacement estimates, greenhouse gas emissions, electricity demand, the market share for each vehicle technology, and much more.

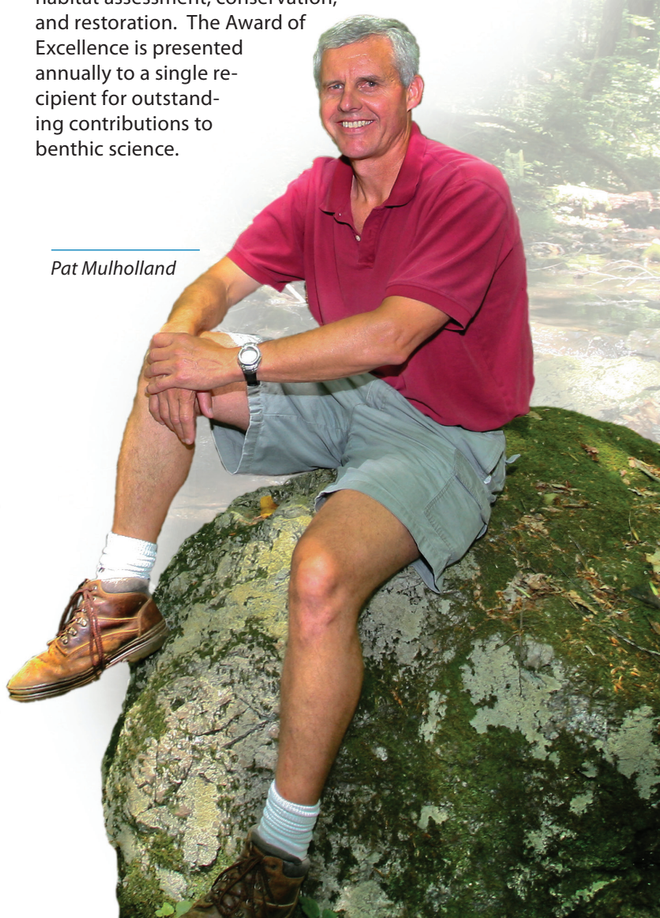
Biosciences Division's Shelton Griffith, post-BS HERE, was awarded 2nd place at the MCBIOS bioinformatics conference for best student talk. Shelton was competing against students nearing completion of their advanced degrees.

Curt Maxey

Energy and Transportation Science Division's Curt Maxey was recognized as ORNL's Inventor of the Year at the Battelle 2011 Achievement Awards Banquet held in April. Jeff Wadsworth, Battelle President/CEO and former ORNL laboratory director, presided over the event, in which 37 individuals or teams were recognized for their contributions to Battelle's success in The Business of Innovation. Each of the national laboratories Battelle manages was invited to send their most recent Inventor of the Year for recognition.

An ORNL team has received accolades for producing a DVD training video that has received multiple requests for use by Federal agencies. "Remediation Guidance for Major Airports after a Chemical Attack: Pre-Planning, Issues and Tools" is an emergency preparedness DVD produced for the Department of Homeland Security by a team that included Environmental Sciences Division's John Sorensen, Barbara Sorensen, Annetta Watson, Bob Bock, and Fred Dolislager and Chemical Sciences Division's Cyril Thompson. The Federal Emergency Management Agency has requested that 500 copies of the DVD be made and distributed to state and local agencies.

Congratulations to Environmental Sciences Division's Pat Mulholland, who has received the 2011 Award of Excellence from the North American Benthological Society (NABS). NABS is an international scientific organization whose purpose is to promote further understanding of aquatic ecosystems, with particular interest in the stream benthic biological community and its relationship to aquatic ecosystem structure and function, the watershed and landscape, habitat assessment, conservation, and restoration. The Award of Excellence is presented annually to a single recipient for outstanding contributions to benthic science.



Pat Mulholland

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Large remote inverter test system now operational

The Large Remote Inverter Test System inside the Distributed Energy Communications & Controls (DECC) Laboratory annex is now operational in Building 3129. The new system provides a second inverter test capability for higher capacity/current inverters and the ability for ORNL to test multiple inverters on a distribution circuit/system. It allows for remote operation using an Automated Logic controller and independent phase control of the three-phase load bank and provides another step-down transformer and panel (480/208/120V) for feeding the HVAC, lights, computers, and instrumentation equipment. DECC is focused on developing and testing smart and innovative inverter controls for the integration of renewable and non-renewable energy for supporting the smart grid. It is sponsored by the DOE Office of Electricity Delivery and Energy Reliability and supported by industry partners including Tennessee Valley Authority, Electric Power Research Institute, Lenoir City Utilities Board, Southern California Edison, and Applied Power Systems.

Energy Materials signs MOU

ORNL's Office of Energy Materials has signed a memorandum of understanding (MOU) with the NNSA Kansas City Plant (KCP), managed by Honeywell Federal and Manufacturing technologies, LLC. The objective of the MOU is to jointly develop a Secure Innovative Materials Development, Product Prototyping and Manufacturing Collaboration that will leverage the unique manufacturing research and process implementation capabilities of ORNL and KCP.

Who Knows?

When it comes to taking care of our customers, which of the following rules should you follow?

- ○ Make it easy for customers to work with us
- ○ Report clearly and often to keep customers up to date
- ○ Solicit customer feedback, listen, and respond
- ○ Advocate what's best for our customers
- ○ Actively seek to learn and anticipate each customer's needs
- ○ All of the above

If you answered **all of the above**, give yourself credit for the quality job you do every day and...

keep up the good work!