

## SCIENCE

### ORNL explores proteins in Yellowstone bacteria for biofuel inspiration

**Studies of bacteria first found in Yellowstone's hot springs** are furthering efforts at the Department of Energy's BioEnergy Science Center toward commercially viable ethanol production from crops such as switchgrass.

The current production of ethanol relies on the use of expensive enzymes that break down complex plant materials to yield sugars that are fermented into ethanol. One suggested cheaper alternative is consolidated bioprocessing, a streamlined process that uses microorganisms to break down the resistant biomass.

"Consolidated bioprocessing is like a one-pot mix," said Oak Ridge National Laboratory's Richard Giannone, coauthor on a BESC proteomics study that looked at one microorganism candidate. "You want to throw plant material into a pot with the microorganism and allow it to degrade the material and produce ethanol at the same time."

The BESC study focused on *Caldicellulosiruptor obsidiansis*, a naturally occurring bacterium discovered by BESC scientists in a Yellowstone National Park hot spring. The microorganism, which thrives at extremely high temperatures, breaks down organic material such as sticks and leaves in its natural environment, and scientists hope to transfer this capability to biofuel production tanks.

In a paper featured on the cover of the *Journal of Proteome Research*, the BESC team conducted a comparative analysis of proteins from *C. obsidiansis* grown on four different carbon sources, ranging from a simple sugar to more complex

substrates such as pure cellulose and finally to switchgrass. The succession of carbon substrates allowed researchers to compare how the organism processes increasingly complex materials.

"This progression helps us look at how proteins change given different carbon substrates," Giannone said. "One of the goals is to identify new proteins that we haven't seen before. If an unknown protein doesn't show up on the simple sugars or cellulose, but it shows up on the switchgrass, then we can say something about that gene or protein—that it responds to something the switchgrass is providing."

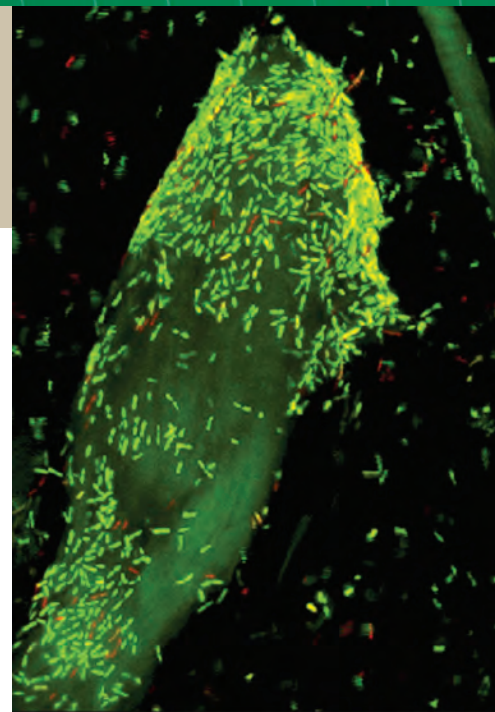
The researchers found that growth on switchgrass prompted the organism to express an expanded set of proteins that deal specifically with the hemicellulose content of the plant, including hemicellulose-targeted glycosidases and extracellular solute-binding proteins. Acting together, these two sub-systems work to break down the plant material and import the resulting sugars into the cell. The scientists went on to show that once inside the cell, the organism "switches on" certain enzymes involved in pentose metabolism in order to further process these hemicellulose-derived sugars into usable energy.

"By comparing how *C. obsidiansis* reacted to switchgrass, relative to pure cellulose, we were able to pinpoint the specific proteins and enzymes that are important to plant cell wall deconstruction—a major roadblock to the production of advanced biofuels," Giannone said. —*Morgan McCorkle* 🌱

---

"You want to throw plant material into a pot with the microorganism and allow it to degrade the material and produce ethanol at the same time."

---



ORNL researchers are studying how bacteria found in Yellowstone hot springs could play a role in the development of a cheaper biofuel production process. (Image: Jennifer Morrell-Falvey/ORNL)

## Table of Contents

ORNL explores proteins in Yellowstone bacteria for biofuel inspiration . . . . .	1
Photographer Ed Westcott celebrates 90th birthday. . . . .	2
Service anniversaries . . . . .	3
ORNL volunteers in local STEM outreach activities . . . . .	4
Wellness . . . . .	5
Club ORNL events. . . . .	5
Treasures from the archives . . . . .	6
Thom's thoughts . . . . .	7
Crystal of the month club . . . . .	8

## Photographer Ed Westcott celebrates 90th birthday with 200 fans



Thom Mason, Ed Westcott and Frank Munger watch the unveiling of a 1947 photo of Westcott that shows him jumping to test lighting equipment. (Photo: Curtis Boles)

Ed Westcott was the 29th person to be issued a security badge in 1942 when the Clinton Engineering Works was forming as part of the Manhattan Project.

That badge would pave the way for thousands of photos that Ed would take over the next several decades that would trace the history of Oak Ridge and preserve it for all time.

“If it wasn’t for Ed, 90 percent of the history of Oak Ridge could not be proved,” Oak Ridge historian Ray Smith said. Ray was among more than 200 friends, family and fans who joined Ed to celebrate his 90th birthday at the American Museum of Science and Energy on Jan. 30.

Ed had permission to possess a camera during the early years of Oak Ridge – cameras were not permitted otherwise inside the confines of the Secret City – and took photos of the construction, the work and the people of the Secret City. He also took photos of activities in town, attending many meetings, dances, sporting events and just about anything where people were gathered. His work appeared in *The Oak Ridge Journal*, the city’s first newspaper.

He took pictures of everyday activities and people in Oak Ridge, scientists, kings and presidents.

One of his most famous photos is of the large celebration that took place in Jackson Square on April 15, 1945 (VJ Day) when the Japanese surrendered to end World War II.

Ed continued to shoot photos of Oak Ridge for many years after the war, recording shots of the opening of the city gates in the spring of 1949 with the small explosion forming a little mushroom cloud at Elza Gate.

Another of Ed’s famous photos was one of U.S. Sen. John F. Kennedy and his wife, Jackie, taken in April 1959 as they were looking into the pool of the Oak Ridge Research Reactor along with ORNL Director Alvin Weinberg and U.S. Sen. Albert Gore Sr.

“What Ed did for this city is amazing and incredible,” Oak Ridge Mayor Tom Beehan said. “He truly was the first photojournalist in Oak Ridge.”

Ray Smith said Ed took great pride in his work, realizing its significance.

“Ed loved history and took a lot of thought and care when he set up,” Ray said. “Ed understood probably better than anyone else in the city that he was recording the history of Oak Ridge, and that responsibility was very important to him.” —Fred Strohl 🌿

---

“Ed understood probably better than anyone else in the city that he was recording the history of Oak Ridge, and that responsibility was very important to him.”

—Ray Smith

---

*Reporter* is published for retirees of ORNL, which is managed by UT-Battelle for the U.S. Department of Energy.

**Morgan McCorkle**

Editor

(865)574-7308

mccorkleml@ornl.gov

**Emma Macmillan**

Writer

**Cindy Johnson**

Design and Layout



We’re transitioning the Reporter to an online or email format. Please send your email address to [ornlreporter@ornl.gov](mailto:ornlreporter@ornl.gov) if you would like to receive the newsletter as an email. You can also access the Reporter online at <http://www.ornl.gov/info/reporter/>.



Service Anniversaries

**April**

**35 years:** Larry M. Rosenbaum, Information Technology Services; Randy W. Burnett, Facilities Management; Ken Guymon, Nonreactor Nuclear Facilities; Mark J. Rennich, Instrument & Source Design; Stephen N. Storch, Fuel Cycle & Isotopes

**30 years:** Geneva C. Johnson, Global Nuclear Security Technology; Curtis A. Maples, Nonreactor Nuclear Facilities; Eraina G. Elliott, Fusion Energy; Carol T. Rice, Business Services Dir.

**25 years:** Jan Z. Palmer, Technology Transfer; Nancy R. Sweat, Nuclear & Radiological Protection; Richard E. Rodriguez, Laboratory Protection; Cathy L. Gaudreau, Biosciences; J. D. Stooksbury, Logistical Services; Randall F. Lind, Measurement Science & Systems Engineering; Susan Thomas, Information Technology Services; Michael L. Baker, ESH&Q Dir.

**20 years:** Kathryn A. Kinney, Jeanne Denise Bonner, Vickie S. Kurtz, Nonreactor Nuclear Facilities; David Robert Hamrin, Laboratory Protection; Sherry E. Hempfling, Center for Computational Sciences; Arpad Alexander Vass, Biosciences; Janet M. Baucom, Measurement Science & Systems Engineering; Ronald Joseph Reagan, Research Reactors; Linda S. Huskey, Fuel Cycle & Isotope; Chad C. Plemmons, International Security & Analysis Programs; Hua-Tay Lin, Materials Science & Technology

**May**

**35 years:** Stephen Kenneth Ellis, Fabrication, Hoisting & Rigging; Becky J. Verastegui, Computing & Computational Sciences Dir.; Van D. Baxter, Energy & Transportation Science; Lewis Franklin Futrell, Jr, Facilities Management; Johnny C. Brown, Utilities; Julia T. Luck, Materials Science & Technology; Suzanne A. Herron, US ITER Project Office

**30 years:** David K. Felde, Reactor & Nuclear Systems; Steve T. Baker, Global Security & Nonproliferation Programs; James E. Radle, Global Nuclear Security Technology

**25 years:** Kara L. Kruse, Computational Sciences & Engineering; Donna L. Balltrip, Materials Science & Technology; Debbie L. Smith, Accounting; J. David Snider, Global Nuclear Security Technology; Robert A. Dean, Research Accelerator; David B. Geohegan, Center for Nanophase Materials Sciences; Patrick H. Worley, Computer Science & Mathematics; Mark B. Rogers, Information Technology Services; Diane Maddox, Environmental Protection & Waste Services

**20 years:** Jeffrey J. Duff, Research Accelerator; DeAnna Kay Hatmaker, Sonya G. Beck, Nuclear & Radiological Protection; Jeffery Lynn Redwine, Martin Bailey Wice, David R. Williams, Laboratory Protection



## ORNL volunteers in local STEM outreach activities



Students at the Knox County Career Fair try out ORNL's mock-up of a hot cell manipulator. (Photo: Genevieve Martin)

To engage the community in science, technology, engineering and math, ORNL participated in two February events that welcomed students of all ages to experience the wonders of science.

ORNL participated in the Knox County Schools Career Day Feb. 23 at the Knoxville Expo Center, which aimed to provide students and parents with information to help shape their high school and post-secondary education choices.

---

“We just want them  
to see that  
science is fun.”

---

ORNL, ORAU and AMSE collaborated to create a Science Village, an area with interactive displays and opportunities for students to ask questions and participate in hands-on science activities. ORNL scientists set up exhibits, such as the simulated Spallation Neutron Source, ITER, and a mock-up of hot-cell manipulators, among many others.

Participating ORNL groups included SNS, Nonreactor Nuclear Facilities, ITER, Fuel Cycle and Isotopes Division, Global Nuclear Security Technology Division and ORNL recruiting.

On Feb. 25, about 15 ORNL scientists participated in the inaugural Science Expo at the Science, Technology, Engineering and Mathematics Academy of Knoxville, which represented 34 schools from East Tennessee and brought in more than 130 elementary school students to see the fun side of science.

The expo included five experiments for the students, touching on nuclear science, electricity and robotics. Students used beta-gamma detectors loaned from Y-12 to find radioactive sources in models of buildings, took a flashlight apart and rebuilt it to see if they could make the bulb light up and operated a robot arm to pick up shaped blocks and put them in the correct slot. More than half of volunteers at the expo were UT nuclear engineering students, who were helping the kids do experiments.

Julie Ezold, cofounder of the inaugural Science Club Science Expo and ORNL nuclear engineer, participated in both of these events.

“Kids are curious right now,” Ezold said. “They want to learn, so it’s the perfect time to introduce them to this. At this age, we don’t expect them to grasp concepts. We just want them to see that science is fun.”—Emma Macmillan 🌱



Julie Ezold, an ORNL nuclear engineer (left), was among dozens of ORNL volunteers who took part in two science education outreach days in February. (Photo: Genevieve Martin)



## Spring to action with a heart-healthy diet

**There are three practical ways to be heart healthy:** lower sodium intake, add more fiber and lower cholesterol and fat. A heart healthy diet can be easily achieved by eating fruits, vegetables, nuts and fish, according to Donna Pierce, ORNL registered dietician.

**Add more fiber to your diet.** The Mayo Clinic recommends five to 10 grams of soluble fiber to lower LDL cholesterol, better known as “bad cholesterol.” Soluble fiber, found in oats, barley, apples and beans, has been shown to decrease serum cholesterol and cause weight loss. Other foods with lots of soluble and insoluble fiber are dried figs, chickpeas, lima and kidney beans, corn grits and carob flour.

**Decrease sodium intake.** “Not all salt is alike,” said Pierce, who advises everyone to check the label. While the Department of Health and Human Services recommends no more than 2300 milligrams of sodium a day, most Americans consume between 3-5,000. There are ways to limit sodium in your diet, such as not adding salt while you’re cooking or at the table, limiting your intake of processed meats and limiting sodium from prepackaged meals. Try using kosher or sea salt, which has less sodium than table salt.

**Lower cholesterol intake.** Cholesterol plays a key role in brain and nerve function, but there’s a difference between “good” and “bad” cholesterol. High-density lipoprotein, or HDL, behaves in a way that makes it “good,” while low-density lipoprotein, or LDL, has been called “bad” cholesterol. To lower dietary cholesterol, limit intakes of meat, choose low-fat or fat-free milk, cheese and yogurt and drink low-fat and skim milk.

**Don’t be confused by fat.** About 30 percent of our caloric intake should come from fat, making it another essential nutrient. Polyunsaturated fatty acids protect against cardiovascular disease by providing more membrane fluidity, and monounsaturated fatty acids have been shown to decrease serum cholesterol. To increase your intake of healthy fat, eat more fish, add nuts to cereals and salads and eat breads that contain nuts.



## Club ORNL events

Get the details and latest news **online** via <https://info.ornl.gov/sites/clubornl>. Request an XCAMS account, which will allow you to participate in these events or contact Lara James at 865-576-3753 or [jamesla@ornl.gov](mailto:jamesla@ornl.gov).

<b>April 13</b>	Alive after Five
<b>April 13</b>	<i>Cowboys</i> at the Cumberland County Playhouse
<b>April 20</b>	Charleston Overnight
<b>May 5</b>	<i>Riverdance</i> at the Tennessee Theatre
<b>May 18</b>	Abingdon/Virginia Creeper/Barter Theater



# THE NEWS

## OAK RIDGE NATIONAL LABORATORY

A Publication by and for the ORNL Employees of Carbide and Carbon Chemicals Company, Union Carbide and Carbon Corporation

Vol. 4—No. 45

OAK RIDGE, TENNESSEE

Friday, May 23, 1952

### W. E. Dougher Dies Friday In Oak Ridge

William Edward Dougher, head of ORNL's Transportation and Labor Department, who would have celebrated his eighth year with the Laboratory yesterday, died last Friday in Oak Ridge Hospital. Mr. Dougher, who was 57, had been ill for some time.



W. E. Dougher

The rosary was recited Friday evening at the Dougher's residence, 304 East Faunce Lane, by the Knights of Columbus. A requiem mass was held Saturday morning at St. Mary's Catholic Church in Oak Ridge.

Mr. Dougher came to the Laboratory May 22, 1944, as an area engineer. Services and interment were held in White Sulphur Springs, West Virginia, last Monday.

Mr. Dougher is survived by his wife, Fernie; three children, Mary Marie Dougher of Chicago, Mrs. Perry Falls, now residing in Pennsylvania; and William, who lives in South Carolina. There is one grandchild, Karen Falls.

He was a member of the ORNL bowling team, and active in several community organizations, among them the Knights of Columbus and Elks. Mrs. Dougher has been a teacher at Elm Grove school for several years.

### Credit Union Announces Repayment Time Change

The board of directors of the ORNL Credit Union, in view of the relaxation of Regulation W by the Federal Reserve Board, has decided to authorize that the repayment time of Secured Loans be set at a maximum of 24 months, instead of 12 or 18 months as was the practice heretofore.

Robert Martin, who made this announcement, stated that this action is effective immediately. The board of directors reached this decision at its monthly meeting held May 15.

### PEGGY BUGG

Peggy Bugg, daughter of M. A. Bugg, head of ORNL's Maintenance Department, is one of the four students sworn in last Wednesday as a student council officer for Oak Ridge High School. Peggy, who was elected secretary, came to Oak Ridge in 1945 from St. Louis. She attended Jefferson Junior High School, where she was elected girl-of-the-year, and is chairman of the Oak Ridge Youth Council. A majorette, Peggy is also in the Leaders' club, orchestra, the National Honor Society, the Junior Key committee, and the social and recreation committee of the student council. She lives at 301 East Forest Lane in Oak Ridge.

### Peruvian Officers Make Unclassified Tour of Laboratory

Seven high-ranking officers of the Peruvian navy were guests of ORNL last Monday when they were conducted on an unclassified tour of the Laboratory facilities. The Laboratory tour was part of a sight-seeing tour through Oak Ridge, a visit to the American Museum of Atomic Energy, and a dinner in Knoxville at which representatives of the Atomic Energy Commission and the Carbide plants in Oak Ridge were present.

The Peruvian officers were: Rear Admiral Roque A. Saldias, Secretary of the Navy; Rear Admiral Ernesto Rodriguez, Commander of the Fleet; Captain Alfredo Freyre, Chief, Bureau of Supplies and Accounts; Captain Guillermo Tirado, Chief, Bureau of Ships; Commander Carlos Salomon, Flag Secretary; Lieutenant Commander Fernando Elias, Assistant Naval Attache to the United States; and Lieutenant Carlos Saldias, Medical Corps, Peruvian Navy.

Also in the party on the unclassified tour were four officers of the U. S. Navy: Rear Admiral M. E. Miles, Captain F. E. Shoup, Chief of Staff, Sixth Naval District; Captain W. E. Zimmerman, Senior U. S. Naval Aide to Admiral Saldias; and Lieutenant (j.g.) A. A. Schirmer (SC).

The Peruvians' itinerary included naval installations and industrial cities.

### 60 University Men Report to ORINS, Lab, AEC, in June

Fifty-four university professors and faculty members will report to the Laboratory early next month for three months of research work in a joint participation program sponsored by the Oak Ridge National Laboratory and the Oak Ridge Institute of Nuclear Studies. This group will bring the number of appointments of university faculty members for research at Oak Ridge to 245.

The great majority of the visitors are here during the summer months, although a smaller number take leaves of absence during the regular school year for this purpose. Twenty-two such leaves were granted during the school year now drawing to a close.

In addition to the 54 who will come to ORNL, four will report to the Institute, and two will work with the UT-AEC agricultural research program. Details of the research participation program were worked out by Dr. Fred C. VonderLage, director of the Educational Relations and Training Division at ORNL, and Dr. Marion T. Clark, acting chairman of the University Relations Division of the Institute.

### "CINDERELLA"

Mrs. Dana Estabrook's dance group will present the ballet, "Cinderella," in Knoxville next week end. The performance will be at 2:30 P.M. Saturday, May 31, at the Knoxville Civic Auditorium.

### Operation of 'Swimming Pool' Reactor At ORNL Announced This Week by AEC

Low-Powered, Relatively Inexpensive Reactor Suitable for Schools and Other Institutions

The development of a relatively inexpensive, low-power nuclear reactor, pioneered and developed by scientists at Oak Ridge National Laboratory, has been announced this week by the Atomic Energy Commission. This reactor, which is submerged in water, is known popularly as the "swimming pool."

This reactor has proved to be an economical and safe producer of radiation for certain purposes. For these reasons, as well as low cost, simplicity, and performance, it is one of several types of reactors which might be suitable for use at schools and other research and training institutions, according to Dr. C. E. Larson, director of the Laboratory, and Dr. A. M. Weinberg, research director.

The reactor is the central feature of a bulk shield testing facility which is used for experiments to aid development of improved reactor shields. It is submerged in a pool of water 20 feet deep, 20 feet wide, and 40 feet long, in which it can be moved about. The reactor became "critical" on December 17, 1950, and was placed in operation soon afterward.

E. P. Bizard and C. E. Clifford of ORNL initiated the project for operating a radiation source under water. William N. Breazeale directed the design work, done by ORNL personnel, and the construction. The reactor and its equipment were built in Laboratory shops, and the facility is now operated by E. L. Meem and his co-workers.

\$58,400, the rest of the cost being for concrete work, the building, and auxiliary equipment. The reactor uses fuel elements which had already been designed for the Materials Testing Reactor which went into operation recently in Idaho.

The "swimming pool" reactor has a continuous, full-load power rating of 10 kilowatts, at which it produces a maximum flux, or neutron density, of approximately 100 billion thermal neutrons per square centimeter per second.

The reactor is an assembly of movable fuel elements placed on end in an aluminum grid. It is suspended by an aluminum framework from what is called the reactor bridge, which spans the pool. The bridge rests on wheels fitted to rails extending

## Sixty years ago this month

### Taken from *The ORNL News* for May 1952

- ORNL topped all previous radioisotope shipment records with 1011 shipments to AEC installations, hospitals, universities and commercial users in the U.S. and abroad. Radioactive iodine-131 and radioactive phosphorus-32 accounted for 56% of the shipments.
- Howard Hudson, frequently referred to as "America's Fastest Secretary," was a recent visitor to ORNL to cover the proceedings of the Biology Research Conference and the Fluid Fuels Conference. On a specially built, high-speed electric typewriter he maintained a fantastic typing record of 160 words per minute, with peaks of 190 for a minute or two — a transcription speed greater than that reached by most shorthand stenographers.
- Drs. Larson and Weinberg announced the Lab's development of a low cost, 10-kilowatt nuclear reactor that is submerged in water, known popularly as the "swimming pool." The reactor has a variety of potential uses in addition to its principal role in the testing of reactor shields.—prepared by ORNL History Room volunteers



A NUCLEAR REACTOR OF 10 KILOWATT "pool" bulk shield testing facility at the Lab as Leo Holland locates an instrument to a low-power reactor, being used to aid development investigations at universities and non-AEC



## From the Lab Director

We were honored by the opportunity on Feb. 15 to host Energy Secretary Steven Chu for a quick nuclear-themed visit. He had earlier in the day visited the site of the Vogtle nuclear power plant in Waynesboro, Ga., billed as “the first of the next generation of passively safe nuclear reactors to be built in the United States.”



Secretary Chu’s visit to ORNL was focused on our leadership of the Consortium for Advanced Simulation of Light Water Reactors, or CASL, which was created in 2010. CASL uses advanced capabilities of the world’s most powerful computers to significantly improve nuclear reactor design and engineering. He received briefings about ongoing CASL research and toured hub facilities, including a 3-D visualization lab.

On his way to the airport Secretary Chu stopped at the new Manufacturing Demonstration Facility (MDF) on Hardin Valley Road for briefings on battery research and advanced manufacturing. He spoke with students who are competing in the national Robotics FIRST competition with coaching from several ORNL researchers. The Lab has also opened up the MDF to local robotics teams for use as a workspace. High schools participating with ORNL sponsorship are Oak Ridge, Hardin Valley, Gibbs, Catholic, Farragut, Seymour, Webb and the STEM Academy.

Congratulations to Steve Zinkle, who has received the prestigious honor of election to the National Academy of Engineering for his many contributions to the understanding of radiation effects in materials for fission and fusion energy systems.

Additional congratulations to Amit Goyal for his election as a 2012 Fellow of the Materials Research Society, recognizing his distinguished research accomplishments and outstanding contributions to the worldwide advancement of materials research.

Also receiving well-deserved accolades is Jerry Tuskan, who has been named Forest Biotechnologist of the Year by the Forest Biotechnology Partnership.

Congratulations also to the team, led by Mike Brady, which was honored with a Federal Laboratory Consortium Award for Excellence in Technology Transfer. The team partnered with Envirofit International and Colorado State University in developing a clean-burning cook stove for use in developing countries.

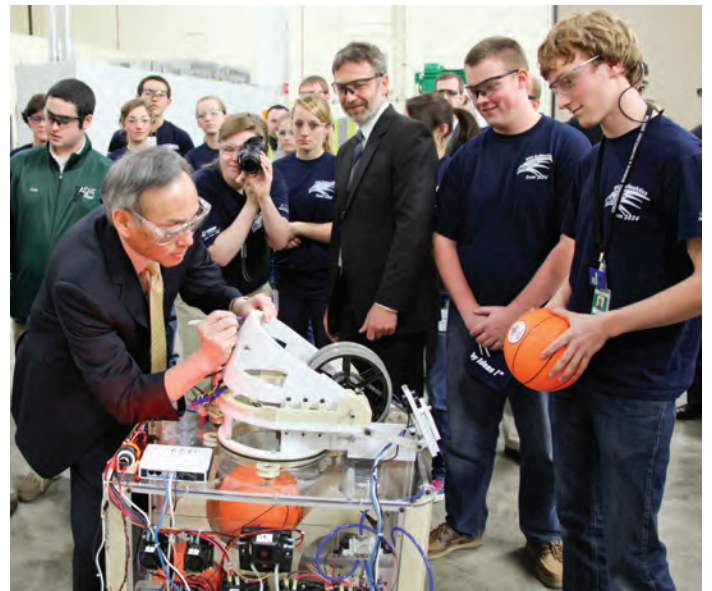
*Thomas Mason*

Thom Mason

“Secretary Chu’s visit to ORNL was focused on our leadership of the Consortium for Advanced Simulation of Light Water Reactors.”



Energy Secretary Steven Chu’s visit to ORNL included a tour of 3-D visualization facilities at the Consortium for Advanced Simulation of Light Water Reactors. (Photo: Jason Richards)



Secretary Chu signs the robot of Hardin Valley Academy’s “RoHawktics” team, one of eight local schools participating in the FIRST Robotics competition with ORNL sponsorship. (Photo: Jason Richards)



Oak Ridge National Laboratory  
**Reporter**  
P.O. Box 2008  
Oak Ridge, TN 37831-6266

PRSR STD  
U.S. Postage  
PAID  
Permit # 37  
Knoxville, TN

## Crystal of the month club

**This color micrograph from ORNL's Materials Science & Technology Division was selected by Buehler**, the scientific equipment manufacturer, for its 2012 Buehler Microstructure Calendar. The month-of-December image reveals the surface of a single crystal of potassium niobium oxide. ORNL's Lynn Boatner, Joanne Ramey and Tom Geer obtained the image by using differential interference contrast microscopy at a magnification of 100x. "This layered structure forms through the intercalation of water in the material following exposure of the single crystal to the air," Boatner said.

