

**SCIENCE**

## Agitator: What a washing machine and E.O. Wollan did for early neutron science

In accounts of seminal neutron research at ORNL's Graphite Reactor, a washing machine figured prominently in some of the first neutron measurement experiments ever performed.

In a 1950 *Physics Today* article titled "Physics at Oak Ridge," Alvin Weinberg stated the importance of knowing the neutron properties "not only of the fissionable isotopes ... but also the neutron properties of elements which might appear in a reactor either as fission products or as structural materials."

During the war, the measurements were needed to address the issue of reactor "poisoning." Manhattan Project scientists learned the hard way at Hanford that certain fission products could effectively shut down the reactors. At Oak Ridge, a researcher named Ernest O. Wollan was among scientists who feverishly worked to understand the phenomenon.

To obtain the measurements, Eugene Wigner suggested researchers move an element sample back and forth in the high flux area of the reactor. But the Graphite Reactor team had to come up with some sort of oscillating mechanism. Wollan adapted the agitating mechanism of a Maytag washing machine so that, by pulling strings, a reciprocating motion produced a sinusoidal signal that allowed

the researchers to take measurements.

The "pile oscillator" was just one of Wollan's innovations. He is also credited with the development of the gamma dosimeter, a safety device that likely saved numerous lives. In May 1944 Wollan requested permission to set up an X-ray diffractometer he had brought from the University of Chicago for his biggest innovation of all.

"I would like to attempt to measure the diffraction of neutrons by single crystals. I have brought some equipment with me from Chicago, and Dr. [L.B.] Borst has shown me an opening in the pile at which this work could be done," he wrote his boss, R.L. Doan.

Permission was apparently granted, because by 1950 he and a protégé, Clifford Shull, authored an article in *Physics Today* titled "Neutrons as Waves and Particles." In it, Wollan and Shull (the future Nobel laureate) described much of what had been learned about neutrons since James Chadwick discovered the neutral particles in 1932, one nuclear reactor and a cannibalized home appliance in the meantime.—*Bill Cabage with*

*Tim Gawne* 🌿



*Eugene Wigner (left) and Ernest O. Wollan in 1946.*



*Herb Pomerance with the Maytag-powered pile oscillator.*

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## USS Nautilus crew visits Oak Ridge



Former crew members of the USS Nautilus tour the control room of the Oak Ridge Graphite Reactor as part of their reunion.

**Approximately 15 former crew members of the USS Nautilus – the world’s first nuclear powered submarine** – came to understand nuclear technology and the Oak Ridge role in the development of their vessel during an Oct. 1 trip to Oak Ridge.

Visiting ORNL and Y-12, the crew received a better understanding of Oak Ridge technology and how it led to the construction and operation of the submarine, which was active from 1954 until 1980.

Bob Childs of Clinton, retired from working at the High Flux Isotope Reactor and a former Nautilus crewmember, said the opportunity to visit Oak Ridge as part of the crew’s reunion was something the men and their families were buzzing about since their arrival in Pigeon Forge, where the reunion was headquartered.

“Oak Ridge was instrumental in a lot of the shielding studies, the fuel studies and everything that went into the development of Nautilus,” Childs said. “A lot of these fellows were part of the original Nautilus crew. They have gotten a chance in their later years to see where this all took place.”

The five-hour Oak Ridge tour included stops at the High Flux Isotope Reactor, the Graphite Reactor and the Supercomputing Center. The group earlier received a bus tour around parts of Y-12 with Oak Ridge historian and Y-12 employee Ray Smith providing commentary. Smith helped set up the visit and toured with the group during the entire day.

Warren Johnson of Clearwater, Fla., stayed in nuclear-related work after leaving the Navy and felt as though he was in familiar surroundings even though this was his first visit to Oak Ridge.

“When I joined the Navy in 1960, I didn’t even know what the word ‘nuclear’ meant,” Johnson said during a lunch break in the ORNL Cafeteria. “My experience in the Navy and aboard the Nautilus provided a foundation that led me into nuclear work when I retired from the Navy and went to work at Babcock Wilcox.”

Visiting the control rooms of both HFIR and the Graphite Reactor, Johnson enjoyed comparing those facilities with the Nautilus control room and the Babcock Wilcox control rooms where he worked.

“While the technology has advanced and there are a lot of differences between the old control rooms aboard the Nautilus and other nuclear power plant control rooms, the technology is still pretty much the same across the board,” Johnson said. “To see these control rooms here in Oak Ridge brings one back to the basics of nuclear technology.”

Fred Carlson, a former Nautilus crewmember who later went to work for a utility company in upstate New York, may be a veteran of the nuclear industry, but he still learned plenty of new information during his visit.

“I’ve always heard a lot about Oak Ridge, but I have never been here before,” Carlson said. “To see where everything got started more than 60 years ago and hear the stories related to it is a thrill.”

Ray Engle, formerly of Chicago, came away from the visit with a different perspective of the Graphite Reactor.

“I was a student at the University of Chicago in 1942 when Enrico Fermi was doing his experiments,” Engle said. “I played squash, and the old squash courts were under the football stands where Fermi was doing his research. There were times when we wouldn’t be allowed in there to play because there were experiments taking place. We weren’t told what all this was about. We learned much later. Looking at this all these years later gives me a better understanding of Fermi’s work.”

Childs said the visit was a highlight of the Nautilus reunion.—Fred Strohl 🌿

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“Oak Ridge was instrumental in a lot of the shielding studies, the fuel studies and everything that went into the development of Nautilus.”

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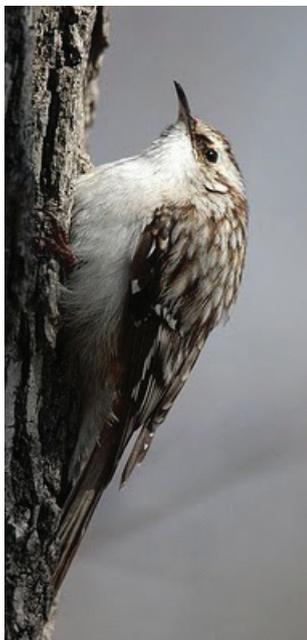
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## Birds eye view – five steps to creating a bird-friendly backyard



“It’s a sure sign that the seasons are **changing** when you start seeing new seasonal birds frequent your yard. Yesterday, I was sitting on the front porch and saw a brown creeper working its way up the trunk of a tree. Can winter be far behind?”

The blog excerpt by Lyn Bales, local Tennessean, Ijams naturalist and author, speaks to this time of year when leaves turn and temperatures drop. During late fall and winter months, many of us tend to neglect our backyards. With Bales’ tips, you can create a rich bird refuge to be enjoyed year round.

- **Provide a water source**—a necessity and especially tough for birds to find in the heat of summer or middle of winter. Bales recommends choosing a heated water feature. It will warm the water just enough to keep it above freezing.
- **Provide feeders**—seed or suet, which is a mix of seeds and energy-rich fats and proteins. Suet keeps birds warm and should be reserved for high-energy springtime or cold winter months. For a project, make your own suet cakes (recipe above).
- **Invest in nest boxes**—purchase or build several different sizes. This will attract a variation of local bird species including Eastern bluebirds, Carolina wrens, tree swallows and even screech owls.
- **Make sure there are a variety of plants**—specifically berry-producing trees and shrubs. The plants are safe hideaways from predators and the berries offer mineral-rich nutrition much like fresh fruit. Start with the flowering dogwood, which offers beautiful blooms in spring and berries in fall. To attract hummingbirds in summer, red flowering plants are commonly used. However, the main goal is to offer nectar-rich flowering plants.—*Stephanie Ritchie* 🌿



### Suet Cake — Soft Peanut Butter Mix

1 cup fresh ground suet  
1 cup peanut butter  
3 cups yellow corn meal  
½ cup white or whole-wheat flour

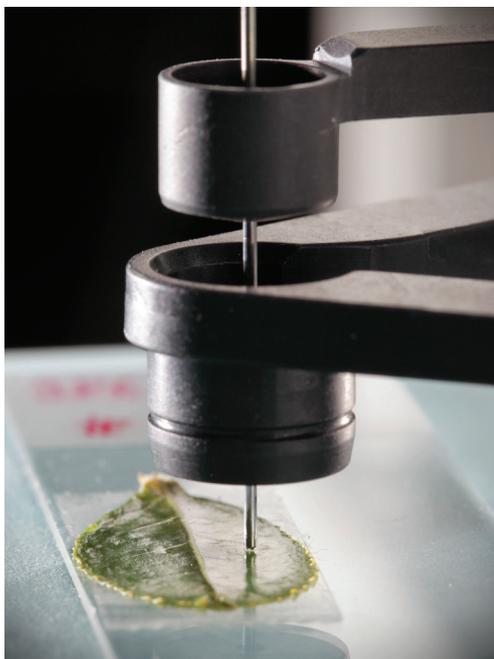
1. Melt suet in a saucepan over low heat.
2. Add peanut butter, stirring until melted and well blended.
3. Mix the rest of the ingredients together in a large bowl.
4. Allow the suet-peanut-butter blend to cool until slightly thickened, then stir it into the mixture in the bowl. Mix thoroughly.
5. Pour or pack into forms or suet feeders; smear onto tree trunks or overhanging limbs and branches; or pack into pine cones.

## 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 576-3753 or jamesla@ornl.gov.

- Nov. 4 Fall Festival and Craft Show
- Nov. 6 Planetarium Trip
- Nov. 25 Scrooge (OR Playhouse)
- Nov. 27 Football: UT vs. Kentucky
- Dec. 4 Fiddler on the Roof
- Dec. 11 Best Christmas Pageant Ever (C.C. Playhouse)
- Dec. 17 Ice Skating
- Dec. 19 Lady Vols vs. Stanford
- Dec. 19 KSO/Clayton Christmas Concert

## ORNL scientists probing the future of drug discovery



A surface sampling probe developed by Gary Van Berkel and Vilmos Kertesz has applications in drug development.

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“If you can’t see the full suite of molecules, drugs and metabolites, you’re limiting the information you have about how a drug works.”

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**A new analytical technology developed at ORNL aims to uncover critical clues about drug metabolism.** Gary Van Berkel and Vilmos Kertesz of ORNL’s Chemical Sciences Division invented a novel sampling probe that can help identify fragile compounds, which may play a critical role in drug research and development.

The technology, which was licensed to AB SCIEX, a global leader in life science analytical instrumentation, offers simplicity, speed and cost effectiveness of sampling. These factors are crucial for drug researchers who use sophisticated equipment like mass spectrometers to collect information from tissues dosed with a candidate drug.

The ORNL probe can efficiently collect samples from the tissues without damaging fragile compounds like phase II metabolites that appear as drug byproducts. Van Berkel says such compounds are not typically studied directly from thin tissue sections using currently available direct surface sampling methods.

“We have the ability to see certain fragile molecules that other techniques have difficulty seeing,” Van Berkel says. “If you can’t see the full suite of molecules, drugs and metabolites, you’re limiting the information you have about how a drug works.”

Conventional techniques that analyze the disposition of drugs in tissues, such as whole-body autoradiography, can be time-consuming and costly.

Pharmaceutical industries are now heavily invested in the use of mass spectrometry instruments, which examine molecular composition, to investigate how potential drugs distribute and break down inside an organism.

Another feature that industry is beginning to value is the ability to sample in an ambient, or real-world, environment. Many mainstream mass spectrometry techniques must be performed under a vacuum, severely limiting the types of samples that can be easily studied.

“The market now appreciates the potential advantages of sampling and ionizing surface materials for study under real-world conditions, not under a vacuum, as has been traditionally the case,” Van Berkel says. “Our probe allows for in situ surface sampling to be carried out under atmospheric pressure.”

The fully automated probe works by creating a micrometer-scale liquid interface, or microjunction, between the instrument and sample. In this noninvasive technique, a sample dissolves in the liquid, is drawn back into the probe, and is “electrosprayed” back into the mass spectrometer for subsequent analysis without damaging the sample.

### From physics to pharmaceuticals

The use of mass spectrometers to study biological tissues directly is a relatively new concept, considering that the instrument originated over 100 years ago in the field of physics. Researchers developed the equipment to study the nature of matter, ultimately making key discoveries such as the identification of stable isotopes.

At Oak Ridge, mass spectrometry equipment has long been a key contributor in scientific research and development. Beginning in the 1940s, mass spectrometers known as calutrons were used in Oak Ridge to separate uranium isotopes for the Manhattan Project.

Van Berkel says Oak Ridge’s unique history of mass spectrometry provides a solid basis for further exploration of mass spectrometry applications far beyond calutrons.

“Scientists and industry alike are continuing to push the frontiers of mass spectrometry to solve challenges in areas such as life sciences, environmental sciences and national security,” Van Berkel says.—*Morgan McCorkle* 🌿

## A slow fade

### An ORNL employee shares his story of caring for a loved one with Alzheimer's

**Imagine yourself sitting alone in a nursing home.** Evening is fast approaching. It's getting dark outside, and you don't know where you are. People speak to you as they pass by your door, yet you can't understand why someone left you all alone. Fear overcomes your mind until you finally panic and cry out for help.

Unfortunately for the over 5.3 million Americans diagnosed with Alzheimer's disease, this scenario, known as "Sundown Syndrome," is all too familiar. The most common form of dementia, Alzheimer's can affect different people in different ways. And while memory loss is the most typical warning sign, the disease is progressive, fatal and invades families once every 70 seconds.

Margie Jean Payne was 64-years-young when she received her official diagnosis. Her son, Terry, a Program Manager in the Energy Science and Transportation Division, stepped in as primary caregiver after making a promise to his dying father.

"His last words were, 'Take care of your mom'," says Terry.

After living with his mother and the disease for several years, Terry chose to share his story with a group of ORNL employees. His goal: To inform and empower those struggling to help and care for a loved one with Alzheimer's disease.

Being the primary caregiver requires a great deal of commitment and compassion. The disease affects the sufferer physically, emotionally and mentally. Because patients often forget to eat, caregivers need to keep a watchful eye on nutrition and medication use.

Ironically, assisted living facilities often allow residents a great deal of "TV time." In actuality, according to experts, this is extremely detrimental to ailing patients. As plaques, or abnormalities, build up between the brain's nerve cells, experts believe they somehow block communication and disrupt activities that cells need to survive. This eventually leads to nerve cell death and tissue loss. Over time, the brain shrinks dramatically. In order to avoid atrophy, doctors recommend that caregivers promote brain stimulation with puzzles, reading or group activities.

Advises Terry, "There will be days when you aren't sure where to turn. Look into resources such as caregiver training and support groups, most of which are offered through local Alzheimer's Association chapters."

"You will have to make a lot of tough decisions," says Terry. "Be prepared because emotions can make it tougher."

While Margie Jean was determined to live in her home, Terry recognized the point when her safety was at risk and it was necessary to choose an assisted living facility or nursing home. Recalling his experience, Terry was able to offer his audience three lessons learned.

First, go visit the facility. Arrive unannounced on several occasions and request a grand tour. This will provide a "true picture" of the facility, living quarters and activities offered to residents. Second, research the facility through the state. In Tennessee, complaints are listed in an online public database. While some comments are petty, the majority of the information can be very useful. And most important, make sure the facility meets the needs of your loved one; "put yourself in their shoes."

Margie Jean Payne passed away Thanksgiving 2008. As in many families with multiple siblings, Terry bore the brunt of his mother's care. But, in hearing him speak, it seems he has no regrets.

"My mom took care of me when I couldn't take care of myself," says Terry. "I was able to do the same and got a chance to repay her."

To learn more about the disease, local support groups or caregiver training, visit [www.alz.org](http://www.alz.org).—Stephanie Ritchie 🌿



**If your loved one is showing tell-tale signs of having Alzheimer's,** Terry suggests pre-planning before a formal diagnosis.

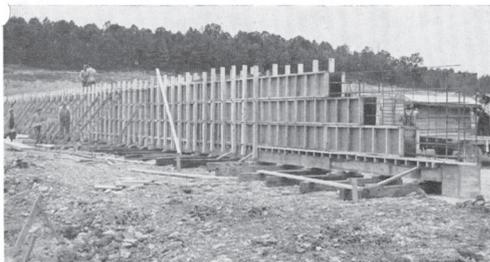
- **Research long-term insurance** as soon as you can. For verification purposes, insurance companies must speak with the person receiving care, so it's best if your loved one's condition is in the early stages.
- **Assure wills are up to date.** Terry encourages caregivers to arrange for loved ones to review wills with their attorneys.
- **Finalize powers of attorney.** This is critical in making final decisions.
- **Change bank accounts** to reflect joint ownership or payable on death.
- **Look into selling a loved one's home** or suggest division of property. As there is still no cure for Alzheimer's, the condition will only worsen with progression. Loved ones rarely return home.
- **Pre-plan the funeral** with as many family members as possible.



# THE NEWS

OAK RIDGE NATIONAL LABORATORY

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**BEGINNING OF ACTUAL CONSTRUCTION OF THE NEW RESEARCH BUILDING**—The first pouring of concrete started Wednesday of last week and it went into the above pictured building form which frames the west exterior wall of Wing No. 4, a wall 227 feet long. North end of this wall connects on to the west wall of the Research Building's main section which extends another 72 feet northward.



**EXCAVATING FOR SOLID ROCK FOUNDATION FOR ISOTOPE RESEARCH AND SEMI-WORKS BUILDING**—The east edge of this area is about 45 feet from the west wall of Wing No. 4, of the Research Building. Depth penetration was attained by Staff Photographer shooting the scene from a perch 25 feet up on a crane which was leaning against the approximately concrete hopper.

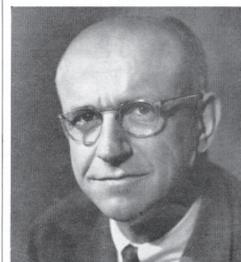
## Construction Progress On Research Lab Marked By Pouring Of Concrete

Progress being made on the new Research Laboratory, Bldg. No. 1, and the new Isotopes Research and Semi-Works Laboratory, Bldg. No. 2, is now becoming visible to all laymen who have had the opportunity lately of visiting the construction site located in the unrestricted area just east of the existing plant. The contractor already has started pouring concrete into forms framing the west wall of Wing No. 4 of the Research Building.

The two buildings are two major projects of New Facilities Construction Program "H" in the Atomic Energy Commission's plan for permanentization of the Laboratory and were designed by The Austin Co., Architects and Engineers, Laboratory coordination with The Austin Co. is being performed by the New Facilities Design Department under the Direction of Dr. D. C. Bardwell. The Isotopes Research and Semi-Works Building is located nearest to the Plant Area and is being erected by the J. W. Bateson Co., Inc. The Research Laboratory building will be located just east of the Isotope Research structure and is being erected by the John A. Johnson and Sons, Inc. When completed these two buildings will be connected by a tunnel.

Completion date for the Isotopes Research and Semi-works Building has been set for September 12, 1951. Completion date for the Research Building has been scheduled for November 20, 1951.

Unless one is familiar with building construction, progress appears slow during the period in which excavation is being done and prior to the time that concrete footings, piers and walls are erected. However, this is not true in respect to these two projects as the excavation being done...



## Boyer Named AEC General Manager

Marion W. Boyer, 49, Esso Standard Oil Company executive and petroleum expert, last week was named General Manager of the Atomic Energy Commission, effective November 1. He succeeds Carroll Wilson, who resigned from the position on August 8.

In announcing Mr. Boyer's appointment to the top operating job in the fast expanding program for developing atomic energy, Gordon Dean, Chairman of the Atomic Energy Commission said:

"He brings to this key place in the atomic energy program broad executive and technical experience..."

## Chest Drive Totals Half Quota 1st Week

The Labor is well on the way toward achieving its quota...

## Evening Course in Elementary Physics Began Oct. 25 with 63

An evening course in Elementary Reactor Physics under the direction of Dr. D. K. Holmes began on October 25 for the benefit of members of Research Divisions within the Laboratory.

The class is held on Monday and Wednesday of each week in the conference room of the cafeteria in the Y-12 Area from 5:00 to 6:30 p. m., and it is expected that the course will continue for approximately six months.

Dr. David K. Holmes, who prepared some of the lecture notes used in the School of Reactor Technology, is in charge of the Elementary Reactor Physics course and has indicated that members of the class will be expected to spend several hours per week in addition to class time in working problems assigned and in preparation for examinations which will be given throughout the course.

Division directors were asked to submit the names of personnel in their Divisions who would attend this course, and the response was gratifying, said Dr. Holmes. Sixty-three Laboratory employees have enrolled in the course; 19 from Materials Chemistry, 13 from Reactor Technology, 10 from Isotope Research and Production, 6 from ANP, 5 from Physics, 4 from

Health-Physical Technology. The course covers the same topics as the class in the Technology, and will be on...

## Carbide Sp Nov. 7 Ele

Complete coverage to the rest of the nation... WATO, in November 7, it has been announced by Carbide... will continue as long as... are made available...

## ORNL Girls C

The ORNL Girls... its next regular... at 8 o'clock, Monday... Garden Apartment... Vanderbilt Drive... Jayne Kelly, public... for the organization... will be devoted to... ness and social ac...

## Sixty years ago this month Taken from The ORNL News for November 1950

- Dr. Cecil Ellis is named Coordinator of the Aircraft Nuclear Propulsion (ANP) Division. He came here on loan from the U.S. Air Force. In 1943 and 1944 he was associated with the Manhattan Project at Columbia University and engaged in high vacuum leak detection.
- Headlines in Chemistry Program on WATO, American Chemical Society guest speaker L.E. Burkhart, stressed the importance of fluorine in drinking water for the preservation of teeth.
- Dr. Francis Davis and Mr. Paul Reinhardt, Health Physics Division, are working with the U.S. Geological Survey in aerial exploration for radioactive metal (uranium) throughout the country. Their job is to design, build, operate and maintain the detection equipment.
- Dr. Max Bredig, formerly with the Physics Division, has been appointed Associate Director of the Chemistry Division, to work primarily on chemistry of the solid state, especially high temperature and crystal chemistry.
- The Long Range Reactor Planning Group has been established in the Reactor Technology Division. J.A. Lane will direct the group; N.F. Lansing and L.C. Noderer will assist similar groups from other labs and guide the overall reactor effort of the AEC.
- November marks seven years since Dr. Fermi supervised the start-up of the graphite X-10 pile. Loading of the uranium slugs started at 5 p.m. on November 3, 1943, and at 2:30 a.m. on November 4th, the neutron counters indicated the pile had reached the critical point and a chain reaction was occurring.

—prepared by ORNL History Room volunteers

## From the Lab Director

ORNL continues to win a host of national awards. Two Lab technologies, TRIAD and Flexible Thin-Film Solar Photovoltaics on RABiTS, have been selected to receive the 2010 Excellence in Technology Transfer award in the Federal Laboratory Consortium's southeast regional competition.

The Telemedical Retinal Image Analysis and Diagnosis, or TRIAD technology, is a Web-based telemedical diagnostic system that enables patients to be quickly screened at a doctor's office or another remote site, permitting early detection and referral for diabetic retinopathy and other retinal diseases.

Flexible Thin-Film Solar Photovoltaics on RABiTS is a technology developed in conjunction with the National Renewable Energy Laboratory and combines ORNL's high-temperature superconducting foil with NREL's work in photovoltaic materials.

Congratulations go to Budhu Bhaduri, who received the 2010 Homeland Security Award from the Christopher Columbus Fellowship Foundation. The award recognizes Budhu's leadership in the development of LandScan USA.

Dana Christensen has received a great opportunity at the National Renewable Energy Laboratory, where he has accepted the position of Deputy Director for Science and Technology. As manager of the nation's largest energy portfolio, Dana strengthened ORNL's leadership role in a host of key energy technologies. I know I speak for many of us who will miss Dana but who also wish him the best in an exciting new job.

The separation of the benefit programs that previously covered both ORNL and Y-12 passed a significant milestone with the first payment of pension checks to retirees on October 1. The separation is very important to our retirees and, from all accounts, went smoothly. The pension vendor, Northern Trust, issued a total payroll of approximately \$6.2 million covering 4,400 retirees and surviving spouses. I have heard favorable comments from staff within the Lab and from retirees regarding the change and the transition process. The success of the separation comes as a result of an outstanding effort by our HR, IT, payroll, and communications organizations. The Business Services Directorate now has responsibility for paying both active employees and retirees monthly, which amounts to approximately 9,300 individuals who are present and past employees of ORNL.

Finally, congratulations to Ronnie Shockley, who won the Ford F-150 truck at the recent safety celebration on the Quad. Some 600 Facilities and Operations employees who were injury-free during fiscal year 2010 qualified for the drawing. The number represented 99 percent of F&O staff, a record deserving special praise. Logistical Services Division's John Bui was the recipient of a \$5,000 bonus in the drawing for supervisors. We ask everyone to make 2011 another exceptional year in working safely.

*Thomas Mason*

Thom Mason




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“ORNL continues to win a host of national awards.”

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Facilities and Operations director Herb Debban hands the keys to a Ford F-150 truck to Ronnie Shockley at the recent safety celebration on the Quad.



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## Native plantings shine with new identification signs

While vibrant leaves and chilly mornings herald the fall season, signs of life are still springing forth in the landscaping around ORNL's campus.

New plant identification markers have been installed around the Visitor Center, the Quad and the west campus area near Bldg 1520 to showcase the different types of native plants used in ORNL landscaping. Native plants and natural landscaping have been a major component of ORNL's modernization plan.

"The goal has been to try and use plants that are found naturally on the Oak Ridge Reservation as much as possible in ORNL landscaping," says Pat Parr, ORNL's natural resources manager. "This gives ORNL a uniquely different look from traditionally landscaped areas and offers the opportunity to learn about our local native plants."

ORNL's coordinated landscape design provides habitat enhancement, erosion control, water-quality improvements and restoration of native plants and wildlife.

"Native plants support native birds, butterflies, dragonflies, and other wildlife—some of which are dependent on specific native plant species for food and reproduction," Parr says.

