

Careers in Isotope Science and Engineering

at Oak Ridge
National Laboratory



Oak Ridge National Laboratory



AT A GLANCE

Established in **1943**
as part of the Manhattan Project

\$2.2B annual budget

9 national
user facilities

5,400 employees

3,200 visiting
scientists

221 R&D 100 Awards

2 Nobel Prize winners

46 National Academy
members

17 UT-ORNL Governor's Chairs

9 university core
research partners

9 new elements discovered

Contents

- 2 Big Science. Big Opportunities.
- 3 Building the World's Premier Research Institution
- 4 About the Isotope Science and Engineering Directorate
- 6 Continuing ORNL's Legacy in Isotopes
- 7 Lab of the Future
- 8 Community and Culture
- 9 How to Apply



Big Science. Big Opportunities.

Oak Ridge National Laboratory (ORNL) was created to help win a war and change the world. We have always adapted to meet national needs, developing expertise, tools, and even entirely new fields to solve the most difficult scientific and technical challenges.

- **We pioneered nuclear energy, science, and engineering**, developing techniques, technologies, and training programs that led to commercialization of nuclear power and creation of the nuclear navy.
- **We produce isotopes not available anywhere else in the world**, allowing for the discovery of new elements, life-saving medical treatments, industry applications, deep space exploration, and national security.
- **We developed neutron diffraction**, a scientific technique available to researchers who use two of the world's most powerful neutron sources at ORNL for studies of materials, medicines, disease progression, and more.
- **We create new materials** including alloys with billion-dollar impacts on industry and unique properties that enable NASA to explore outer space.
- **We build some of the world's most powerful supercomputers**, with three No. 1 systems since 2009 and one of the world's first exascale systems, Frontier, due in 2021.
- **We printed a car** (and a house, jeep, boat ...) to study methods for improving the efficiency and productivity of manufacturing processes that give American industry a competitive edge.
- **We secure the nation** with expertise from across our research portfolio, sending teams worldwide to keep nuclear materials safe, pursuing cybersecurity for the power grid, and more.
- **We discovered the sex-determining role of the Y chromosome** and make breakthroughs in biology from genes to ecosystems, providing insights benefiting biotechnology, biosecurity, and biofuels.
- **We invented radioecology** and lead large-scale experiments in the Arctic and other remote locations.

*Join us on
our quest to
deliver scientific
impact that
changes the
world.*

We always ask, "What's next?" We stand ready for the unexpected. Today, we are applying our expertise in several areas in the global fight against COVID-19, and we are looking to the future.



Building the World's Premier Research Institution

National labs are distinguished by their ability to assemble large teams of experts from a variety of scientific and technical disciplines to tackle compelling national problems. They also design, build, and operate powerful scientific facilities that are available to the international research community.

From the start, ORNL has applied scientific discoveries and new technologies to address pressing challenges in the areas of clean energy and global security and to create economic opportunity for the nation. Today, Oak Ridge is the most diverse of the Department of Energy's 17 national laboratories, providing leadership in energy research and technology, advanced materials, nuclear science and engineering, neutron science, isotope production, national security, environmental and biological sciences, and high-performance computing.

Resources like these enable the US to compete in what former ORNL Director Alvin Weinberg called the arena of "Big Science" and they empower our researchers to pursue knowledge that's fundamental to solving some of our world's greatest challenges.

Biology and Environment

We sequenced the poplar genome and are leveraging these data with ORNL-developed algorithms and supercomputing to engineer better bioenergy feedstocks and more climate-resilient crops.

Fusion and Fission

A multidisciplinary team is printing a microreactor to help industry address high costs and lengthy deployment timelines that threaten the future of nuclear energy—the nation's largest carbon-free energy source.

National Security

The Mobile Uranium Facility equips ORNL staff members to characterize, process, package, and transport uranium materials anywhere in the world. We are using our scientific capabilities to counter enduring and emerging threats to national security.

Materials

We developed a new class of affordable, lightweight superalloys that can withstand temperatures almost 100 degrees Celsius hotter than existing commercial alloys in complex engine parts.

Clean Energy

Our magnetic coils and power electronics enable the extreme fast charging of electric vehicles—wirelessly. ORNL's expertise also supports industry and has set standards for energy efficiency.

Isotopes

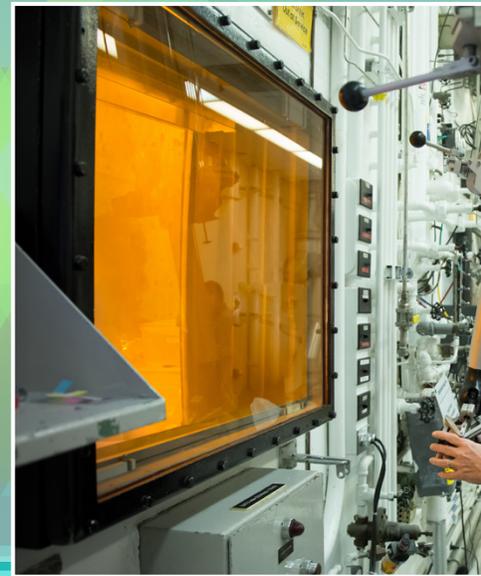
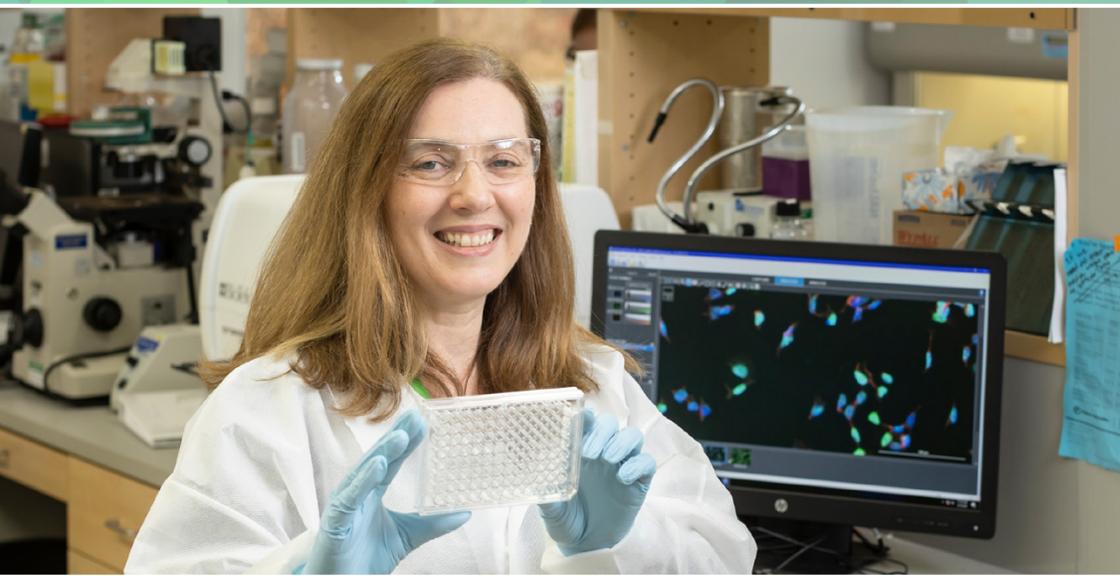
We produce unique medical isotopes for life-saving treatments and diagnoses, including actinium-227, a critical material for making a highly effective prostate cancer drug.

Neutron Science

We use neutrons to directly observe battery behavior in pursuit of safer, more reliable energy storage and extended battery life, to study the behavior of drugs in combating disease, and much more.

Supercomputing

Our scientists are cracking the code on opioid addiction using Summit, one of the world's fastest supercomputers, to perform immense calculations on genomic data. Summit provides unique multi-precision computing capabilities that are ideal for artificial intelligence and machine learning applications.



About the Isotope Science and Engineering Directorate

The directorate is focused on isotope science and technology, delivering high-impact isotopes that offer a range of applications for industry, science, and medicine, making ORNL a world leader in isotope research, development, and production.

It is built upon the foundational science performed during the Manhattan Project, when the Lab pioneered world-changing technologies and applications to harness the atom. Using the X-10 Graphite Reactor, the world's first continuously operated nuclear reactor, ORNL worked to better understand and produce strategically important isotopes. Today, the Lab uses its institutional knowledge and leading nuclear facilities for breakthrough technological innovations.

The directorate is working on advancing the application and production of stable and radioactive isotopes for scientific discovery, life-saving medical treatments, industrial applications, deep space exploration, and national security; advancing technology as the nation's steward of enrichment science and engineering; and operating, maintaining, and expanding the Lab's complex of nuclear facilities.

ENABLING DEEP SPACE EXPLORATION

In 2015, ORNL produced 50 grams of plutonium-238, restoring the nation's capability after nearly 30 years. Since that achievement, the Lab has continued advancing the production of the valuable radioisotope—leveraging the Lab's High Flux Isotope Reactor and the Radiochemical Engineering Development Center, ORNL's largest hot cell facility—moving closer to the goal of 1.5 kg of Pu-238 annually by 2025. Because of this success, NASA is considering additional deep space missions in the coming decades, and the Mars 2020 mission is using ORNL-produced Pu-238 to help power the Perseverance rover.



The research portfolio for the directorate spans three divisions and advances key science, technology, and engineering capabilities while building a competitive world-class workforce to meet our future mission needs.

- The **Radioisotope Science and Technology Division** provides leadership in actinide science, delivers innovations in isotope production technology, and advances the field of radiochemical processing methods to provide for the production and delivery of radioisotopes for science, medicine, industry, and security. The division's focuses include improving irradiation target assemblies, developing production infrastructure, pursuing new isotopes, and researching innovative radioisotope applications.
- The **Enrichment Science and Engineering Division** is the national steward for research, development, and demonstration of centrifuge technology innovations; advances electromagnetic isotope separations technology; and delivers stable isotopes for medical, industrial, and DOE mission critical applications. The division works with state-of-the-art systems, applying advanced theoretical and engineering analysis principles to design machines and manufacture prototypes using novel fabrication tools and techniques. Researchers are focused on conceptualizing, developing, and deploying enrichment systems, including designing robust, flexible testbeds with advanced control system architectures. The division also leads new enriched isotope production approaches.
- The **Nonreactor Nuclear Facilities Division** operates, maintains, and modernizes ORNL's unique complex of nuclear facilities to support the ongoing and increasing demand for isotope production and nuclear fuels and materials development. This includes the facility infrastructure, staffing, and processes needed to support the Lab's diverse R&D mission. The division also oversees transportation of nuclear materials on site in support of the lab's missions. It provides safety support, through engineering designs for facility upgrades, evaluation of the methods used to implement R&D mission activities, training, work control, and document control.

AT A GLANCE



More than 375 scientists, engineers, and technical support staff



\$175 million R&D budget



70 percent of the world's Californium-252 is produced by ORNL



1946 ORNL makes the first official shipment of a radioisotope produced at a nuclear reactor



Plutonium-238 produced at ORNL will help power the Perseverance rover in NASA's 2020 mission to Mars



Element 117, now known as tennesseine, was discovered in 2010 using ORNL-produced berkelium-249



Continuing ORNL's Legacy in Isotopes

Established in 2020 as part of Reimagining ORNL, this new directorate is sharpening the Lab's focus on the isotopes mission. Using the High Flux Isotope Reactor, the Radiochemical Engineering Development Center, and the Lab's other hot cell facilities, this new directorate will grow the impact of the unique isotopes produced at ORNL. Just in the last decade, the Lab started production of actinium-227, a critical ingredient in a highly effective prostate cancer treatment; discovered tennesseine, element 117; and produced ruthenium-96—the first ruthenium enriched in the United States since 1983—to support studies on fundamental nuclear physics. Each of these milestones represents the Lab's leading-edge isotope production capabilities and sustains a legacy that began less than a year after World War II, when ORNL made its first official shipment of an isotope for treating cancer patients.

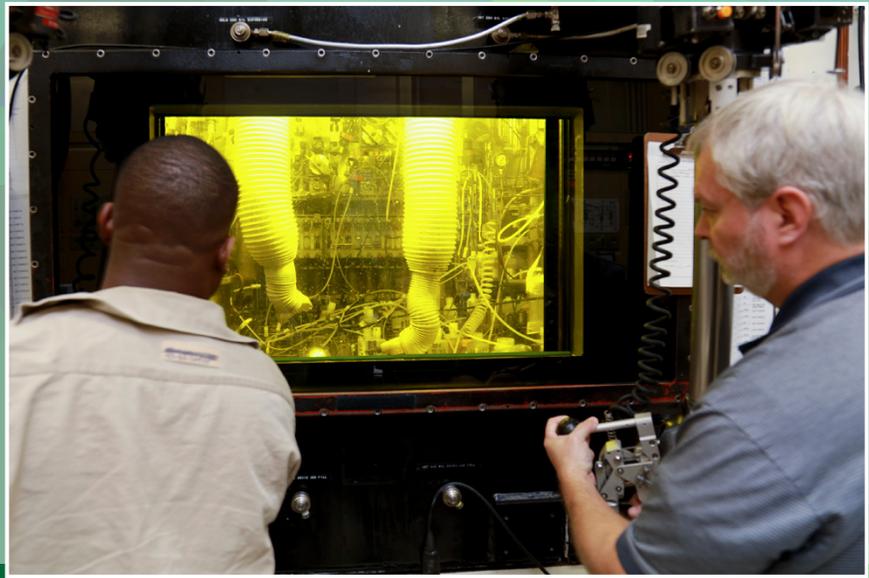
Ten-Year Vision

Over the next decade, we will answer the nation's need for new applications and production of unique isotopes through our diverse staff of scientists and engineers and world-leading capabilities.

Our vision enables us to:

- Make vital science and technology advancements that expand the application and production of isotopes for science, medicine, industry, and security.
- Carry out advancements and technology deployments that enable important national missions as the nation's steward of enrichment technology, including centrifuge technology development, electromagnetic isotope separations technology advancement, and stable isotope production.
- Operate, maintain, and expand the unique facilities that comprise ORNL's isotopes and nuclear materials complex to ensure their continued impact for the next generation of nuclear scientists and engineers.





Lab of the Future

In May 2020, we launched an internal initiative to strategically expand opportunities for scientific leadership aligned with growth in key programs, mission needs, and emerging research areas. As part of the effort, ORNL's Leadership Team considered how to sustain global leadership in research and development, a relentless pursuit of operational excellence, and an inclusive environment that fosters innovation, creativity, and collaboration.

Our goal is to serve the nation as the world's premier research institution, empowering leaders and teams to pursue breakthroughs in an environment marked by operational excellence and engagement with the communities where we live and work.

Join Us!

ORNL's research groups and sections are the building blocks of a premier research institution and will focus on the disciplines essential to our missions and to leadership in emerging fields. We're creating new, focused teams to accelerate leadership in core capabilities identified by our sponsors, partners, and research staff.

- New **Section Heads** will provide R&D leadership to groups in common thematic areas, set consistent expectations, coordinate across disciplines, and help to align the activities of groups with the vision of the directorate and the Lab as a whole.
- New **Group Leaders** will sustain individual excellence in research and development while building a group of peers who pursue global leadership and exemplify ORNL's commitment to solving some of the world's most difficult problems.

Leadership Opportunities in Isotope Science and Technology

- Radioisotope Research and Development
- Radioisotope Production and Operations
- Centrifuge Engineering and Fabrication
- Testing Science and Cascade Engineering
- Stable Isotope Research, Development, and Production
- Nuclear Facility Management
- Nuclear Operations
- Safety Engineering and Support

*We're seeking
passionate leaders who
will help us become the
world's premier
research institution.*



Community and Culture

The strong partnership between DOE and ORNL contractor UT-Battelle, LLC, has created a national resource that draws outstanding researchers in a wide range of disciplines to world-class facilities where they tackle fundamental scientific challenges, couple discoveries with applied research, and work with industry to translate results into commercial applications. The work of the laboratory is being performed safely and efficiently in a modern campus setting. Throughout the region, ORNL is regarded as a high-value asset for innovation, education, and economic development.

Discover East Tennessee

East Tennessee offers a variety of resources and experiences ranging from mountains, rivers, lakes, and a full menu of outdoor adventures to championship college teams and minor-league baseball to the arts and culture of Knoxville, including the internationally recognized [Big Ears Festival](#). The city is recognized as one of the country's best places to live, in part thanks to its [Urban Wilderness](#) system linking residential and commercial areas with the great outdoors. ORNL is within a day's drive of 50 percent of the nation's population and all of the East Coast's major cities.

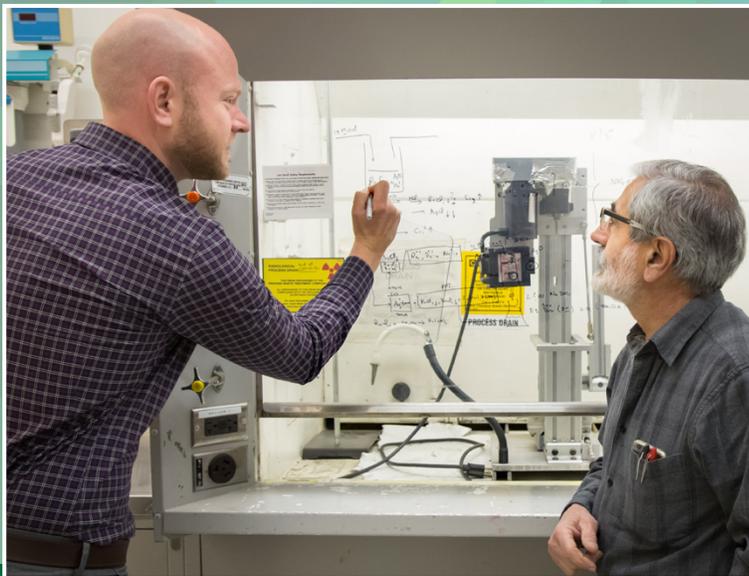
Our Workforce

ORNL is a great place to chart your own research course, work with like-minded colleagues, and build an extraordinary career. With more than 5,400 employees representing more than 60 countries, we assemble teams of experts from diverse backgrounds, equip them with powerful instruments and research facilities, and address compelling national problems.

In addition, ORNL offers professional development training at no cost to employees, provides professional networking opportunities, and sponsors employee resource groups that support diversity and inclusion efforts across the lab.

Diversity and Inclusion

ORNL's ability to build and sustain a highly skilled workforce in a rapidly changing competitive environment for talent is greatly influenced by our ability to plan and forecast workforce needs and promote diversity. Maintaining an inclusive environment is a business imperative that focuses on people in all areas of the laboratory and on maximizing the unique talents of individuals, teams, and business partners to pursue world-leading scientific impact.



We Welcome Your Application

Our challenge now is to sustain our leadership and build on our success. Thank you for your interest in ORNL and how we are helping to address some of the big science challenges facing our nation and the world.

Apply Today

Apply at jobs.ornl.gov

Equal Employment Opportunity

ORNL is an equal opportunity employer committed to a diverse and inclusive workplace that fosters collaborative scientific discovery and innovation. All qualified applicants, including individuals with disabilities and protected veterans, are encouraged to apply.

CONTACT

Gary Worrell
Director, Talent Acquisition
worrellgs@ornl.gov
1 Bethel Valley Road
Oak Ridge, TN 37831
jobs.ornl.gov

Oak Ridge National Laboratory is managed
by UT-Battelle for the US Department of Energy.



**U.S. DEPARTMENT OF
ENERGY**