

Careers in Physical Sciences

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 Physical Sciences Directorate
- 6 Pioneers in Advanced Materials
- 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 life-saving medical isotopes** and operate the National Isotope Development Center for the Department of Energy (DOE).
- **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

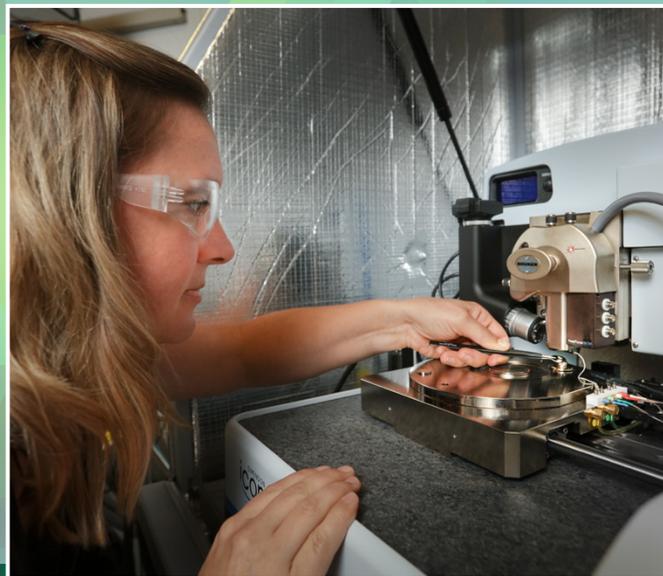
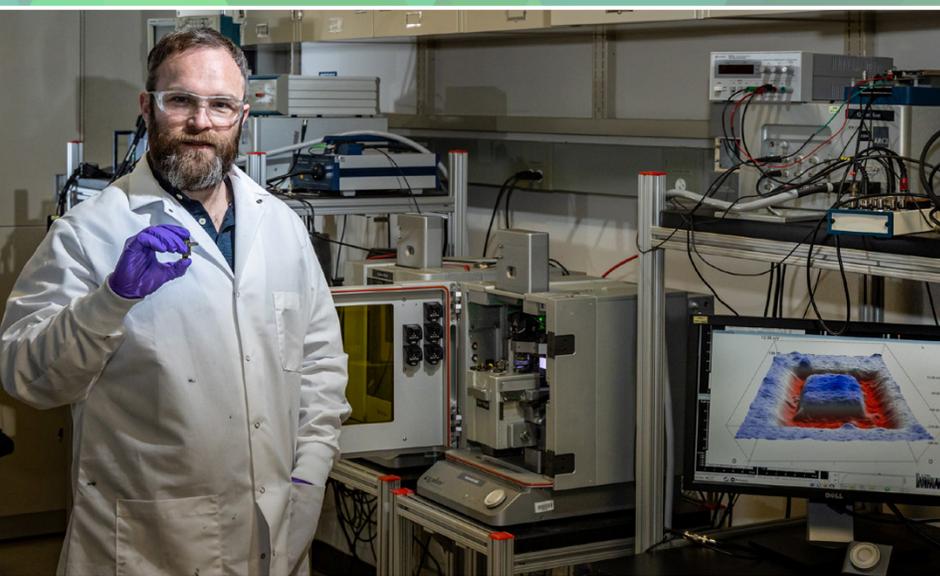
We produce unique medical isotopes for life-saving treatments and diagnoses, including actinium-227, a critical material for making a highly effective prostate cancer drug.

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 Physical Sciences Directorate

The Physical Sciences Directorate (PSD) conducts highly integrated basic and applied research programs that develop new materials, chemical processes, and technologies for energy generation and storage and environmentally benign energy use. Our research encompasses foundational science in chemistry, materials science, nanoscience, and physics.

Our scientists work in a collaborative environment to develop composites and alloys to withstand the extreme environments in nuclear and fusion reactors, understand why there is more matter than antimatter in the universe, design new catalysts for clean energy, support the search for new superheavy elements, develop strong lightweight materials for energy-efficient transportation, enable safe high-performance solid-state batteries, advance direct air capture of CO₂, develop self-healing polymers for energy-efficient buildings, and advance new materials for quantum sensing and quantum computing.

Our R&D portfolio spans from scientific discovery to technology transfer. It integrates precise synthesis and advanced processing methods with theory, modeling and simulation, and state-of-the-art characterization tools, using ORNL's signature strengths in high-performance computing, data science, and neutron scattering. PSD is also home to the Center for Nanophase Materials Sciences.

ENABLING BIG DISCOVERIES THROUGH NANOSCIENCE

The Center for Nanophase Materials Sciences (CNMS) at ORNL provides a national and international user community access to expertise and equipment for a broad range of nanoscience research, including nanomaterials synthesis, nanofabrication, imaging/microscopy/characterization, and theory/modeling/simulation. CNMS acts as gateway for the nanoscience community to benefit from ORNL's neutron sources and computational resources. CNMS facilities and capabilities are accessible based on peer-reviewed proposals and are offered at no cost to users who intend to publish their results.



The research portfolio for Physical Sciences Directorate spans four research divisions to advance key science, technology and engineering capabilities while building a competitive, world-class workforce to meet our future mission needs.

- The **Center for Nanophase Materials Sciences** provides a national and international user community access to expertise and equipment for a broad range of nanoscience research, including nanomaterials synthesis, nanofabrication, imaging/microscopy/characterization, and theory/modeling/simulation.
- The **Chemical Sciences Division** performs discovery and use inspired research to understand, predict, and control the physical processes and chemical transformations, relevant to energy technologies, over a broad range of length and time scales.
- The **Materials Science and Technology Division** conducts fundamental and applied materials research for basic energy sciences programs and a variety of energy technologies, including energy efficiency, renewable energy, transportation, conservation, fossil energy, fusion energy, nuclear power, and space exploration.
- The **Physics Division** performs outstanding leadership research for the Nation in nuclear science, isotopes, and related areas. Our focus is in the areas of Fundamental Symmetries, Nuclear Structure Physics, Nuclear Astrophysics, Heavy Ion Collisions, and Isotope R&D and Production.

AT A GLANCE



438 scientists and engineers



\$243 million R&D budget



42 core research groups



4 Governor's Chairs



802 journal articles and conference papers in 2019



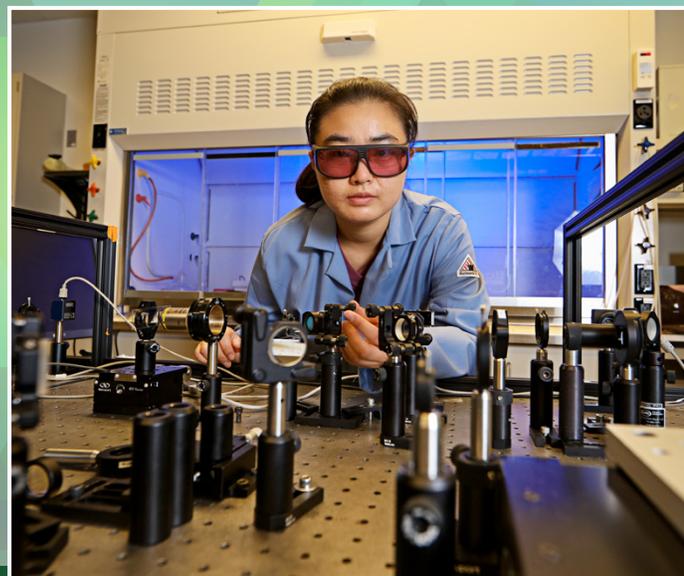
44 patents issued in 2019



1 Office of Science Nanoscale Science Research Center user facility



653 unique users in 2019



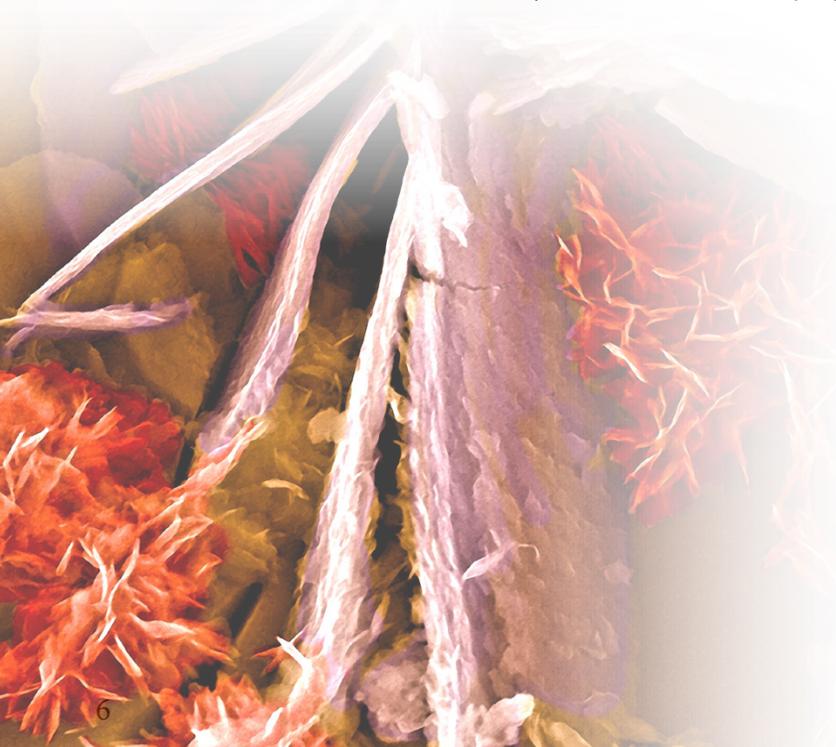
Pioneers in Advanced Materials

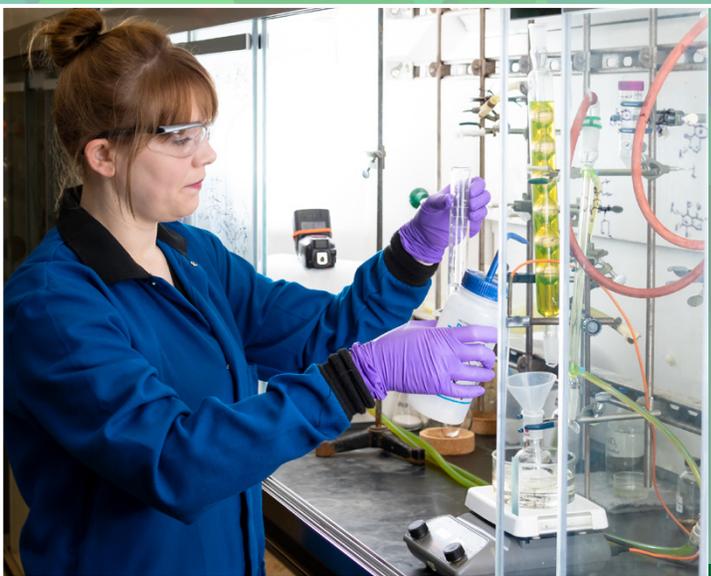
PSD is rooted in early ORNL research on radiation effects in graphite and metals and chemical separation of nuclear materials. The curiosity-driven research of Nobel prize winner Clifford Schull and his colleague Ernest Wollan established the use of neutron scattering to understand materials structure. Since then, PSD has led efforts to develop advanced materials and understand physical and chemical processes at the single-atom and molecular levels.

Building off our expertise in materials and chemical sciences, we have become leaders in the development of new alloys, high-temperature materials, ceramics, catalysts, separations agents, composites, batteries, and polymers. We develop and use analytical tools, neutron scattering, spectroscopy, and computation to characterize materials at atomic scale and decipher chemical transformations and material structure and dynamics. Our physics research has made crucial contributions in developing the understanding of nuclear matter and fundamental symmetries and developing breakthrough detector technologies.

Ten-Year Vision

Over the next decade, PSD will deliver foundational knowledge to spur the discovery, design, synthesis, and fabrication of next-generation materials with novel structures, properties, and function. Our “science of the future” strategy integrates high-performance computing, data science, and artificial intelligence with materials synthesis, fabrication, and characterization to accelerate innovation. We will use advances in precision synthesis, quantum information science, neutron scattering, and characterization across length and time scales to redefine how the world makes, understands, and uses materials.





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.

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

Leadership Opportunities in Physical Sciences

- Nanomaterials Characterization
- Nanomaterials Synthesis
- Theory & Simulation
- Chemical Transformations
- Nuclear Analytical Chemistry
- Separations and Polymer Chemistry
- Foundational Materials Science
- Materials Structure & Processing Science
- Materials In Extremes
- Materials Theory, Modeling, & Simulation
- Fundamental Nuclear & Particle Physics
- Nuclear Science and Advanced Technology



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.

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**U.S. DEPARTMENT OF
ENERGY**