

# Careers in Biological & Environmental Systems Science

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at Oak Ridge  
National Laboratory

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# 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

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## 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 US 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 Biological and Environmental Systems Science Directorate

Oak Ridge National Laboratory's Biological and Environmental Systems Science (BESS) Directorate leads convergence research in biology, ecology, engineering, data discovery, physical sciences, and computing to advance U.S. competitiveness in the global bioeconomy and Earth system sustainability.

Our researchers enjoy an open, inclusive, and innovative workplace where they collaborate daily to advance renewable energy solutions, biodiversity research, and push the frontiers of systems and synthetic biology. The future looks equally bright as we understand how genes influence ecosystem-level processes, learn more about how biodiversity shapes the world around us, develop novel biodesign tools and testbeds for enzyme engineering, apply the world's fastest supercomputers to transform biological and environmental data into knowledge, advance signature technologies for dynamic characterization of complex biological and environmental systems, and apply emerging capabilities that promise to transform how science is done through automated, data rich, and interconnected systems.

Together we can strengthen the nation's economic competitiveness, enable resilient and sustainable economies, and make possible the stewardship of managed and natural resources.

### SYSTEMS SCIENCE AT EVERY SCALE

BESS is home to the DOE's Atmospheric Radiation Measurement (ARM) Data Center, which provides data to scientists from around the world. The Center for Bioenergy Innovation enables high-impact and value-added advances along the bioenergy supply chain. The Climate Change Science Institute fosters the integration of experiments, measurements, and simulation to achieve a predictive understanding of our changing world. The UT/ORNL Center for Molecular Biophysics explores the structural dynamics of biomolecules by uniquely working at the interface of biology, chemistry, and the physical sciences, aided by neutron and computational sciences.



The research portfolio for Biological and Environmental Systems Science spans two research divisions to advance key science, technology and engineering capabilities while building a competitive, world-class workforce to meet our future mission needs.

- The **Environmental Sciences Division** focuses on expanding scientific knowledge and developing innovative strategies and technologies that will strengthen the nation's leadership in creating solutions to help sustain Earth's natural resources. Our staff explore how genes, organisms, populations, and communities influence, and are influenced by, the management, health, and sustainability of ecological systems; work to understand and predict how terrestrial and aquatic ecosystems exchange carbon, water, nutrients, and trace elements across multiple spatial and temporal scales; and advance next-generation computational and data analytics to extract and transfer information to understand ecosystems and their representation in numerical models.
- The **Biosciences Division** advances science and technology to characterize and engineer complex biological systems that benefit the environment and our bioeconomy. Our staff characterize and engineer biological behavior and determine how rational or automated design can be used to drive innovation in biotechnology and the environment; advance frontiers in computational methods to analyze chemical, physical, and biological data and arrive at new predictions and discoveries; and harness technologies in neutrons, quantum imaging, mass spectrometry and beyond to collect and interpret how molecular patterns, properties, and processes at smaller scales translate to larger-scale phenomena.

#### AT A GLANCE



152 scientists and engineers



\$100 million R&D budget



20 research groups



1,757 journal publications  
in the last 5 years



36 patents  
in the last 5 years



## Pioneers of Biology and Earth Systems Science

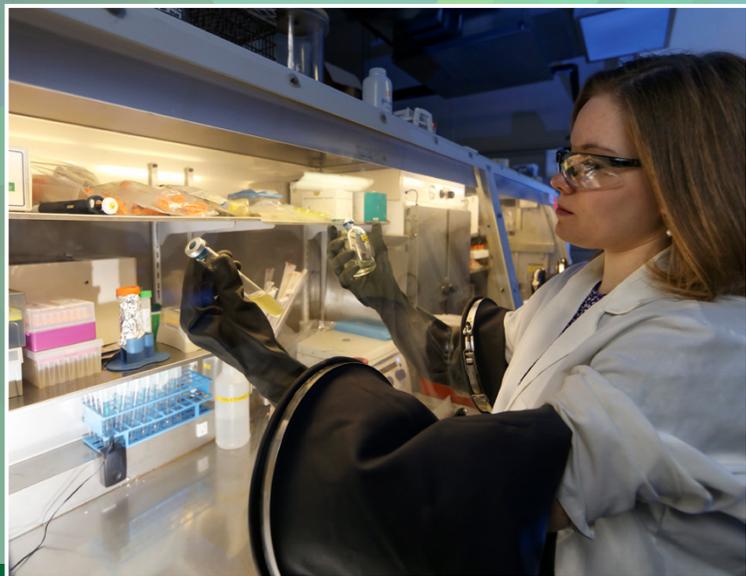
Building upon a rich history of breakthroughs in biology and ecology, BESS scientists are proud to have sequenced the first tree genome, pioneered the field of global change biology, and solved the 40-year mystery of how bacteria transform mercury into highly toxic methylmercury.

We are well-positioned to accelerate discovery using ORNL's facilities for high-performance computing, neutron scattering, materials science, and nanoscale research. Armed with these world-class capabilities they advance our understanding of the natural world, providing the insight needed to predict change, build resilient systems, and support a thriving, sustainable economy.

### Ten-Year Vision

Our vision is to harness tools of next-generation biology to decipher the genetic underpinnings of traits that control complex cellular, organismal, and environmental systems. Our genes-to-ecosystem vision is shaped by emerging capabilities in synthetic and systems biology, enzyme engineering, advanced imaging, data analytics and visualization, and Earth systems modeling. Informed by AI models and HPC, we will translate mechanistic understanding derived across multiple scales into predictive, process-rich models capable of generating testable hypotheses that advance knowledge discovery.

Our commitment to becoming the nation's lab of the future includes automation and edge computing as essential tools to delivering world-class capabilities in biology and ecology. We serve as a resource to address critical questions relevant to basic science, biodiversity research, environmental concerns, the bioeconomy, national security, and biosecurity.



## 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 exemplary operational support and meaningful 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 Biological and Environmental Systems Science

- Biodiversity and Sustainable Systems
- Earth Systems Science
- Earth System Informatics and Data Discovery
- Biodesign and Systems Biology
- Biocomputing and Information
- Bioimaging and Analytics

*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](http://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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