"Biosciences span from genes to ecosystems. Our diverse community of scientists employs techniques from exascale computing to microfluidics in enabling biological approaches to environmental sustainability."

Julie Mitchell,
Director, Biosciences Division

Biosciences

The Biosciences Division at Oak Ridge National Laboratory (ORNL) is focused on advancing science and technology to better understand complex biological systems and their relationship with the environment. The division has expertise and special facilities in genomics, computational biology, microbiology, microbial ecology, biophysics and structural biology, and plant sciences. This collective expertise includes collaborations within and outside ORNL and focuses on scientific challenges in biology for Department of Energy (DOE) missions in energy and the environment.

Understanding Biological Systems

Biological and Environmental Research Information Systems—Supporting the genome program of DOE's Biological and Environmental Research (BER) program as its primary communications resource for more than 20 years. In 2009, the group's role expanded to encompass communicating all of BER's science.

Biological and Nanoscale Systems—Focusing on the characterization, integration, and adaptation of natural and synthetic systems across multiple length scales. A continuing emphasis is to characterize and understand how natural systems are organized at the nanoscale and how this organization contributes to biological function.

Metabolomics and Bioconversion—Performing multidisciplinary research for DOE-relevant applications, including the characterization of plant biomass and microbial cultures that are potentially suitable for biofuel production.

Systems Genetics—Integrating environmental, laboratory, and computational approaches to study microbes and their roles in a wide range of environments, from hot springs and soils to plants, animals, and humans.

Molecular Biophysics—Studying molecular systems using simulation and predictive modeling in order to characterize their functions and mechanisms of action. Design and modeling to guide experimentation and help develop new approaches to bioenergy and biomedicine.

975
Publications since 2014

84
Total staff

1st
To break exascale computing barrier with genomics study

42,000
Populus genes decoded

47
Patents since 2014





Computational Biology and Bioinformatics—Developing computational methods for integrating large, diverse sets of biological data and exploring biological space to predict and discover models of biological systems and how they operate using techniques including search, optimization, neural networks, probabilistic inference, and supervised and machine learning.

Plant Systems Biology—Exploring and understanding the network of genes, proteins, metabolites, and environmental signals that lead to complex phenotypes in DOE-relevant plant species. Use multidisciplinary approaches to gain predictive understanding ranging from the molecular level to the ecological level of plant performance under changing environments.

Microbial Ecology and Physiology—Investigating microbial communities and the science underlying bioenergy production, bioremediation, carbon cycling and storage, and other uses of biotechnology. Combines genomic and biochemical methods with biogeochemistry and modeling to predict how changing microbiomes affect multiscale ecosystems.

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Research and Development Centers

Joint Institute for Biological Sciences

The Joint Institute for Biological Sciences (JIBS) is a collaborative research and education effort between UT and ORNL. The mission of the institute is to focus ORNL capabilities to accelerate approaches to drug development, personalized treatment, diagnosis, and prediction of outcomes in health management.

Center for Bioenergy Innovation

The Center for Bioenergy Innovation (CBI) is developing plants and microbes for a new generation of cost-effective, environmentally friendly, and industrially relevant bioproducts and biofuels. CBI harnesses natural diversity and beneficial plant-microbe interactions to create biomass feedstocks that are fast growing, drought tolerant, fertilizer efficient, and pest and pathogen resistant. CBI develops advanced fuels from biomass, creates value-added coproducts from lignin residues, and engineers microbes that consolidate biofuels production processes, increasing efficiency and lowering costs.

Center for Molecular Biophysics

The UT/ORNL Center for Molecular Biophysics performs research at the interface of biological, environmental, physical, computational, and neutron sciences. The goal is to study and understand the function of biologically relevant molecular systems by employing high-performance computer simulations in combination with biophysical experiments.