



Biosciences

The Biosciences Division at Oak Ridge National Laboratory focuses on advancing science and technology to better understand complex biological systems and their relationship with the environment. Research focuses on innovations that support the nation's growing bioeconomy and on scientific challenges in biology for the US Department of Energy. The division has expertise and special facilities in genomics, artificial intelligence, microbiology, microbial ecology, biophysics and structural biology, plant sciences, and secure biosystems design.

From identification of gene function to microbial enhancement of plant growth to materials development and bioengineering of non-model microbes, scientists at ORNL partner with industry to translate scientific discoveries into new technologies for industry. Researchers accelerate scientific breakthroughs using ORNL's world-leading facilities for high-performance computing, neutron scattering, material and nanoscale research, and advanced manufacturing.

Understanding Biological Systems

Biological and environmental research information systems—Supporting the genome program of DOE's Biological and Environmental Research 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, including quantum mechanics in biological systems; characterizing and understanding 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, machine learning, predictive modeling, and neutron science 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

957

Publications in the last 5 years

93

Staff

1st

To break exascale computing barrier with genomics study

42,000

Populus genes decoded

36

Patents in the past 5 years



"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

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, design of secure biosystems, and other uses of biotechnology; combining genomic and biochemical methods with biogeochemistry and modeling to predict how changing microbiomes affect multiscale ecosystems

Research and Development Centers



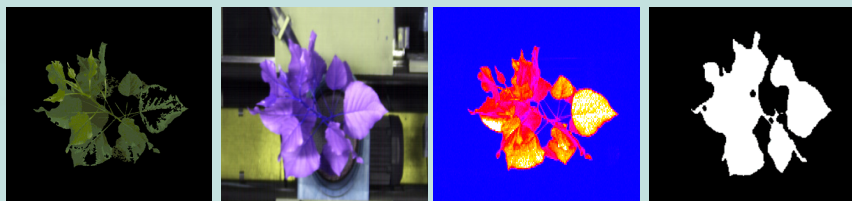
Joint Institute for Biological Sciences—The Joint Institute for Biological Sciences is a collaborative research and education effort between the University of Tennessee and ORNL focused on biomedical research with positive, measurable impacts on health outcomes relevant to the region and the nation. Focus areas include opioid use disorder, Alzheimer's disease, and cancer.



Center for Bioenergy Innovation—The Center for Bioenergy Innovation is harnessing natural diversity and beneficial plant-microbe interactions to create high-performance biomass feedstocks for environmentally friendly, cost-effective, and industrially relevant bioproducts and biofuels. CBI creates value-added coproducts from lignin residues and engineers microbes that consolidate biofuel production processes, thereby 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.



Connecting Plant Genes to Traits—ORNL has installed a unique high-throughput plant phenotyping system to aid the scientific community in connecting plant gene functions to observable traits. The system automates measurement of a range of key plant characteristics using the most diverse suite of imaging capabilities of any system worldwide.

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