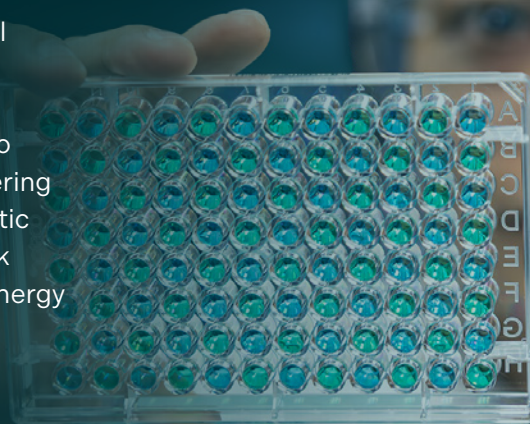


Biosciences

The Biosciences Division (BSD) at Oak Ridge National Laboratory (ORNL) advances understanding and design of biological systems and their environmental interactions. BSD translates foundational science into solutions, including bio-based approaches for recovering critical minerals and materials, strengthening domestic manufacturing, and securing supply chains. This work supports the US Department of Energy missions in energy and national security, driving economic growth and enhancing America's global competitiveness.



BY THE NUMBERS

1,056

Publications in
the past 5 years

126

Staff

10,000-plant

AI-assisted
phenotyping system

25 TB

Dataset spanning
Populus microbiome
to ecosystem processes

43

Patents in the
past 5 years

Understanding Biological Systems

BSD integrates experimental biology with high-performance computing, artificial intelligence, neutron imaging, and advanced characterization tools to uncover how genes, microbes, plants, and ecosystems function—and how they can be engineered to address national priorities. The research extends from atoms to applications to address critical challenges in biotechnology, energy, the environment, and health.

Bioanalytical mass spectrometry—Developing and deploying high-performance mass spectrometry techniques for characterization of biomolecules

Biological and environmental research information systems—Supporting DOE's Biological and Environmental Research program as its primary communications resource

Biological systems design—Engineering proteins, microbes, and plants to understand and manipulate complex biological systems

Computational and predictive biology—Employing data science, predictive modeling, and HPC to transform biological data into knowledge

Integrative microbiomics—Combining cellular, molecular, and genomic approaches to study microbes and their interactions with hosts and the environment

Microbial engineering—Modifying microorganisms to increase energy security and industrial competitiveness

Molecular and cellular imaging—Advancing and implementing tools to observe biological function in action

Molecular biophysics—Applying scalable computing and data science to characterize the structure, function, and dynamics of complex biomolecular systems

Plant systems biology—Exploring the network of genes, proteins, metabolites, and environmental signals that lead to improved plant performance





“We push the boundaries of biology to develop transformative solutions that advance biotechnology, resilience, and biosecurity.”

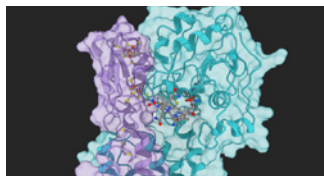
— Biosciences Division Director, **Jesse Labbé**



Advanced Plant Phenotyping Laboratory—APPL is a unique AI-enabled plant phenotyping system aids the scientific community in connecting gene functions to observable traits. The system automates measurement of above- and belowground plant characteristics using one of the world’s most diverse suites of plant imaging capabilities to accelerate biotechnology innovation.



Center for Bioenergy Innovation—The Center for Bioenergy Innovation (CBI) develops high-performance plant feedstocks and microbes for cost-effective, industrially relevant production of chemicals, materials, and sustainable aviation fuel to strengthen domestic supply chains.



Center for Molecular Biophysics—The University of Tennessee/ORNL Center for Molecular Biophysics employs high-performance computing simulations in combination with biophysical experiments to advance understanding of the function of biologically relevant molecular systems. The fundamental discoveries it enables inform drug development, biomanufacturing, and biosecurity.

Recent Impacts

- Licensed two catalyst technologies to advanced fuels company Gevo, which plans to scale the technology for efficient production of specialty jet fuel blendstocks.
- Developed a suite of biosensors for plant transformation R&D and for detection of crop threats such as early fungal outbreaks.
- Launched a first-of-its-kind automated root imaging platform to accelerate the development of stress-resistant crops.
- Demonstrated an agentic AI platform and developed an AI foundation model to accelerate analyses and discovery in the ORNL Advanced Plant Phenotyping Laboratory.
- Developed a DNA editing technology called tSAGE to quickly customize thermophilic microbes that thrive in industrial manufacturing processes.
- Created software called MIJAMP to speed the identification of methylation motifs in microbial strains for faster engineering and biotechnology development.
- Developed a detailed inventory of the chemical profiles present in chestnut trees in support of a nationwide research effort to restore the iconic American chestnut.
- Created synthetic nanobodies that precisely bound to target proteins, supporting ORNL’s research into delivery mechanisms for radiopharmaceuticals such as actinium-225.

CONTACT:

Jesse Labbé
Biosciences Director
Biological and Environmental Systems
Science Directorate

labbejl@ornl.gov

1 Bethel Valley Road
Oak Ridge, TN 37830



U.S. DEPARTMENT
of ENERGY

Office of
Science



www.ornl.gov jobs.ornl.gov

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