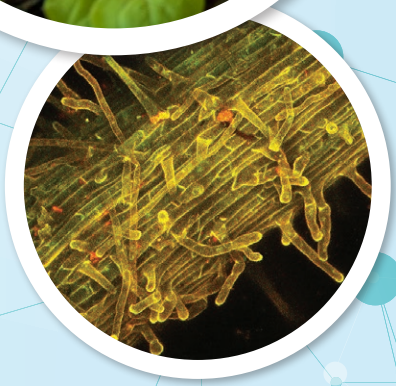
U.S. Department of Energy Office of Science

Biological and Environmental Research



The Biological and Environmental Research (BER) program supports transformative science and scientific user facilities examining complex biological, Earth, and environmental systems for clean energy and climate innovation.

BER research seeks to understand the fundamental biological, biogeochemical, and physical principles needed to predict a continuum of processes occurring across scales, from molecules and genomes at the smallest scales to environmental and Earth system change at the largest scales. This research—conducted at universities, U.S. Department of Energy (DOE) national laboratories, and research institutions across the country—is contributing to a future of reliable, resilient energy sources and evidence-based climate solutions.

U.S. Department of ENERGY | Office of Science

Biological and Environmental Research Program

science.osti.gov/ber

BER BY THE NUMBERS

FISCAL YEAR 2023

184
Universities, Nonprofits, and Research Institutions and **13** DOE National Laboratories Conduct BER Basic Research

>1,300
PUBLICATIONS IN **434** JOURNALS

> 4,100
USERS AT **3** USER FACILITIES

$908
MILLION
Total Budget

Biological Systems Science

BER's Biological Systems Science Division (BSSD) seeks to understand, predict, manipulate, and design plant and microbial systems for advances in renewable energy, insights into environmental processes, and biotechnological breakthroughs supporting the U.S. bioeconomy. To expand knowledge of biological systems, BSSD supports basic research and capabilities in foundational genomic science, systems biology, genome engineering, computational analysis, molecular imaging, and structural characterization.

Bioenergy

Provides genomics-based insights needed to produce and deconstruct renewable plant biomass and convert it to sustainable fuels, chemicals, and other bioproducts.

Biosystems Design

Accelerates the ability to securely design, build, and control plants and microbes for beneficial purposes such as clean energy, biomaterials, and carbon sequestration.

Environmental Microbiome

Develops a process-level understanding of the impacts of plant and soil microbial communities on the cycling and fate of carbon, nutrients, and contaminants in the environment.

Computational Biology

Integrates capabilities, including artificial intelligence and machine learning, tailored to large-scale data science investigations of plant and microbial systems.

Bioimaging Science

Advances multifunctional technologies, including quantum-enabled approaches, to image, measure, and model key metabolic processes in microbial cells and plant tissues.

Joint Genome Institute

The JGI user facility is the preeminent resource for sequencing plants, fungi, algae, microbes, and microbial communities foundational to energy and environmental research. With more than 2,300 users worldwide, JGI sequences over 700,000 billion DNA bases per year. Beyond sequencing, JGI provides state-of-the-science capabilities for metabolomics, data synthesis, and analysis.

jgi.doe.gov

Structural Biology and Imaging Resources

BER supports unique crystallography, scattering, spectroscopy, imaging, and cryogenic electron microscopy and tomography capabilities at DOE synchrotron and neutron user facilities. The spatial and temporal resolutions provided by these resources enable unprecedented characterization and imaging of interactions among plants, microbes, and the environment.

berstructuralbioportal.org

Bioenergy Research Centers

Bringing together top scientists from multiple disciplines, DOE's four Bioenergy Research Centers (below) are advancing the basic science underlying commercial production of biofuels and bioproducts. Research is focused on sustainable production and development of plant feedstocks and their deconstruction and conversion to fuels, chemicals, and other useful products.

- ***Center for Advanced Bioenergy and Bioproducts Innovation****, led by the University of Illinois at Urbana-Champaign*
- ***Center for Bioenergy Innovation****, led by Oak Ridge National Laboratory*
- ***Great Lakes Bioenergy Research Center,*** *led by the University of Wisconsin–Madison*
- ***Joint BioEnergy Institute****, led by Lawrence Berkeley National Laboratory*

genomicscience.energy.gov/bioenergy-research-centers

Earth and Environmental Systems Sciences

The Earth and Environmental Systems Sciences Division supports research to characterize and understand feedbacks between Earth and energy systems, including studies on atmospheric physics and chemistry, ecosystem ecology, and biogeochemistry. Research also includes developing and validating Earth system models that integrate information on the biosphere, atmosphere, terrestrial land masses, oceans, sea ice, land ice, subsurface, and human components.

Atmospheric Research

Explores the interdependencies of clouds, atmospheric aerosols, and precipitation that influence Earth's radiation balance, advancing insights that improve climate and Earth system models.

Environmental System Science

Deepens understanding of terrestrial ecosystems, watersheds, and coastal regions by investigating their interdependent microbial, biogeochemical, ecological, hydrological, and physical processes across space and time scales.

Earth and Environmental Systems Modeling

Extends the frontiers of Earth system knowledge, with emphasis on the complex interactions of its natural and human components and climate system processes, centered around advanced computational modeling and methods that include the Energy Exascale Earth System Model, multimodel approaches, data-driven machine learning, and discovery-based visualization.

Data Management

Develops multiscale visualization and analysis methods for observational and model-generated data to benefit the scientific community.

Atmospheric Radiation Measurement User Facility

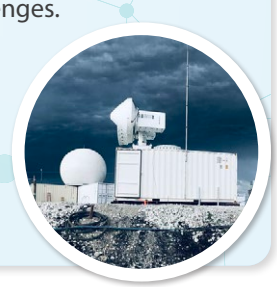
ARM supports highly instrumented ground stations, mobile measurement resources, and aerial vehicles to continuously measure cloud and aerosol properties and their impacts on Earth's energy balance. ARM's long-term observations provide an unparalleled resource for examining atmospheric processes and evaluating Earth system model performance.

arm.gov

Environmental Molecular Sciences Laboratory

EMSL provides users with integrated experimental and computational resources for discovery and technological innovation in the environmental molecular sciences. Researchers use EMSL to extend understanding of the physical, biogeochemical, chemical, and biological processes that underpin energy and environmental challenges.

emsl.pnnl.gov



Urban Integrated Field Laboratories

Urban IFLs are dedicated to developing the science framework, observational tools, and prediction capabilities needed to understand how urban areas interact with the climate system. The four Urban IFLs (below) will provide the knowledge necessary to inform equitable climate and energy solutions that can strengthen community-scale resilience across urban landscapes.

- ***Baltimore Social-Environmental Collaborative**, led by Johns Hopkins University*
- ***Community Research on Climate and Urban Science**, led by Argonne National Laboratory*
- ***Southeast Texas**, led by University of Texas–Austin*
- ***Southwest**, led by Arizona State University*

ess.science.energy.gov/urban-ifls

Biological and Environmental Research Staff

U.S. Department of Energy Office of Science

science.osti.gov/ber/about/staff

ASSOCIATE DIRECTOR OFFICE

Dorothy Koch, Associate Director, dorothy.koch@science.doe.gov

Senior Technical Advisors
- Joseph Graber
  joseph.graber@science.doe.gov
- Mike Riches
  mike.riches@science.doe.gov
- Tristram West
  tristram.west@science.doe.gov

Program Analyst
- Leslie Madison
  leslie.madison@science.doe.gov

Business Analyst
- Lauren Brunk Cadiz (Contractor)
  lauren.brunkcadiz@science.doe.gov

Administrative Specialist II
- LeeAnne Baldwin (Contractor)
  leeanne.baldwin@science.doe.gov

BIOLOGICAL SYSTEMS SCIENCE DIVISION (BSSD)

Todd Anderson, Director, todd.anderson@science.doe.gov

Foundational Genomics Research
- Pablo Rabinowicz
  pablo.rabinowicz@science.doe.gov
- Dawn Adin, *dawn.adin@science.doe.gov*
- Shing Kwok, *shing.kwok@science.doe.gov*
- Resham Kulkarni
  resham.kulkarni@science.doe.gov
- Vijay Sharma
  vijay.sharma@science.doe.gov
- Kari Perez
  kari.perez@science.doe.gov
- Elizabeth White
  elizabeth.white@science.doe.gov
- Paul Wilson (Lab Detailee)
  paul.wilson@science.doe.gov

Computational Biosciences
- Ramana Madupu
  ramana.madupu@science.doe.gov
- Resham Kulkarni
  resham.kulkarni@science.doe.gov

Environmental Genomics
- Boris Wawrik, *boris.wawrik@science.doe.gov*
- Dawn Adin, *dawn.adin@science.doe.gov*

Bioenergy Research Centers
- Shing Kwok, *shing.kwok@science.doe.gov*

Biomolecular Characterization and Imaging Science
- Amy Swain, *amy.swain@science.doe.gov*
- Paul Sammak, *paul.sammak@science.doe.gov*

Biosystems Design
- Pablo Rabinowicz
  pablo.rabinowicz@science.doe.gov

Human Subjects Protection
- Elizabeth White
  elizabeth.white@science.doe.gov

BSSD Small Business Innovation Research
- Boris Wawrik, *boris.wawrik@science.doe.gov*

BSSD Scientific Program Specialist
- Meredith Rutledge
  meredith.rutledge@science.doe.gov

USER FACILITY
Joint Genome Institute, *jgi.doe.gov*
- Ramana Madupu
  ramana.madupu@science.doe.gov

EARTH AND ENVIRONMENTAL SYSTEMS SCIENCES DIVISION (EESSD)

Gerald Geernaert, Director, gerald.geernaert@science.doe.gov

Atmospheric System Research
- Shaima Nasiri, *shaima.nasiri@science.doe.gov*
- Jeff Stehr, *jeff.stehr@science.doe.gov*

Earth and Environmental Systems Modeling
- Renu Joseph, *renu.joseph@science.doe.gov*
- Bob Vallario, *bob.vallario@science.doe.gov*
- Xujing Davis, *xujing.davis@science.doe.gov*

Data Management
- Justin Hnilo, *justin.hnilo@science.doe.gov*

Environmental System Science
- Daniel Stover, *daniel.stover@science.doe.gov*
- Paul Bayer, *paul.bayer@science.doe.gov*
- Brian Benscoter
  brian.benscoter@science.doe.gov
- Daniel Winkler, *daniel.winkler@science.doe.gov*
- Michael Kuperberg
  michael.kuperberg@science.doe.gov
- Beth Drewniak (Lab Detailee)
  beth.drewniak@science.doe.gov
- Jeremy Semrau (IPA)
  jeremy.Semrau@science.doe.gov

EESSD Small Business Innovation Research
- Justin Hnilo, *justin.hnilo@science.doe.gov*
- Sally McFarlane, *sally.mcfarlane@science.doe.gov*

EESSD Scientific Program Specialist
- Andrew Flatness
  andrew.flatness@science.doe.gov

USER FACILITIES
Atmospheric Radiation Measurement User Facility
arm.gov
- Sally McFarlane, *sally.mcfarlane@science.doe.gov*

Environmental Molecular Sciences Laboratory
emsl.pnnl.gov
- Paul Bayer, *paul.bayer@science.doe.gov*

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