

# Biological and Environmental Research (BER) Biological Systems Science Division (BSSD)

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U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

[Energy.gov/science](https://www.energy.gov/science)

# Office of Science Statement of Commitment & Other Guidance

- **SC Statement of Commitment** - SC is fully and unconditionally committed to fostering safe, diverse, equitable, inclusive, and accessible work, research, and funding environments that value mutual respect and personal integrity.  
<https://science.osti.gov/SW-DEI/SC-Statement-of-Commitment>
- **Expectations for Professional Behaviors** - SC's expectations of all participants to positively contribute to a professional, inclusive meeting that fosters a safe and welcoming environment for conducting scientific business, as well as outlines behaviors that are unacceptable and potential ramifications for unprofessional behavior.  
<https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/Harassment>
- **How to Address or Report Behaviors of Concern** - Process on how and who to report issues, including the distinction between reporting on unprofessional, disrespectful, or disruptive behaviors, and behaviors that constitute a violation of Federal civil rights statutes.  
<https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/How-to-Report-a-Complaint>
- **Implicit Bias** - Be aware of implicit bias, understand its nature - everyone has them - and implicit bias if not mitigated can negatively impact the quality and inclusiveness of scientific discussions that contribute to a successful meeting.  
<https://kirwaninstitute.osu.edu/article/understanding-implicit-bias>

# Housekeeping

**During the presentation**, submit questions using the Zoom Q&A feature. This is accessible at the bottom of your Zoom window. We will answer these live at the end of the presentation as time permits.

**After the presentation** if there is time, you can ask your question live by raising your hand in Zoom. We will ask you to unmute to ask your question.

If your question is not answered today, or if you have additional questions about a specific topic, please contact any BSSD program manager.

Recordings and slides from office hours will be posted after completion of each office hour. <https://science.osti.gov/ber/officehours>

# Agenda

- Overview of the Biological Systems Science Division (BSSD)
- User Facilities and Enabling Capabilities
  - BSSD-supported User Facilities and Enabling Capabilities
  - Other BER-funded User Facilities
  - SC User Facilities
- BSSD Research Funding Mechanisms
- Q&A

# Office of Science Research Portfolio

## Advanced Scientific Computing Research

- Delivering world leading computational and networking capabilities to extend the frontiers of science and technology

## Basic Energy Sciences

- Understanding, predicting, and ultimately controlling matter and energy flow at the electronic, atomic, and molecular levels

## Biological and Environmental Research

- Understanding complex biological, earth, and environmental systems

## Fusion Energy Sciences

- Supporting the development of a fusion energy source and supporting research in plasma science

## High Energy Physics

- Understanding how the universe works at its most fundamental level

## Nuclear Physics

- Discovering, exploring, and understanding all forms of nuclear matter



**DOE Office of Science**  
Harriet Kung, Acting Director

Advanced Scientific Computing Research

Basic Energy Sciences

Fusion Energy

**Biological and Environmental Research**

High Energy Physics

Nuclear Physics

**Dorothy Koch, Associate Director**

**Biological Systems Science**  
Todd Anderson, Director

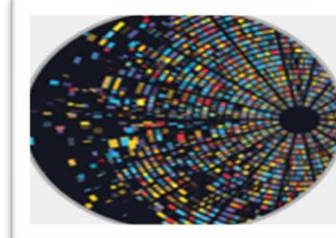
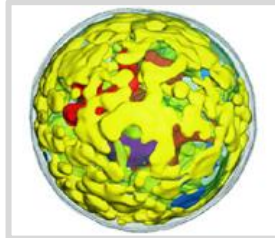
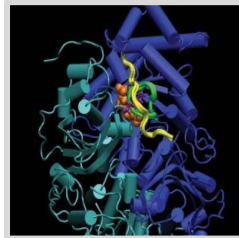
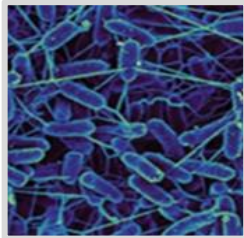
- Genomic Science
  - Bioenergy Research Centers
- Biomolecular Characterization & Imaging Science
- Facilities & Infrastructure
  - Joint Genome Institute

**Earth & Environmental Systems Science**  
Gary Geernaert, Director

- Atmospheric System Research
- Environmental System Science
- Earth and Environmental Systems Modeling
- Facilities & Infrastructure
  - Environmental Molecular Sciences Laboratory (EMSL)
  - Atmospheric Radiation Measurement (ARM)

# Biological Systems Science Division (BSSD)

**Mission:** Provide the necessary fundamental science to understand, predict, manipulate, and design biological processes that underpin innovations for bioenergy and bioproduct production and enhance understanding of natural, environmental processes relevant to DOE.



## Genomic Science

- Bioenergy
  - Sustainable Bioenergy
  - Plant Genomics
  - Microbial Genomics
- Biosystems Design
  - Secure Biosystems Design
- Environmental Microbiome

## Biomolecular Characterization and Imaging Science

- Bioimaging Technologies
  - Quantum Imaging
- Structural Biology
- Cryo-EM Resources

## Computational Biology

- Systems Biology Knowledgebase (KBase)
- National Microbiome Data Collaborative (NMDC)

## Scientific User Facilities

- Joint Genome Institute (JGI)



# Bioenergy Research

*Provide the basic science needed to convert renewable biomass to a range of fuels, chemicals, and other bioproducts in support of a burgeoning bioeconomy.*

- Gain a genome-level understanding of **plant metabolism, physiology, and growth to develop new bioenergy feedstocks** with traits tailored for bioenergy and bioproduct development
- Develop an understanding of **microbial and fungal metabolism** necessary to design new strains, communities, or enzymes capable of **converting plant biomass** components into fuels, chemicals, and bioproducts.
- Understand the genomic properties of **plants, microbes, and their interactions** to enable the development of new approaches **that improve the efficacy of bioenergy crop production** on marginal lands with few or no agricultural inputs, while **minimizing ecological impacts** under changing environmental conditions.



<https://genomicscience.energy.gov/bioenergy/>



# Environmental Microbiome Research

*Understand the assembly, function, and behavior of microbiomes and to manipulate them to facilitate microbial solutions to challenging environmental problems and advance their utility across the bioeconomy.*



- Develop environmental omics approaches and associated data integration tools to investigate *in situ* microbial community functional activities controlling key environmental processes
- Facilitate realistic recapitulations of microbial ecosystems
- Consider complex, interkingdom biological dependencies among soil microbial community members
- Provide a framework for predictive modeling to understand microbial community function
- Test and develop ecologic theory to explain microbiome behavior in the environment
- Leverage omics and modeling approaches to understand the rate and magnitude of microbially mediated biogeochemical cycles to understand feedbacks with and responses to global change
- Develop tools and techniques to manipulate microbiomes for beneficial purposes
- Facilitate novel and innovative approaches to functional gene characterization

<https://genomicscience.energy.gov/environmental-microbiome-research/>

**VISION: Advance fundamental understanding of genome biology and develop the genome-scale engineering technologies needed to design, build, and control plants and microbes for the production of biofuels, bioproducts, and biomaterials**

- Discover and develop novel platform organisms across a range of physiologies as chassis for synthetic biology.
- Develop innovative genome-engineering tools, including large-scale DNA synthesis and intracellular delivery, recoded and minimal genomes, orthogonal pathways, and cell-free systems.
- Develop high-throughput genome editing, automated screening, characterization, phenotyping, and testing of engineered organisms.
- Elucidate mechanisms for the acquisition, storage, transport, and chemical transformation of substrates in engineered organisms.
- Elucidate gene function at the genome scale to develop generalized approaches for biological engineering.
- Provide open-access computer-aided design tools and AI/ML approaches for plants and microbes.
- Support research to build new genetic, regulatory, biosynthetic, and organismal systems to biologically produce novel molecules and materials that may not exist in nature.
- Expand the “design-build-test-learn” cycle to organismal consortia.

# Bioimaging Science

*Improve or develop new multifunctional, multiscale imaging and measurement technologies that enable visualization of the spatiotemporal and functional relationships among biomolecules, cellular compartments, and higher-order organization of biological systems.*

- Enhance the accessibility of bioimaging and structural biology infrastructure within the research community and at DOE user facilities.
- Develop and enhance tools for sample handling and transfer, optimizing the samples for multiple imaging modalities and approaches.
- Develop fast and sensitive detectors with extremely high rates of data collection and the necessary computational tools to handle large, real-time, noisy, multimodal, and multiscale data.
- Develop multifunctional, in situ, and nondestructive observation technologies for repetitive sample analyses for systems biology research.
- Visualize the spatial and temporal dynamics of expressed biomolecules within or between living plant or microbial cells and their communities.
- Explore quantum science concepts for optical imaging and sensing of cellular processes.

<https://genomicscience.energy.gov/ber-structural-biology-and-imaging-resources/>

# Enabling Capabilities

*Support the development of computational and instrumental platforms to enable broader integration and analysis of large-scale complex data within BER's multidisciplinary research efforts.*

## BER-supported User Facilities and Enabling Capabilities

- Computational Biology Platforms
  - DOE Systems Biology Knowledgebase (KBase)
  - National Microbiome Data Collaborative (NMDC)
- User Facilities
  - Structural Biology and Imaging Resources
  - Joint Genome Institute (JGI)
  - Environmental Molecular Sciences Laboratory (EMSL)
- Other SC User Facilities
  - National Energy Scientific Computing (NERSC) User Facility

# Computational Biology: Integrated Computational Platforms

*Create open-access and integrated computational capabilities tailored to large-scale data science investigations for molecular, structural, genomic, and omics-enabled research on plants and microorganisms for a range of DOE mission goals.*

- Assemble capabilities for processing large, complex, and heterogeneous systems biology data into open-access analysis platforms addressing DOE missions.
- Create the next-generation data systems and algorithms needed for large-scale systems biology data science that connects observations across scales and integrates molecular, structural, genomic, and other omics data with cellular and multicellular processes.
- Develop explainable artificial intelligence algorithms to identify relationships among different parts of genomes and build integrated biological models that capture higher-order complexity of the interactions among cellular components that lead to phenotypic differences.
- Generate advanced algorithms and data-handling techniques to process and integrate imaging and structural biology data with simulations and other biological measurements.

<https://genomicscience.energy.gov/compbioawards2023/>

<https://genomicscience.energy.gov/computational-tool-development-for-integrative-systems-biology-data-analysis/>

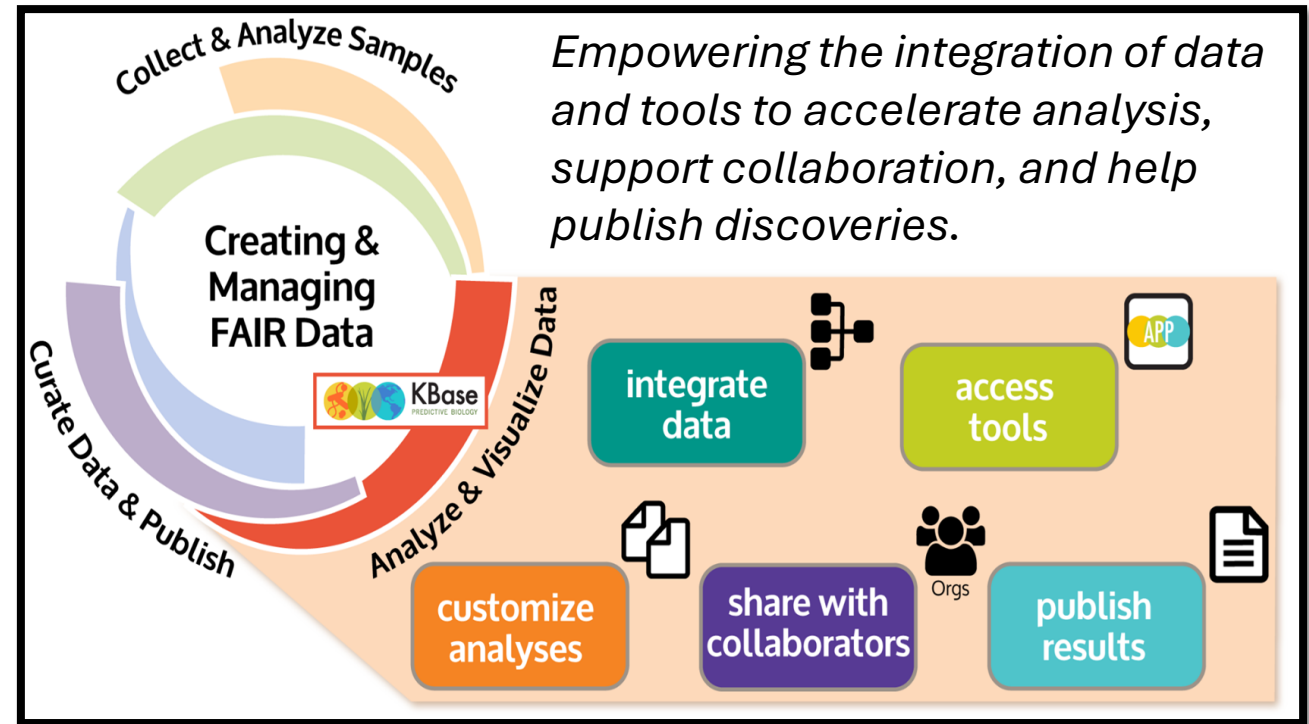
# DOE Systems Biology Knowledgebase (KBase)



- KBase is an open, FAIR biological data science platform to empower scientists to collaboratively drive discovery, for prediction, control and design of function in plants, microbes and their communities.
- Bring data in from BER facilities or other sources, analyze in KBase, and export to curation and publication platforms.

KBase enables Users with

- Data Integration
- Customized Data Analysis
- Sharing & Publishing Results



<https://www.kbase.us/engage/>

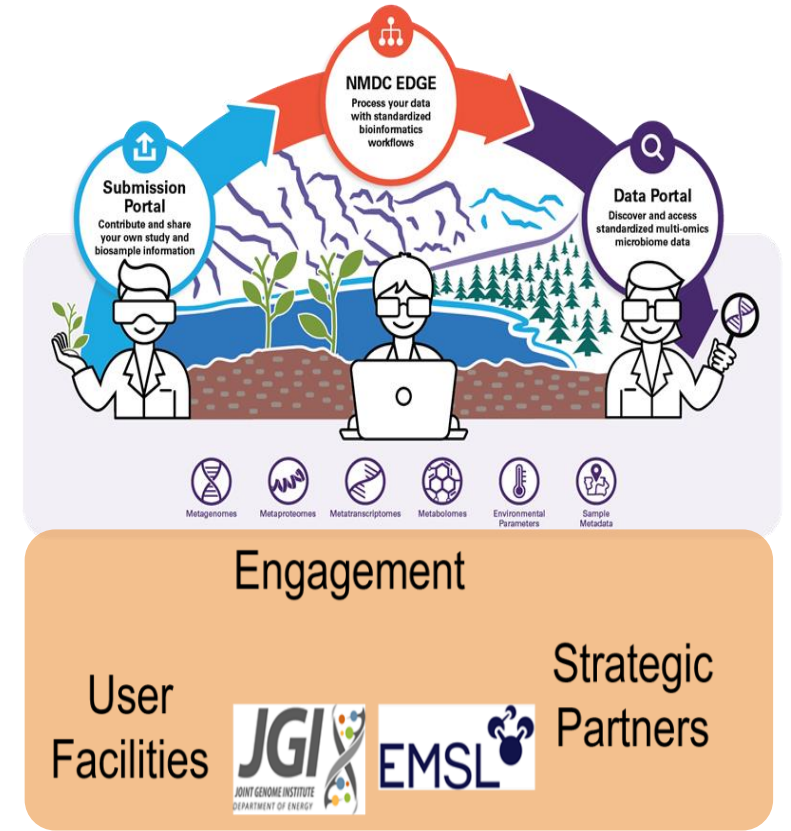
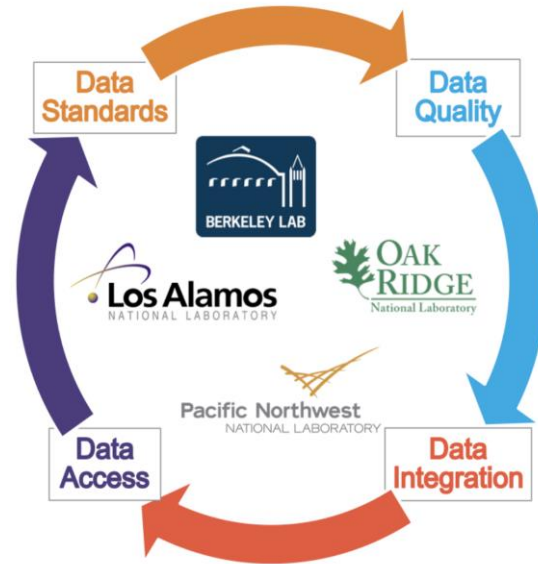


# National Microbiome Data Collaborative

<https://microbiomedata.org/>

**Objective:** Connect data, people, and ideas to advance microbiome innovation and discovery.

**Approach:** Support a FAIR microbiome data sharing network, through infrastructure, data standards, and community building, that addresses pressing challenges in environmental sciences.



## Submission Portal

**Contribute and share your own study and biosample information**

## Data Portal

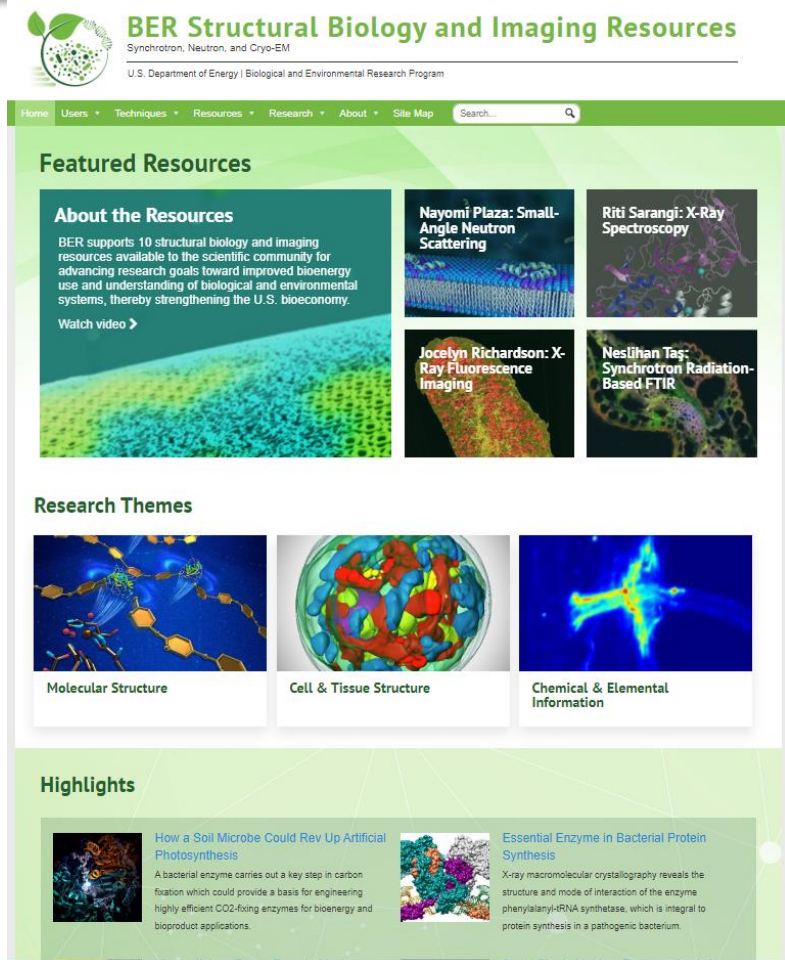
**Discover and access standardized multi-omics microbiome data**

## NMDC EDGE

**Process your data with standardized bioinformatics workflows**



## Facility-based user resources for 3D structure, imaging and chemical characterization



**BER Structural Biology and Imaging Resources**  
Synchrotron, Neutron, and Cryo-EM  
U.S. Department of Energy | Biological and Environmental Research Program

Home Users Techniques Resources Research About Site Map Search...

### Featured Resources

- About the Resources: BER supports 10 structural biology and imaging resources available to the scientific community for advancing research goals toward improved bioenergy use and understanding of biological and environmental systems, thereby strengthening the U.S. bioeconomy. Watch video >
- Nayomi Plaza: Small-Angle Neutron Scattering
- Riti Sarangi: X-Ray Spectroscopy
- Jocelyn Richardson: X-Ray Fluorescence Imaging
- Neslihan Tas: Synchrotron Radiation-Based FTIR

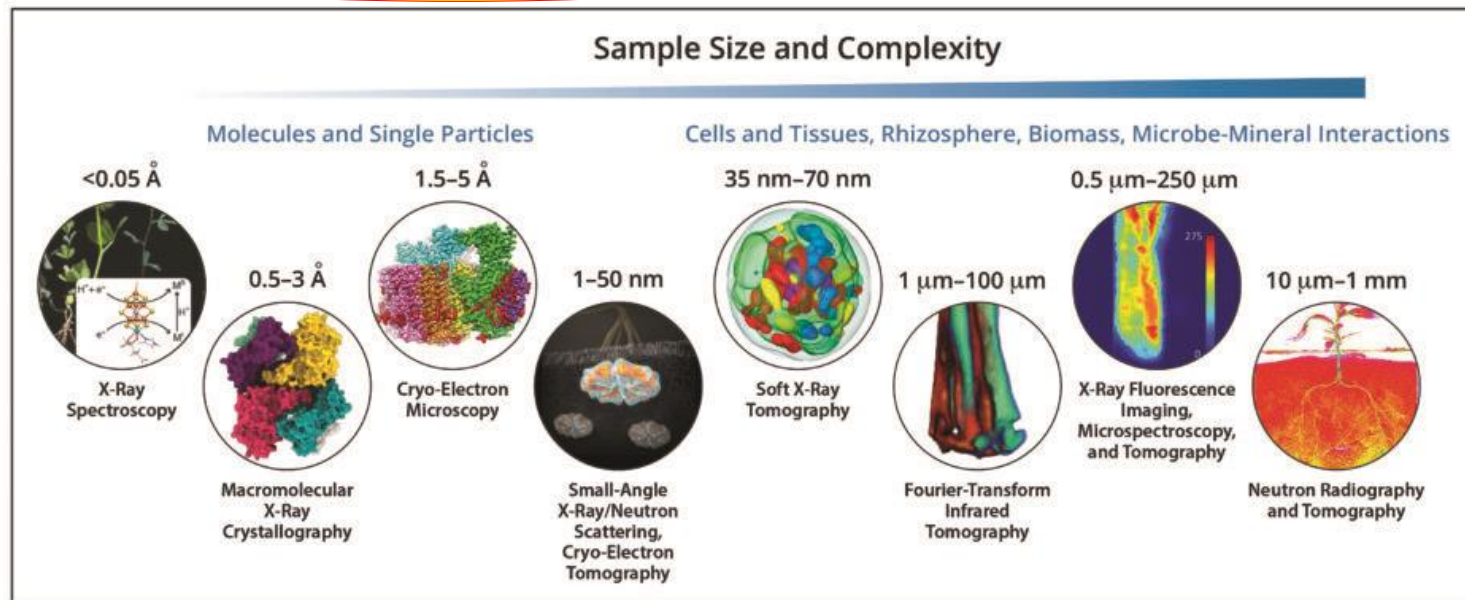
### Research Themes

- Molecular Structure
- Cell & Tissue Structure
- Chemical & Elemental Information

### Highlights

- How a Soil Microbe Could Rev Up Artificial Photosynthesis: A bacterial enzyme carries out a key step in carbon fixation which could provide a basis for engineering highly efficient CO<sub>2</sub>-fixing enzymes for bioenergy and bioproduct applications.
- Essential Enzyme in Bacterial Protein Synthesis: X-ray macromolecular crystallography reveals the structure and mode of interaction of the enzyme phenylalanyl-tRNA synthetase, which is integral to protein synthesis in a pathogenic bacterium.

Visit [BERStructuralbioportal.org](http://BERStructuralbioportal.org)



*Measure from angstroms to millimeters, from femtoseconds to days*

Freely available through proposal process: access, training, support

- Synchrotron x-rays & infrared
- Neutrons
- Electrons

**For information, visit [BERStructuralbioportal.org](http://BERStructuralbioportal.org)**

Program manager: amy.swain@science.doe.gov

# Joint Genome Institute (JGI)

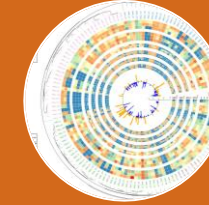
## Mission

As a US Department of Energy User Facility, JGI provides advanced genomic capabilities, large-scale data, and professional expertise to support the global research community in addressing energy and environmental research grand challenges.

Nutrient  
Cycling



Functional  
Diversity



Data and  
Connectivity



Stewarding  
Resources



## Genome Targets



Plant



Fungal & Algal



Metagenome



Microbial

## Infrastructure/ Capabilities



### DNA Sequencing Platforms

- Illumina NovaSeq X
- PacBio Revio
- Oxford Nanopore PromethION



### Advanced Genomic Technologies

- Single-cell Sequencing
- Stable Isotope Labeling
- Methylation/Epigenomics
- Transcriptomics



### Metabolomics

- Polar-/non-polar LC/MS metabolite profiling
- Targeted and untargeted metabolite analysis



### DNA Synthesis

- Design & Pathway Assembly
- Host Engineering



### Secondary Metabolites

- Large-scale bioinformatic mining
- Integrated workflows
- BGC exploration

## Data Science & Informatics



# JGI User Programs

Proposal Call Type	Review Frequency	Submission Deadline	Review Date
CSP Annual	Annual	Apr 18 2024	August 2024
FICUS JGI-EMSL	Annual	Spring 2025	June 27-28 2024
CSP New Investigator	Annual	Oct 4, 2024	Dec 2024
CSP Functional Genomics	Annual	Jan 30, 2025	March 2025

<https://jgi.doe.gov/user-programs/>

## **Freely available Online Resources, Data Systems, Tutorials, & Symposia**

- Stable Isotope Probing (SIP)
- Long-read Sequence Applications
- Integrated Microbial Genomes (IMG)
- MycoCosm for Analysis of Fungi
- PhycoCosm for Analysis of Algae

<https://jgi.doe.gov/news-publications/webinars/>





## SC User Facilities and BSSD Enabling Capabilities

NERSC

EMSL

BER Structural  
Biology and Imaging  
Resources

KBase  
PREDICTIVE BIOLOGY

nmDC

JGI  
JOINT GENOME INSTITUTE

### [Joint Genome Institute \(JGI\)](#)

Provides the global research community with access to the most advanced integrative genome science capabilities for advancing solutions to bioenergy & environmental grand challenges

### [National Microbiome Data Collaborative \(NMDC\)](#)

Supports microbiome data exploration through a sustainable data discovery platform that promotes open science and shared-ownership across a broad and diverse community of researchers.

### [DOE Systems Biology Knowledgebase \(KBase\)](#)

Empowers scientists via an open, FAIR biological data science platform to collaboratively drive discovery, for prediction, control and design of function in plants, microbes and their communities.

### [BER Structural Biology and Imaging Resources](#)

Enables scientists to understand the relationships between plant and microbial genomes, protein structure and function, and environmental interactions using techniques available only at DOE User facilities.

### [Environmental Molecular Sciences Lab \(EMSL\)](#)

Provides access to premier multimodal molecular science instruments, data analytics, production computing, and multiscale modeling to understand the function of biotic and abiotic processes in a systems context.

### [National Energy Research Scientific Computing \(NERSC\)](#)

Accelerates scientific discovery by providing allocations for high performance computing and data analysis, enabling science at scale across a range of DOE relevant research areas.

\*Relevant to BSSD

# BSSD Research Funding Mechanisms

## ■ Academic Research

- Targeted FOAs
- Crosscutting FOAs
- Bioenergy Research Centers

<https://science.osti.gov/ber/Funding-Opportunities>

## ■ National Labs

- Science Focus Areas
- Crosscutting Lab Announcements
- Other Projects







## ■ SBIR/STTR

<https://science.osti.gov/sbir/Funding-Opportunities>



# BSSD Fiscal Year 2024 Funding Opportunities

- Bioimaging Research and Approaches for the Bioeconomy and the Environment FOA
- Low Dose Radiation Research FOA
- Building EPSCoR-State/National Laboratory Partnerships FOA
- Early Career Research Program FOA and Lab Call
- Funding for Accelerated, Inclusive Research (FAIR) FOA – Pre-Applications Due: 4/23/24
- Reaching a New Energy Sciences Workforce (RENEW) FOA – Pre-Applications Due: 4/30/24

<p>DEPARTMENT OF ENERGY (DOE) OFFICE OF SCIENCE (SC)</p>  <p><b>EARLY CAREER RESEARCH PROGRAM (ECR)</b></p> <p>FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER: DE-FOA-0003176</p> <p>FOA TYPE: AMENDMENT 000001 CFDA NUMBER: 81.049</p> <table border="1"> <tr><td>FOA Issue Date:</td><td>December 15, 2023</td></tr> <tr><td>Submission Deadline for Pre-Applications:</td><td>January 30, 2024 at 5:00 PM ET A Pre-Application is required. Pre-Applications must be submitted by an authorized institutional representative.</td></tr> <tr><td>Pre-Application Response Date:</td><td>March 14, 2024 at 11:59 PM ET</td></tr> <tr><td>Submission Deadline for Applications:</td><td>April 25, 2024 at 11:59 PM ET</td></tr> </table> <p><small>Amendment 000001 has been issued to update the Notice on page 11 and to change Manager on page 45.</small></p>	FOA Issue Date:	December 15, 2023	Submission Deadline for Pre-Applications:	January 30, 2024 at 5:00 PM ET A Pre-Application is required. 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Pre-Application Response Date:	February 20, 2024 at 5:00 PM ET	Submission Deadline for Applications:	April 2, 2024 at 11:59 PM ET	<p>DEPARTMENT OF ENERGY (DOE) OFFICE OF SCIENCE (SC)</p>  <p><b>FY 2024 FUNDING FOR ACCELERATED, INCLUSIVE RESEARCH (FAIR)</b></p> <p>FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER: DE-FOA-0003207</p> <p>FOA TYPE: INITIAL CFDA NUMBER: 81.049</p> <table border="1"> <tr><td>FOA Issue Date:</td><td>March 12, 2024</td></tr> <tr><td>Submission Deadline for Pre-Applications:</td><td>April 30, 2024 at 5:00 PM Eastern Time A Pre-Application is required. 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Pre-Application Response Date:	May 28, 2024 at 11:59 PM Eastern Time	Submission Deadline for Applications:	July 16, 2024 at 11:59 PM Eastern Time	<p>DEPARTMENT OF ENERGY (DOE) OFFICE OF SCIENCE (SC)</p>  <p><b>FY 2024 REACHING A NEW ENERGY SCIENCES WORKFORCE (RENEW)</b></p> <p>FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER: DE-FOA-0003280</p> <p>FOA TYPE: INITIAL CFDA NUMBER: 81.049</p> <table border="1"> <tr><td>FOA Issue Date:</td><td>March 12, 2024</td></tr> <tr><td>Submission Deadline for Pre-Applications:</td><td>April 30, 2024 at 5:00 PM Eastern Time A Pre-Application is required. 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<https://science.osti.gov/ber/Funding-Opportunities>

# Crosscutting Office of Science Initiatives

## BSSD Participates in Multiple Office of Science Initiatives

- Reaching a New Energy Sciences Workforce ([RENEW](#))
- Funding for Accelerated, Inclusive Research ([FAIR](#))
- Established Program to Stimulate Competitive Research ([EPSCoR](#))
- Early Career Research Program ([ECRP](#))
- SC Energy Earthshot Initiative ([Earthshots](#))
- Accelerate Innovations in Emerging Technologies (Accelerate)
- Biopreparedness Research Virtual Environment ([BRaVE](#))
- Quantum Information Science ([QIS](#))
- Workforce Development for Teachers and Scientists ([WDTS](#)) programs
  - Science Undergraduate Laboratory Internships (SULI)
  - SC Graduate Student Research (SCGSR) Program
  - Community College Internships (CCI)
  - Visiting Faculty Program (VFP)
  - Albert Einstein Distinguished Educator Fellowship (AEF) Program



# We need your help to review proposals!

BER conducts peer reviews of funding applications to obtain an independent assessment of the scientific and technical merit of the proposed research. Reviewers are selected based the following considerations:

- Individual reviewers should have the appropriate scientific expertise.
- Conflicts of interest should be avoided.
- Review panels should include an appropriate mix of disciplines.
- Panels should have a balanced demographic diversity, including affiliation, geographic location, research sector, gender, career level, etc.
- Program Managers consider applicants' requests to include or exclude specific individuals as reviewers.

See our user-friendly web form to volunteer and indicate your expertise and interests.

<https://genomicscience.energy.gov/reviewer-application/>



# Stay Connected

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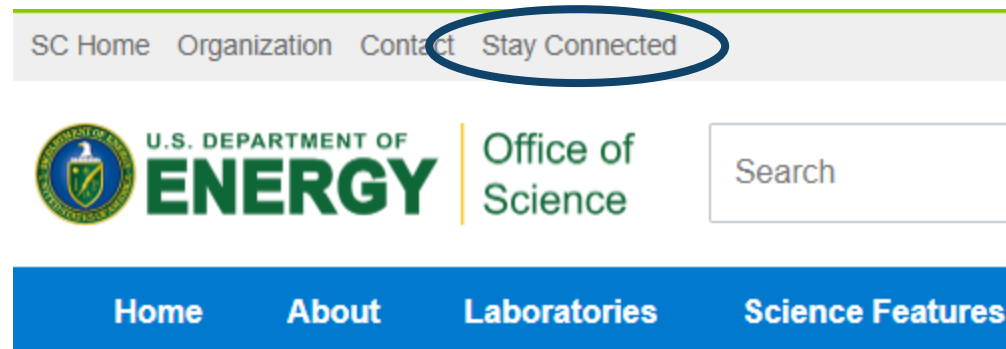
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- This is an opt-in, opt-out service where subscribers decide which topics they are interested in, then join or drop off as interests change.
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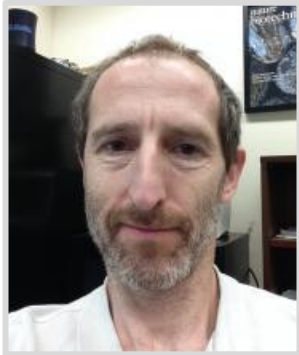
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# Thank you from all of us in BSSD!



**Todd Anderson**  
Division Director



**Pablo Rabinowicz**  
Biosystems Design  
Early Career



**Dawn Adin**  
Microbial Conversion



**Ramana Madupu**  
Computational Biology  
JGI User Facility



**Shing Kwok**  
BRCs



**Resham Kulkarni**  
Computational,  
BRaVE, & Low Dose



**Boris Wawrik**  
Environmental  
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Sustainability



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Plant Genomics



**Amy Swain**  
Structural Biology &  
Imaging Resources



**Paul Sammak**  
Bio- & Quantum  
Imaging



**Elizabeth White**  
DOE Human Subjects  
Research



**Meredith Rutledge**  
Science Assistant  
BSSD Budget

# Future BER Office Hours

- Upcoming dates/topics:
  - Tuesday, May 28, 2024 at 2:00-3:00 pm ET  
*Introduction to the **BER Earth and Environmental Systems Science** portfolio*
- Additional information and registration links here:  
<https://science.osti.gov/ber/officehours>
  
- **Zoom Poll**
  - How did you hear about BER office hours?
  - What additional office hours topics interest you?

# Questions & Answers

Questions asked during the presentation through the Zoom Q&A will be answered live now.

If there is time available and you would like to ask your question live, raise your hand in Zoom and we will ask you to unmute to ask your question.

If your question is not answered today, or if you have additional questions about a specific topic, please contact any BSSD program manager.



# Thank you!





# Helpful Links

Biological and Environmental Research (BER)

Biological Systems Sciences Division (BSSD)

Genomic Science Program (GSP)

Joint Genome Institute (JGI)

Environmental Molecular Science Laboratory (EMSL)

DOE Systems Biology Knowledgebase (KBase)

DOE National Microbiome Data Collaborative (NMDC)

BER Structural Biology Portal

BER Funding Opportunities

<https://science.osti.gov/ber>

<https://science.osti.gov/ber/Research/bssd>

<https://genomicscience.energy.gov/>

<https://jgi.doe.gov>

<https://www.emsl.pnnl.gov/science>

<https://www.kbase.us/>

<https://microbiomedata.org/>

<https://berstructuralbioportal.org/>

<https://science.osti.gov/ber/Funding-Opportunities>

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Support: 866-606-8220

Support: 800-899-6665

<https://pamspublic.science.energy.gov>

Support: 855-818-1846 or [sc.pams-helpdesk@science.doe.gov](mailto:sc.pams-helpdesk@science.doe.gov)

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