U.S. DEPARTMENT OF ENERGY | Office of Science

2020 Genomic Sciences Program Annual PI Meeting

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Department of Energy, Office of Biological & Environmental Research

February 24, 2020

BSSD Science Outlook

Industries of the Future Act

"…. (5) in order for the United States to maintain its global economic edge, Federal investment must be made in research and development efforts focused on industries of the future, such as artificial intelligence, quantum information science, biotechnology, and next generation wireless networks and infrastructure, advanced manufacturing, and synthetic biology….."

(Senate Hearing 1/15/2020 Committee on Commerce, Science & Transportation)

Engineering our way to a Sustainable Bioeconomy

(House Hearing 3/12/19 HSST Subcommittee on Research and Technology)

STATEMENTS & RELEASES

Presidential Message on National Biotechnology Month

INFRASTRUCTURE & TECHNOLOGY | Issued on: January 1, 2020

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President's Request
FY 2021 Research Initiatives

New

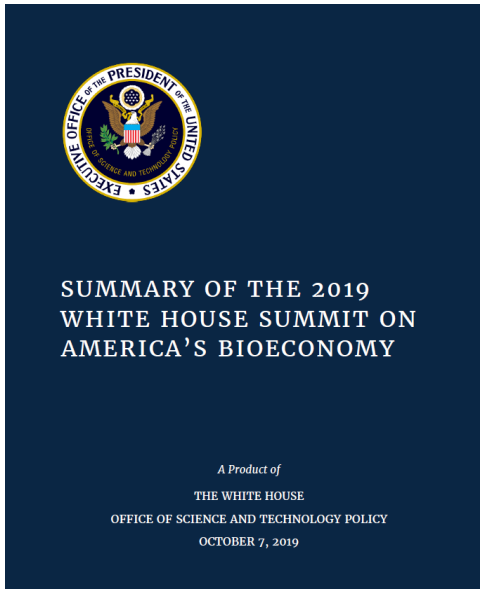
Next Generation Biology Initiative

Revolutionizing Polymer Upcycling

Ongoing

Biosecurity

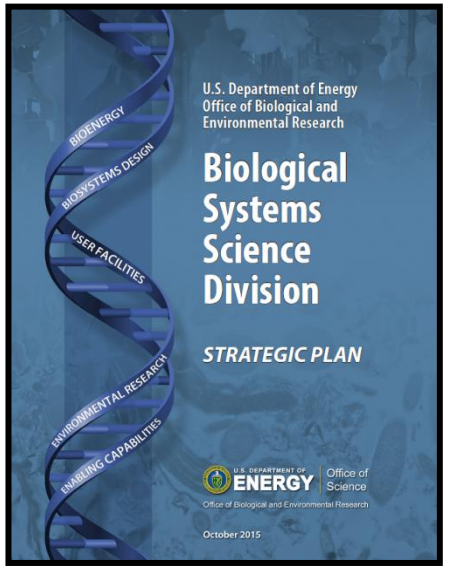
Quantum Information Science



"The bioeconomy represents the infrastructure, innovation, products, technology, and data derived from biologically-related processes and science that drive economic growth, improve public health, agricultural, and security benefits."

Biological Systems Science Division

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



Objectives

- ***Plant & Microbial Bioenergy Research***
- ***Biosystems Design & Synthetic biology***
- ***Environmental Microbiome Science***

Genomic Science Program

- ***Enabling Capabilities***
- ***User Facility Integration***

The Biological Systems Science Division Portfolio

Genomic Science Program

- Bioenergy Research Centers (BRCs) → Biomass conversion to fuels and products
- Systems Biology for Bioenergy → New microorganisms for bioenergy applications
- Plant Genomics Research → Understanding plant gene function
- Sustainability Research for Bioenergy → Plant-microbe-environment research
- Biosystems Design → Genome-scale engineering and synthetic biology
- Environmental Microbiome Science → Discovering the principles of microbial ecology
- Computational Biosciences → Data analyses and tools for discovery

Bioeconomy Research

Biotechnology

Synthetic Biology

Biosecurity

Quantum Information Science

Biomolecular Characterization and Imaging Science

- Fundamental molecular structure and function

- Quantum Science for Bioimaging → Quantum science-enabled bioimaging concepts

Facilities & Infrastructure

- Joint Genome Institute (JGI) → Data generation and interpretation for discovery

New Integrative Genomics Building

JGI JOINT GENOME INSTITUTE
A DOE OFFICE OF SCIENCE USER FACILITY

KBase
PREDICTIVE BIOLOGY
DOE Systems Biology Knowledgebase

New Awards from FY 2019 Funding Opportunity Announcements

Plant Genomics Research

Genomics-Enabled Plant Biology for Determination of Gene Function (DE-FOA-00002060)

Novel genomics-based approaches and technological innovations that will lead to transformative knowledge in validating gene function in energy crops

Environmental Microbiome Research

Systems Biology Enabled Research on the Roles of Microbiomes in Nutrients Cycling Processes (FOA-0002059)

Systems biology studies on regulatory, metabolic, and signaling networks of microbes, microbial consortia, and microbe-plant interactions involved in biogeochemical cycling of nutrients

New Lab Funding Biosecurity and Computational Biology Awards

4 New *Secure Biosystems Design Pilot Projects* (12 months)
Machine Learning-Guided Design of Efficient Safeguard Systems that Operate Under Different Bacterial Physiologies ANL [PI: P. Noirot]
Lock and Key: Securing Genomes Against the CRISPR/CAS9 Gene-Editing Tool ORNL [PI: P. Abraham]
Genome remodeling to control the persistence of engineered functions in soil microbes PNNL [PI: R. Egbert]
Fail-safe Genome Engineering SLAC [PI: M. Salit]

5 New Computational Biology Awards 2-3 years of funding
Optimal experimental design of biological systems BNL [PI: F. Alexander] 2 yrs of funding
Genomes to predictive biology: machine learning for the integration of inter-species functional genomics data BNL [PI: S. Yoo] 2 yrs of funding
Accelerate JGI-KBase Codevelopment Effort on Homology Microservices LBNL [PI: K. Fagnan] 2 yrs of funding
Exascale & Petascale Networks for KBase ORNL [PI: D. Jacobson] 2 yrs of funding
Elucidating Principles of Bacterial-Fungal Interactions PNNL [PI: W. Cannon] 3 yrs of funding

New Cryo-EM Capabilities at EMSL

Increase cryo-EM accessibility for BER researchers through providing sample screening as well as data collection capability.

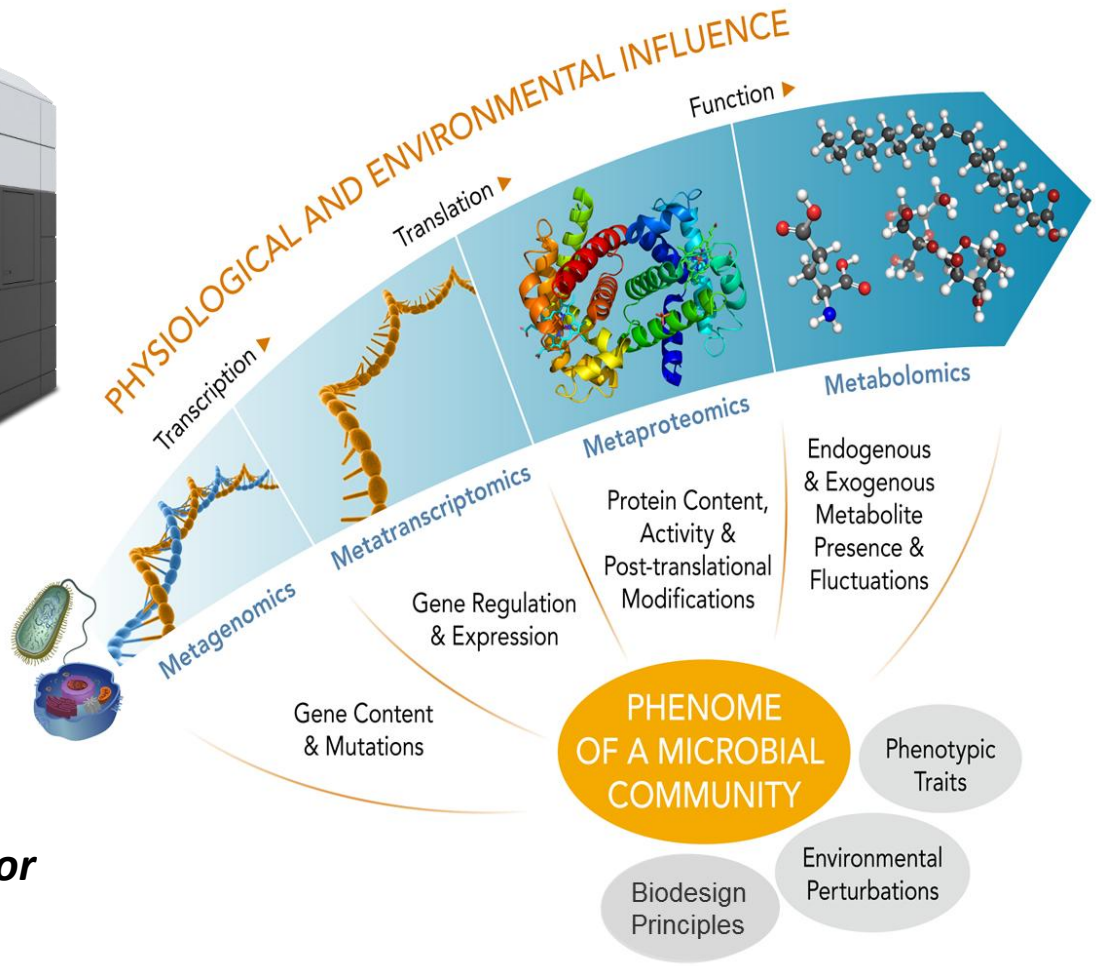
New cryo-EM at EMSL

- Thermo Fisher Krios G3i 300 kV cryogenic electron microscope
- Leverages infrastructure PNNL has implemented for the Pacific Northwest Cryo-EM Center

Access & Impacts

- Through the proposal process, BSSD researchers will have dedicated access to 50% instrument time; BER researchers will have priority access.

Douglas Mans, EMSL Director
Plenary talk
Tuesday 9:30 – 9:50AM



Additional Cryo-EM capabilities available at:
SLAC (PI: W. Chiu)

New capabilities available later this year at:
BNL (PI: L. Wang)

Visit the booth at the poster session

New BSSD Program Staff

Dr. Shing Kwok

Program Manager

Foundational Genomics Science

Connections within the Genomic Science Program Portfolio

If you are a PI funded under:

- *Systems Biology for Bioenergy*
- *Plant Genomics Research*
- *Sustainability Research for Bioenergy*
- *Biosystems Design*
- *Environmental Microbiome Science*

Bioenergy Research Centers

Poster Boards - *{M/T} 61-62, 69-76, 83-90 95-102, 107-114*

ORNL - ***Plant Microbe Interfaces***
Poster Boards – {M/T}125, {M/T}171, {M/T}183, {M}150, {M}167, {T}170

ORNL - ***Dynamic Visualization of Lignocellulose Degradation by Integration of Neutron Scattering Imaging and Computer Simulation***
Poster Boards – {M}42, {T}38, {T}130

LBNL - ***Ecosystems and Networks Integrated with Genes and Molecular Assemblies(ENIGMA)***
Poster Boards –{M}63-67 , {M}77-80, {M}91-92

LANL - ***Soil Metagenomics and Microbial Carbon Cycling in Terrestrial Ecosystems***
Poster Boards - {M/T}116, {M}136) {T}115, {T}126

LLNL - ***A Systems Biology Approach to Energy Flow in Biofuel Producing Microbial Communities***
Poster Boards - {M/T}106, {M/T}184, {M}135, {T}166-167

LBNL – ***m-CAFEs: Microbial Community Analysis and Functional Evaluation in Soils***
Poster Boards - {M}104, {T}91-92, {T}103,

PNNL – ***Phenotypic Response of the Soil Microbiome to Environmental Perturbations***
Poster Boards - {M/T}28, {M}36, {T}16, {T}17

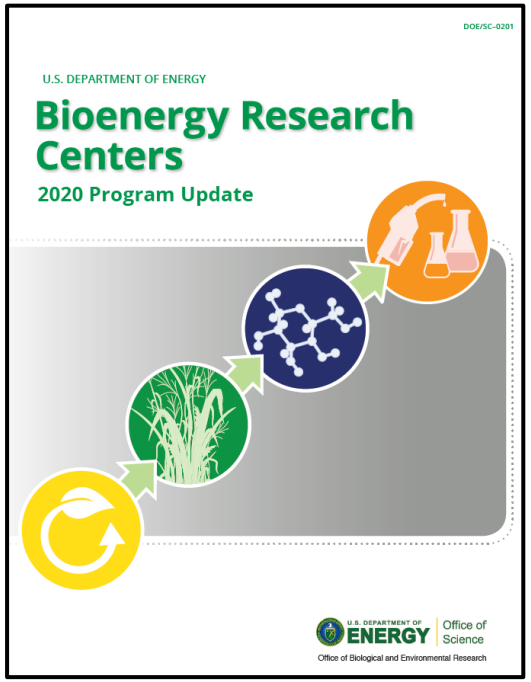
LANL – ***Bacterial: Fungal Interactions and Their Role in Soil Functioning***
Poster Boards - {M}115, {T}18, {M}35, {T}27

LLNL – ***Microbes Persist: Systems Biology of the Soil Microbiome***
Poster Boards - {M/T}128, {T}127, {T}135

Bioenergy Research Centers

Multidisciplinary fundamental science guided by milestones & deliverables, targeted to key areas needed to improve production of biofuels from renewable biomass.

- **Center for Bioenergy Innovation (CBI)**
  Oak Ridge National Laboratory (https://cbi.ornl.gov/)
- **Great Lakes Bioenergy Research Center (GLBRC)**
  University of Wisconsin, Michigan State University (https://www.glbrc.org/)
- **Joint BioEnergy Institute (JBEI)**
  Lawrence Berkeley National Laboratory (https://www.jbei.org/)
- **Center for Advanced Bioenergy and Bioproducts Innovation (CABBI)**
  University of Illinois (UIUC) (https://cabbi.bio/)



New Brochure for 2020

https://www.genomicscience.energy.gov/centers/BRC_Booklet_2020HR.pdf

Program Managers:
Dr. Kent Peters & Dr. Shing Kwok

Monday 11:00-12:00PM
Plenary Session #1 Talks
Posters: (*Mon & Tues) 61-62, 69-76, 83-90, 95-102, 107-114*

Systems Biology for Bioenergy

Fundamental, systems-level understanding of microbes and microbial communities relevant to advanced biofuels production.

DOE Genomic Science Program

Systems Biology of Bioenergy-Relevant Microbes to Enable Production of Next-Generation Biofuels and Bioproducts

Latest Awards (2018)

https://www.genomicscience.energy.gov/biofuels/systemsbiology/microbialbiofuelsawardsflyerLR.pdf

Monday Breakout 2:00-5:00PM
Session C: Columbia (Terrace Level)

BER Program Manager: Dr. Dawn Adin

Plant Genomics Research for Bioenergy

Research to address the challenges and opportunities in associating gene(s) to function (i.e., genotype to phenotype) in DOE-relevant plant systems.

Genomics-Enabled Plant Biology
for Determination of Gene Function

Summary of projects awarded in 2019 under Funding Opportunity Announcement DE-FOA-0002060

Genomic Science Program | genomicscience.energy.gov

12 New Awards

https://www.genomicscience.energy.gov/plantscience/PlantAwards_2019LR.pdf

New Awardee Talks
Tuesday Breakout 2:00-5:00PM
Session F: Columbia (Terrace Level)

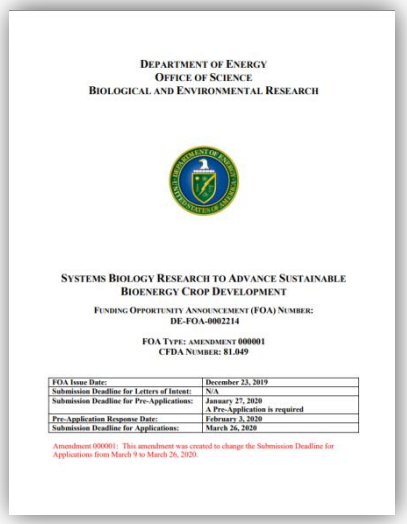
USDA Feedstocks Genomics Talks
Monday Breakout 2:00-5:00PM
Session B: Columbia (Terrace Level)

BER Program Manager: Dr. Cathy Ronning

Sustainability Research for Bioenergy

Research to Advance Bioenergy Agriculture

Understanding plant/soil/microorganism interactions in field settings



DEPARTMENT OF ENERGY
OFFICE OF SCIENCE
BIOLOGICAL AND ENVIRONMENTAL RESEARCH

SYSTEMS BIOLOGY RESEARCH TO ADVANCE SUSTAINABLE BIOENERGY CROP DEVELOPMENT

FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER:
DE-FOA-0002214

FOA TYPE: AMENDMENT 000001
CFDA NUMBER: 81.049

FOA Issue Date:	December 23, 2019
Submission Deadline for Letters of Intent:	N/A
Submission Deadline for Pre-Applications:	January 27, 2020 A Pre-Application is required
Pre-Application Response Date:	February 3, 2020
Submission Deadline for Applications:	March 26, 2020

Amendment 000001: This amendment was created to change the Submission Deadline for Applications from March 9 to March 26, 2020.

New FOA for FY 2020!

DE-FOA-002214
SYSTEMS BIOLOGY RESEARCH TO ADVANCE SUSTAINABLE BIOENERGY CROP DEVELOPMENT
Proposals due: 3-26-2020

Sustainability Talks
Tuesday Breakout 2:00-5:00PM
Session F: Columbia (Terrace Level)

Program Managers:
Dr. Cathy Ronning & Dr. Shing Kwok

Biosystems Design

Systems biology and genome engineering to enable design of new biological systems for bioenergy and bioproduct production

New *FY2019 Secure Biosystems Design Pilot Projects*
ANL - Machine Learning-Guided Design of Efficient Safeguard Systems that Operate Under Different Bacterial Physiologies [PI: Noirot]
ORNL - Lock and Key: Securing Genomes Against the CRISPR/CAS9 Gene-Editing Tool [PI: Abraham]
PNNL - Genome remodeling to control the persistence of engineered functions in soil microbes [PI: Egbert]
SLAC - Fail-safe Genome Engineering [PI: Salit]

New for FY 2020 Secure Biosystems Design (DOE Lab)

Tuesday Breakout 2:00-5:00PM
Session E: Columbia (Terrace Level)

BER Program Manager: Dr. Pablo Rabinowicz

Environmental Microbiome Science

Genome enabled research linking structure and function of microbial communities with key environmental or ecosystem processes

Systems Biology Enabled Research on the Roles of Microbiomes in Nutrient Cycling Processes

Summary of Projects Awarded in 2019 under the Funding Opportunity Announcement DE-FOA-0002059

Genomic Science Program | ***genomicscience.energy.gov***

13 new Awards

https://www.genomicscience.energy.gov/carboncycle/2019awardsLR.pdf

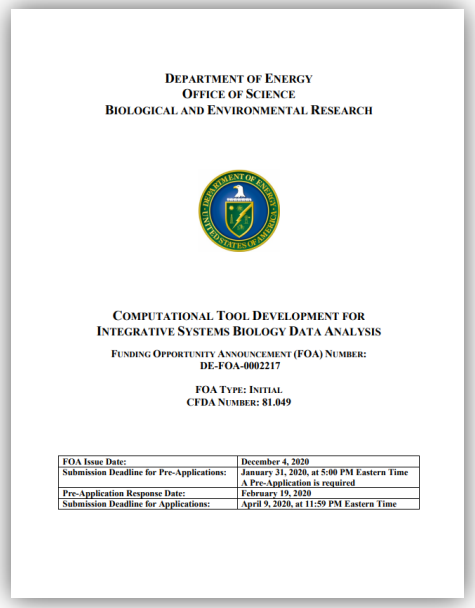
Tuesday Breakout 2:00-5:00PM
Session D: Columbia (Terrace Level)

BER Program Manager: Dr. Boris Wawrik

Computational Biosciences

New FY 2020

Funding Opportunity Announcement



DEPARTMENT OF ENERGY
OFFICE OF SCIENCE
BIOLOGICAL AND ENVIRONMENTAL RESEARCH

COMPUTATIONAL TOOL DEVELOPMENT FOR INTEGRATIVE SYSTEMS BIOLOGY DATA ANALYSIS

FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER: DE-FOA-0002217

FOA TYPE: INITIAL
CFDA NUMBER: 81.049

FOA Issue Date:	December 4, 2020
Submission Deadline for Pre-Applications:	January 31, 2020, at 5:00 PM Eastern Time A Pre-Application is required
Pre-Application Response Date:	February 19, 2020
Submission Deadline for Applications:	April 9, 2020, at 11:59 PM Eastern Time

DE-FOA-002217
COMPUTATIONAL TOOL DEVELOPMENT FOR INTEGRATIVE SYSTEMS BIOLOGY DATA ANALYSIS
Proposals due: 4-9-2020

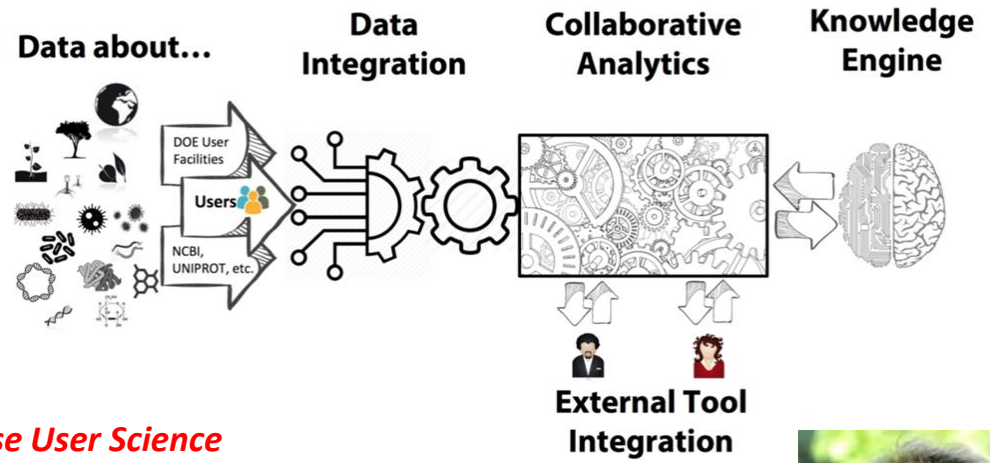
Plenary Session 3:
"Defragmenting to Accelerate Discovery: Making Better Use of Biological Data"
Tuesday 10:30 – 12:00PM

Program Manager: Dr. Ramana Madupu

DOE Systems Biology Knowledgebase

KBase PREDICTIVE BIOLOGY
DOE Systems Biology Knowledgebase

http://www.kbase.us



KBase User Science
Monday Breakout 2:00-5:00PM
Session A: Columbia (Terrace Level)

Kbase Hand's On Session
Tuesday 1:00-5:00PM
Fairchild (E&W)

KBase 1-on-1 Consultation & Help
(10 per hour)
Tuesday 2:00-5:00
Embassy

Adam Arkin (LBNL)
Plenary Session 2 Talk
Tuesday 9:10 – 9:30AM

National Microbiome Data Collaborative

nmdc National Microbiome Data Collaborative

Initiated in July 2019

www.microbiomedata.org
@microbiomedata

Plenary Session 2 Talk
Tuesday 8:50 – 9:10AM

Program Manager: Dr. Ramana Madupu

Biomolecular Characterization and Imaging Science

Structural Biology Beamline Resources

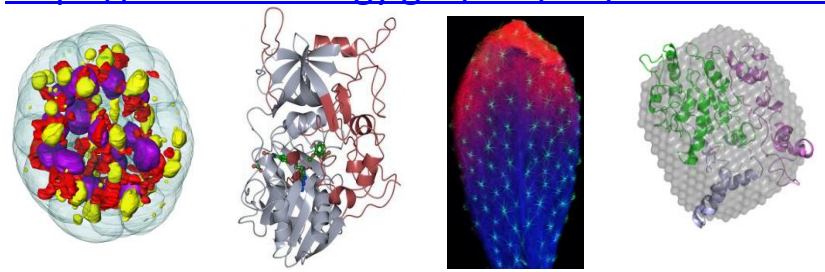
Supported by BER and Other Sponsors at DOE Basic Energy Sciences Light Source and Neutron User Facilities

Visit the website! BERStructuralBioPortal.org

https://science.energy.gov/bes/suf/user-facilities/

Some of the techniques available:

X-ray Crystallography; X-ray Cell Tomography, X-ray and Neutron and Scattering; Infrared spectromicroscopy, X-ray Spectroscopy and Imaging.



Hugh O'Neill (ORNL)
Plenary Session 2 Talk
Tuesday 9:50 – 10:10AM

Visit with staff during the poster sessions and at the booths nearby

See the latest Bioimaging program posters in Tuesday's Poster session

Biomolecular Characterization and Imaging Science PI Meeting
Feb 26 – 27, Jefferson room

BER Program Manager: Dr. Amy Swain & Dr. Prem Srivastava

JGI JOINT GENOME INSTITUTE
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Important Dates

Calls for User Proposals			
Proposal Call Type	**Review Frequency**	**Next Submission Deadline**	**Next Review Date**
CSP Annual	Annual	LOIs due April 10, 2020	August 2020
FICUS JGI-EMSL	Annual	LOIs due Mar 18, 2020	June 2020
FICUS JGI-NERSC-KBase	Annual	TBD	TBD
CSP New Investigator	Twice Yearly	Proposals due Mar 2, 2020 & Sept. 19, 2020	May 2020 & November 2020
CSP Functional Genomics	Twice Yearly	Proposals due July 30, 2020	TBD

JGI User Meeting
March 22-26 Oakland, CA

Nigel Mouncey, JGI Director
Plenary Session 2 Talk
Tuesday: 8:30-8:50 AM

Program Manager: Dr. Ramana Madupu

Thank you

http://science.energy.gov/ber
https://www.energy.gov/science/office-science

Latest Reports Now Available at:
http://genomicscience.energy.gov