

BSSD Workshop: Technologies for Characterizing Molecular and Cellular Systems Relevant to Bioenergy

**BERAC
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Department of Energy



Office
of Science

Office of Biological
and Environmental Research

September 21-23 Workshop: Technologies for Characterizing Molecular and Cellular Systems Relevant to Bioenergy

Rockville Hilton

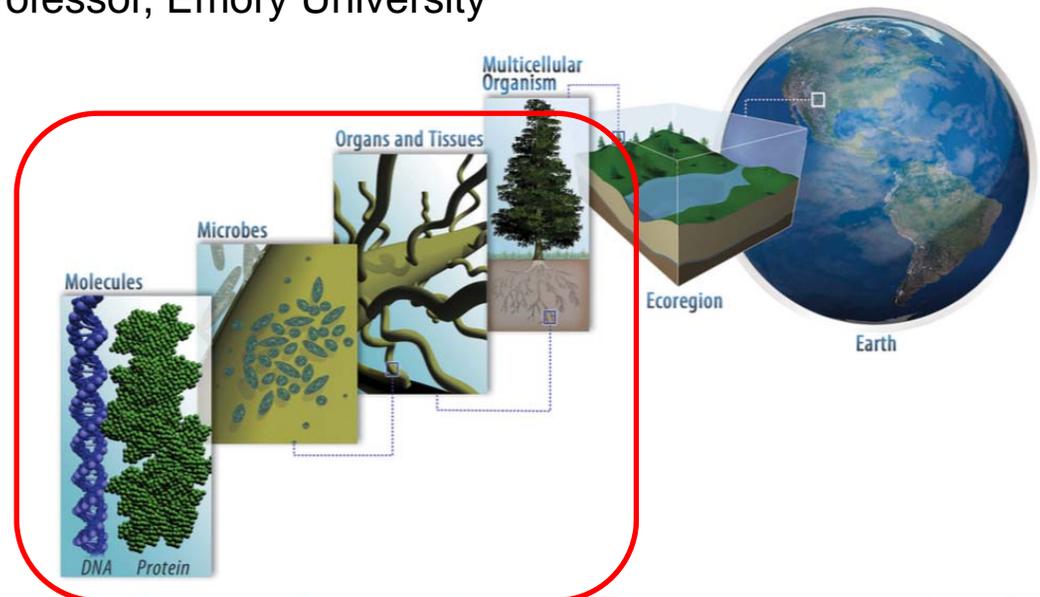
A.K.A. Workshop on Molecular to Mesoscale Technologies

Co-chairs:

Paul Adams, Ph.D., Division Director, Molecular Biophysics & Integrated Bioimaging, LBNL
Elizabeth R. Wright, Ph.D., Associate Professor, Emory University

32 Participants

Outcome: Report, early 2017



Workshop Participants

Chairs: Paul Adams, LBNL, Elizabeth Wright, Emory U.

Participant	Institution	Participant	Institution
Rommie Amaro	UCSD	Britt Hedman	SLAC
Parastoo Azadi	U. Georgia	Hoi-Ying Holman	LBNL
Philip Benfey	Duke U.	Greg Hura	LBNL
Joerg Bewersdorf	Yale U.	Farren Isaacs	Yale U.
Julie Biteen	U. Mich.	Andrzej Joachimiak	ANL
Wah Chiu	Baylor	Udaya Kalluri	ORNL
Bob Cottingham	ORNL	Ken Kemner	ANL
Shi-you Ding	Michigan State U.	Carolyn Larabell	UCSF
Jose Dinneny	Carnegie Inst.	Sean McSweeney	BNL
James Evans	EMSL	Michelle O'Malley	UCSB
Matthew Fields	Montana State U.	Hugh O'Neill	ORNL
Brian Fox	U. Wisc.	Jennifer Pett-Ridge	LLNL
Jamie Fraser	UCSF	Elizabeth Villa	UCSD
Sriram Ganesh	U. Maryland	Tuan Vo-Dinh	Duke U.

Workshop Goal: Identify Integrative Technologies to Facilitate Systems Biology Research

The Biological and Systems Sciences Division is interested in gaining a predictive understanding of plant and microbial biology for a host of DOE-relevant missions including:

- Bioenergy development
- Carbon/nutrient cycling processes in the environment
- Biosystems design/synthetic biology
- Sustainability research

Identify or Develop Integrative Technologies to:

- Understand key biological processes within and among plant and microbial cells
- Test/verify hypotheses of genome-to-function translation
- Understand the spatio-temporal nature of metabolism within/among cells
- Identify metabolic bottlenecks to pathway design or optimization
- Understand biomolecular structure-function relationships
- Improve computational descriptions and predictions of cellular processes

Current Enabling Capabilities



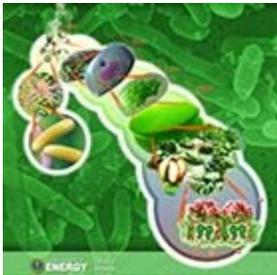
- **Joint Genome Institute**
 - User Facility for genome sequencing and interpretation



- **Systems Biology Knowledgebase**
 - Online open source systems biology platform



- **Structural Biology Infrastructure**
 - Light and Neutron source experimental stations for structural biology and imaging



- **New Bioimaging Technologies**
 - Imaging technology development program underway



- **Environmental Molecular Science Laboratory**
 - User Facility for proteomics, microscopy, cell dynamics



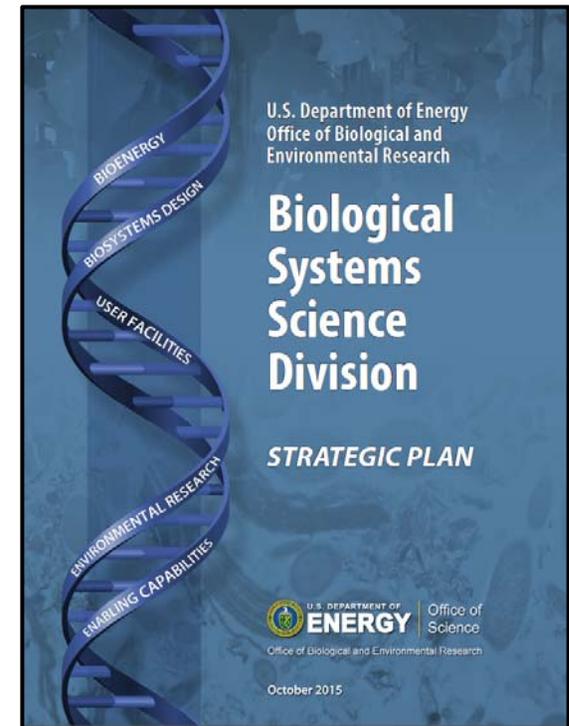
- **National Energy Research Supercomputing Center**
 - Computational resources and expertise for basic scientific research

Rationale - 2015 BSSD Strategic Plan

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.*

Objective 4: Develop the enabling computational, visualization, and characterization capabilities to integrate genomic data with functional information on biological processes.

- Convened workshop to identify and articulate the scientific basis for requesting for new resources

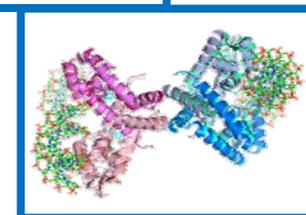
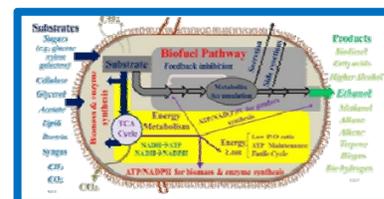


Biology Themes

plenary and breakout sessions

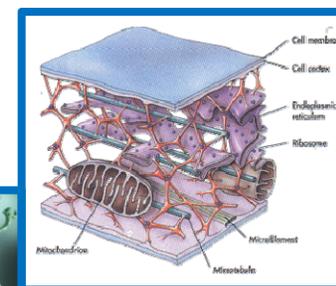
- **Cellular ultrastructure and physiology**

- Metabolic Pathways in Plants, microbes and fungi
- Cellular structure, organization, signalling, network



- **Bioenergy and bioproducts production**

- Cell Wall Composition and Degradation
- Synthetic Biology/Biosystems Design



- **Environmental microbiology**

- Community Interactions (including Rhizosphere)
- Biogeochemical Cycling of Elements



Workshop Charge Summary

Charge to Biologists:

- What are the barriers to making advances in characterizing your (representative) systems of interest?
- Are there paths to overcoming them?
- What other biological systems would benefit?
- What are the length and time scales involved?

Charge to Technology Experts:

- What current technical limits prevent the biological advances described above? e.g., resolution/scale, sample preparation, experimental conditions, stability, accessibility, analysis tools, etc.
- What technologies might be adapted, created, further developed, or combined to address the barriers?
- What are the obstacles to applicability or broad use of potential technological solutions?

Stay tuned...

Report expected in early 2017