



# BER User Facilities and Research Resources

Environmental System Science PI Meeting  
May 1, 2018

**Amy L. Swain, Ph.D.**  
Program Manager  
Office of Biological & Environmental Research



U.S. DEPARTMENT OF  
**ENERGY**

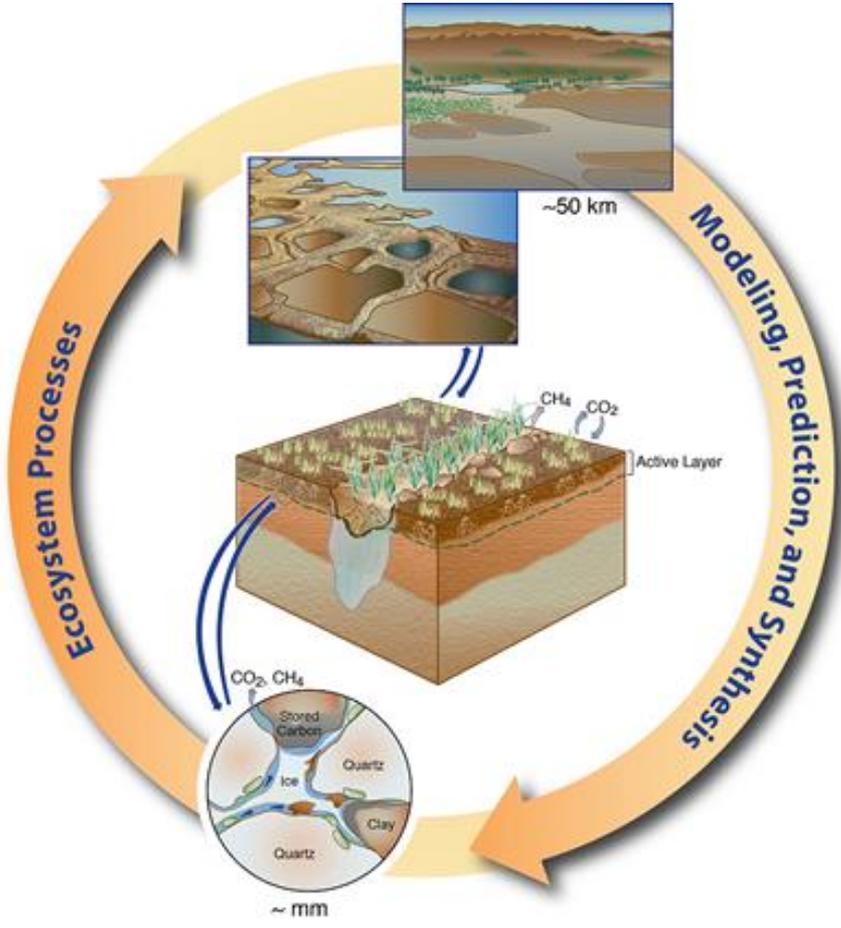
Office  
of Science

Office of Biological  
and Environmental Research

# Environmental Systems Science

## Terrestrial Ecosystem Science

“...mechanistic and predictive understanding...”  
Subsurface Biogeochemistry Program

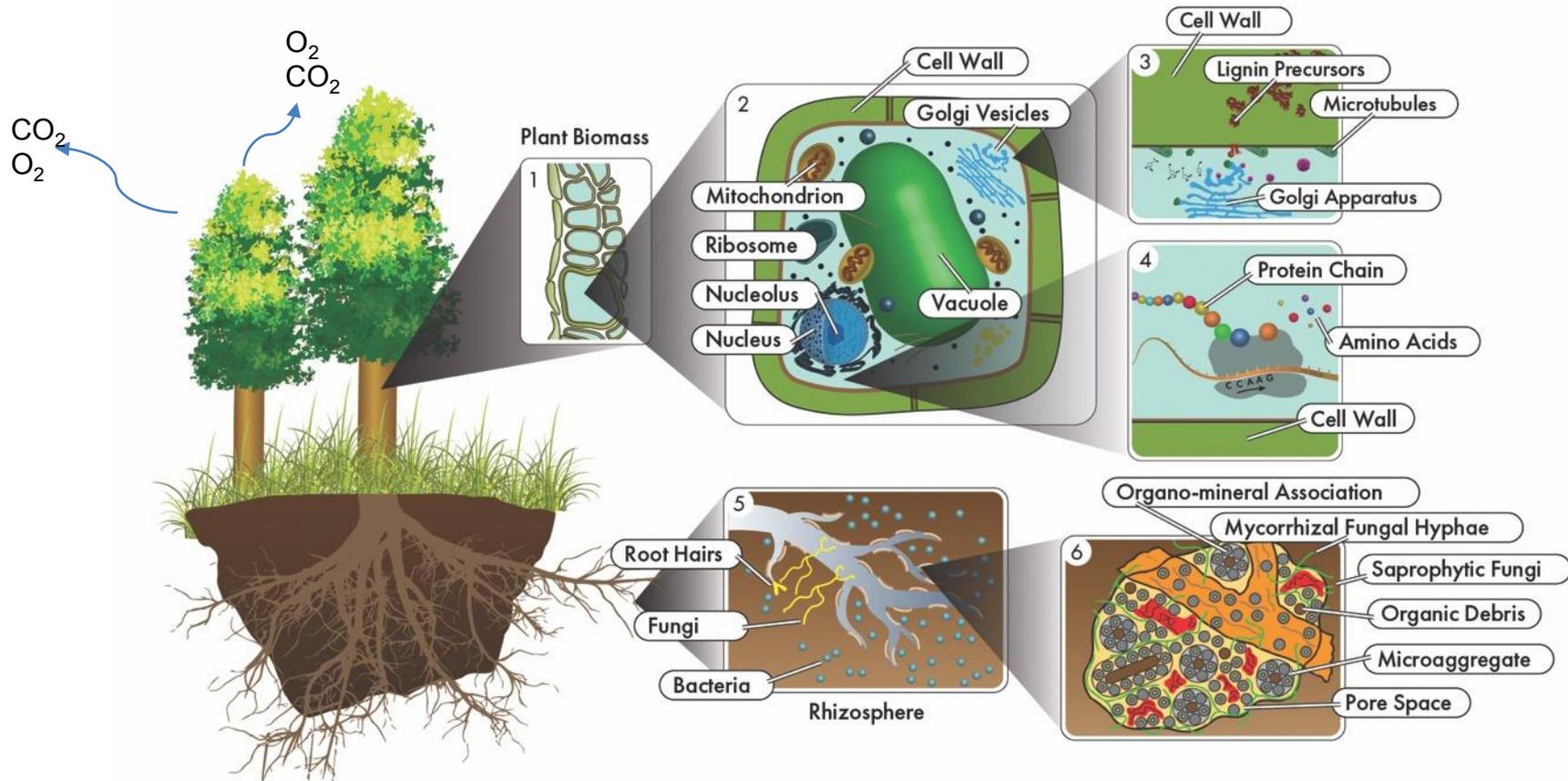


Terrestrial biosphere's role in the global cycling of carbon, nutrients, and water



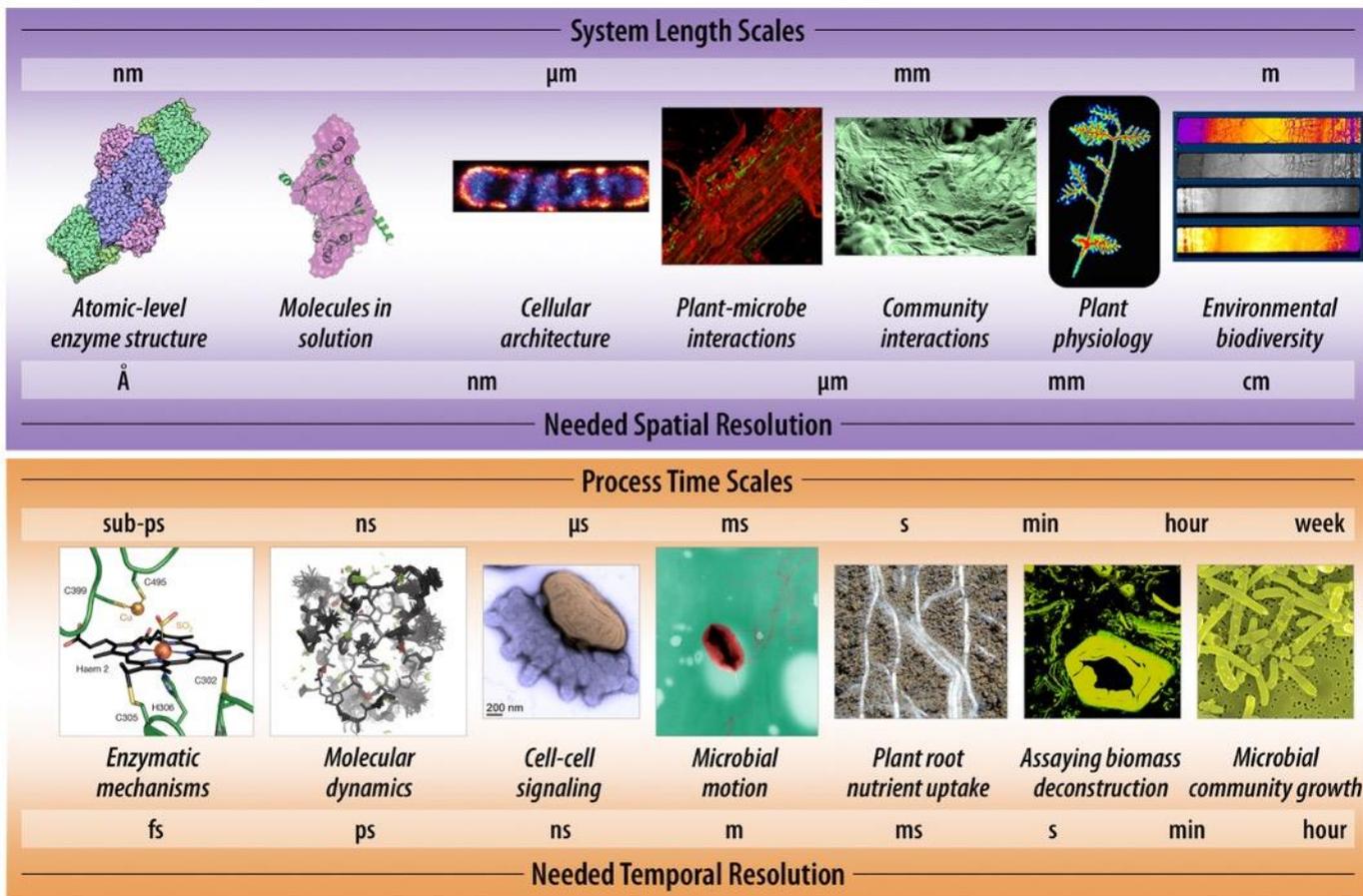
Predictive Understanding of Watershed Systems

# Multiscale Studies ...



U.S. DOE. 2017. Technologies for Characterizing Molecular and Cellular Systems Relevant to Bioenergy and Environment, page 82. DOE/SC-0189, U.S. Department of Energy Office of Science. [science.energy.gov/ber/community-resources/](http://science.energy.gov/ber/community-resources/).

# Needed Length and Time Scales

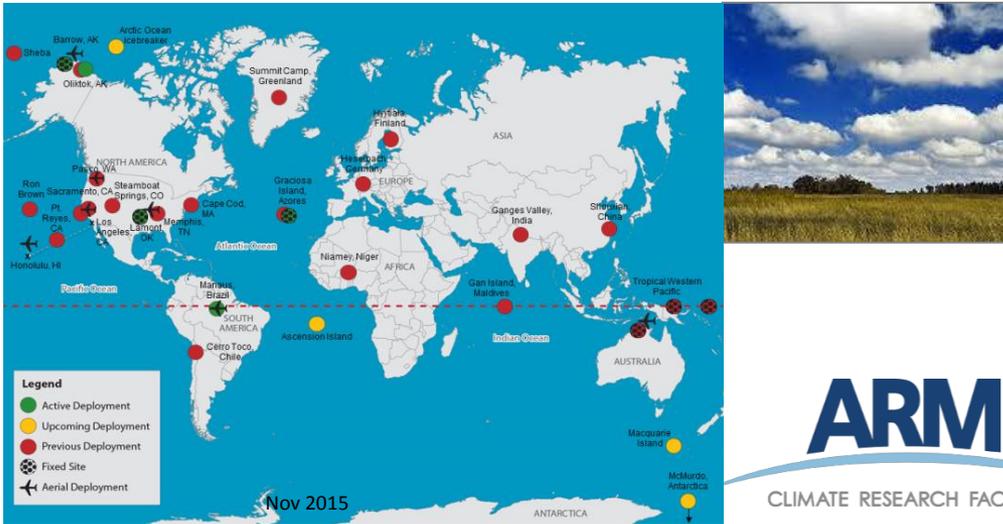
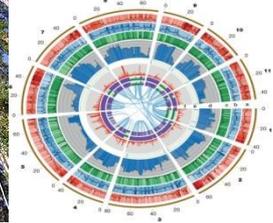


<http://genomicscience.energy.gov/technologies>

U.S. DOE. 2017. Technologies for Characterizing Molecular and Cellular Systems Relevant to Bioenergy and Environment, page 3. DOE/SC-0189, U.S. Department of Energy Office of Science. [science.energy.gov/ber/community-resources/](http://science.energy.gov/ber/community-resources/).

# Scientific User Facilities Enabling BER Research

**Joint Genome Institute (JGI)** - meeting the genome sequencing needs of the bioenergy, carbon cycle, and biogeochemical science communities



**Atmospheric Radiation Measurement (ARM) Climate Research Facility** - providing continuous field measurements and data products to improve cloud and aerosol science in climate models

**Environmental Molecular Sciences Laboratory (EMSL)** - enables molecular-scale experimental and theoretical research in biological and environmental systems science.



# DOE Synchrotron and Neutron User Facilities

Funded by Office of Basic Energy Science



**Advanced Photon Source (APS)**  
Argonne National Laboratory



**National Synchrotron Light Source (NSLS-II)**  
Brookhaven National Laboratory



**Advanced Light Source (ALS)**  
Lawrence Berkeley National Laboratory



Experiment Categories:  
spectroscopy  
scattering  
imaging



**Stanford Synchrotron Radiation Lightsource (SSRL)**  
SLAC National Accelerator Laboratory



**Linac Coherent Light Source (LCLS)**  
SLAC National Accelerator Laboratory  
Stanford University



**Spallation Neutron Source (SNS) and High Flux Isotope Reactor (HFIR)**  
Oak Ridge National Laboratory

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# Environmental Sciences at the Synchrotron Facilities



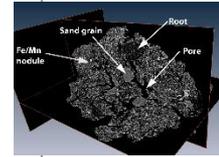
Hoi-Ying Holman



**Advanced Photon Source (APS)**  
Argonne National Laboratory

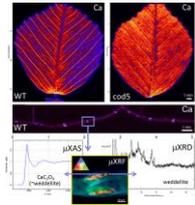


Ken Kemner – Fe and S  
Biogeochemistry in Redox  
Dynamic Environments SFA

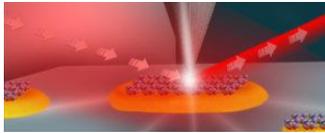


**National Synchrotron  
Light Source (NSLS-II)**  
Brookhaven National Laboratory

Ryan Tappero



**Advanced Light Source (ALS)**  
Lawrence Berkeley National Laboratory

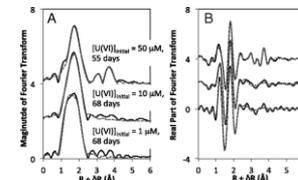


**Stanford Synchrotron Radiation  
Lightsource (SSRL)**  
SLAC National Accelerator Laboratory

John Bargar – Groundwater  
Quality SFA

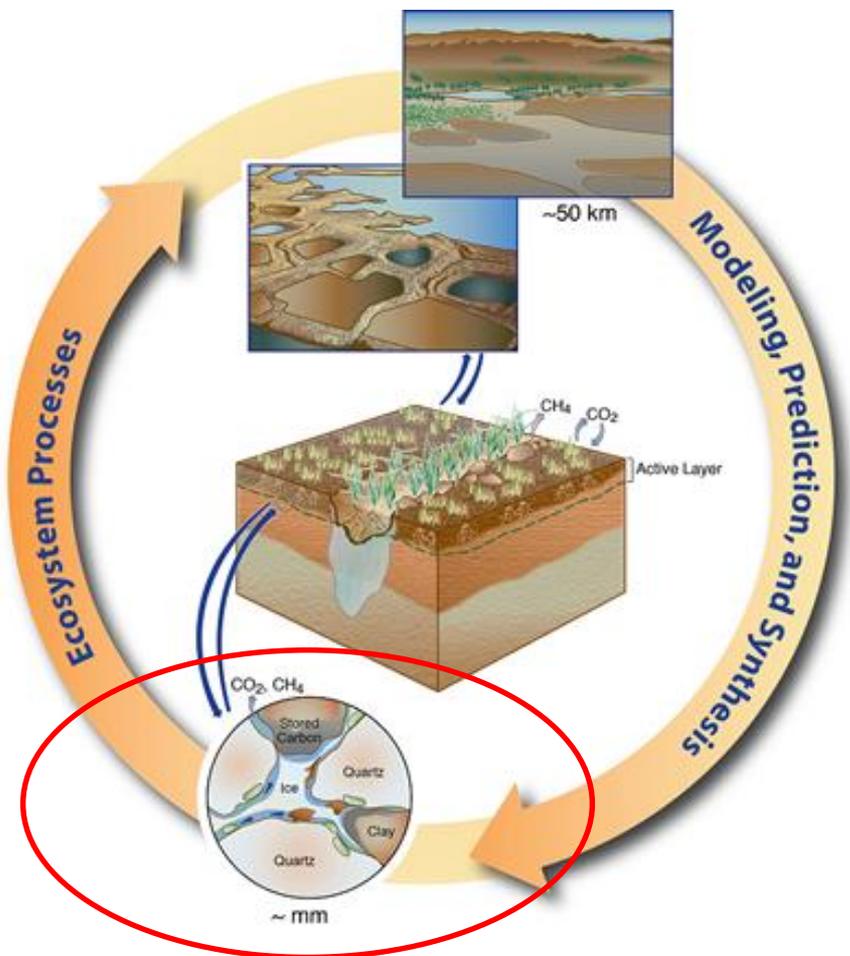


**Spallation Neutron Source (SNS)  
and High Flux Isotope Reactor (HFIR)**  
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# Environmental Systems Science

## Terrestrial Ecosystem Science



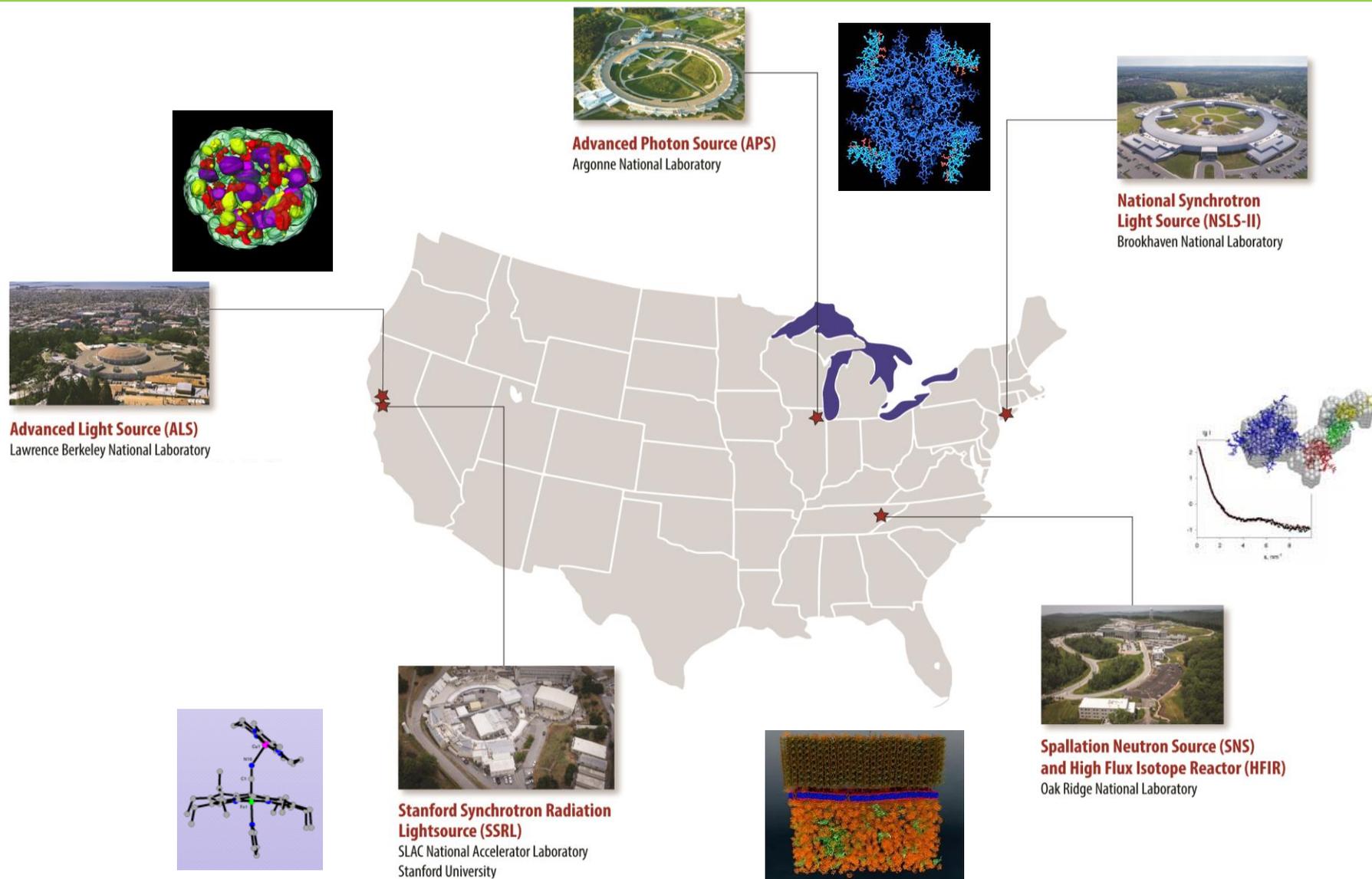
Terrestrial biosphere's role in the global cycling of carbon, nutrients, and water

## Subsurface Biogeochemistry Program



Predictive Understanding of Watershed Systems

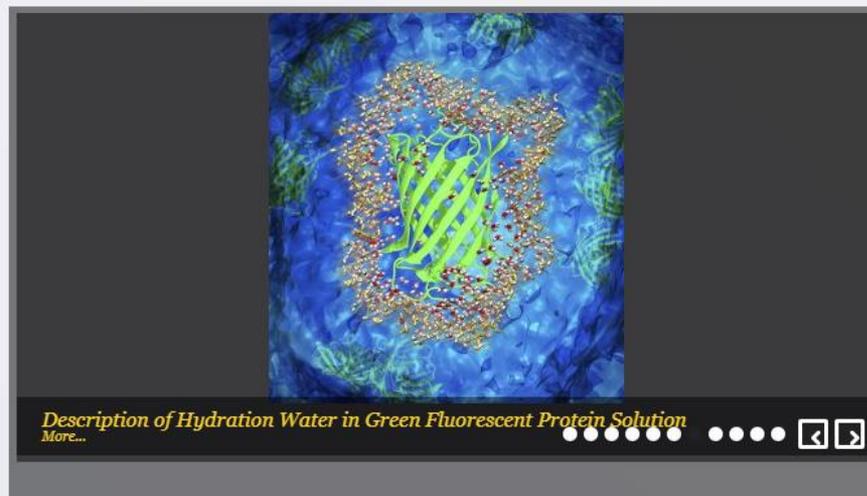
# BER Biology Resources at the Light and Neutron Sources



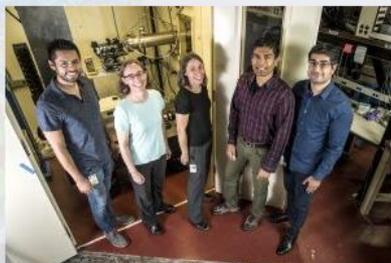
## BER Structural Biology and Imaging Resources at Synchrotron and Neutron Facilities

[HOME](#) [ABOUT](#) [USERS](#) [CAPABILITIES](#) [FACILITIES](#) [RESEARCH HIGHLIGHTS](#) [SITE MAP](#)

Scientists have made remarkable progress over the past few decades in biological imaging, from the atomic scale (sub-nm) to the cellular (micron) scale. There are extraordinary opportunities for scientists working to understand and harness biological systems for addressing the Biological and Environmental Research program's mission relevant challenges. Many of these advances are made possible by the unique crystallography, scattering, spectroscopy, and imaging capabilities of the U.S. Department of Energy's national user facilities available at neutron and synchrotron light sources. [more...](#)



### User Experiences



X-Ray Footprinting Solves Mystery of Metal-Breathing Protein

### Highlights

Cyanobacterial Studies Examine Cellular Structure During Nitrogen Starvation

November 15, 2017

Dynamics on Cellulose Show Two Important Populations from Neutron Scattering and Simulations

September 19, 2017

Measuring and Modeling Poplar Root Water Extraction After Drought Using Neutron Imaging

September 9, 2017

The Origins of Photosynthesis in a Sun-Loving

### Related Reports

Biological Small Angle Scattering: Techniques, Strategies and Tips



Grand Challenges for Biological and



# BER User Facilities and Research Resources

...at this meeting



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



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



- **Atmospheric Research Measurement**
  - Ground-based observations facility advancing atmospheric and climate research



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



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



- **ESS Data Infrastructure for a Virtual Ecosystem**
  - New data archive for Earth and environmental science data

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...at this meeting



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

Suzannah Tringe



- **Environmental Molecular Science Laboratory**
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Nancy Hess



- **Atmospheric Research Measurement**
  - Ground-based observations facility advancing atmospheric and climate research

Ricky Petty



- **Structural Biology Infrastructure**
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Amy Swain



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

Chris Henry



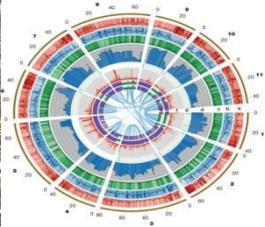
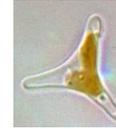
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Deb Agarwal



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**FICUS**  
Facilities Integrating  
Collaborations for User Science

The logo for FICUS features a stylized tree with a dark trunk and branches. The leaves are represented by various colored circles (yellow, green, blue, orange) of different sizes, giving it a modern, scientific feel.

**Environmental Molecular Sciences Laboratory (EMSL)** - enables molecular-scale experimental and theoretical research on aerosol chemistry, biological systems, geochemistry/biogeochemistry, and interfacial and surface science.



# User Facility and Research Resource Information

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- **Poster Session** – Wednesday, 12:00, Lobby Area  
Ben Franklin Building (here)
- **Informational Materials** on Flash Drive

Under /Programmatic Documents/BER User Facilities/

- ARM Climate Research Facility
- EMSL – Environmental Molecular Science Laboratory
- JGI – Joint Genome Institute
- Kbase
- Synchrotron & Neutron Resources

Environmental Science Resources  
Biology Resources