

# Advanced Bioimaging Capabilities and Biomedical Research Opportunities: A Dialog Series Between the NIH and DOE Research Communities

- **Objectives:**

- **Characterize the current state of high resolution bioimaging technology**
- **Identify significant biomedical challenges**
- **Identify novel technology that could advance biomedical imaging**

Upcoming Request for Information

- **Provide a forum to cross fertilize ideas from technology developers and biomedical researchers**

Future workshops

**Paul Sammak, Michele McGuirl NIGMS/NIH**

**Richard Leapman, Shumin Wang, NIBIB/NIH**

**Peter Lee, and Amy Swain, DOE**

# NIH-DOE Bioimaging Webinar, March 11, 2020: Data Acquisition and Available Techniques

**Stefan Vogt, Argonne National Laboratory**

*Synchrotron-based x-ray imaging for biology: visualization of trace elements to cellular structure*

**Bridget Carragher, New York Structural Biology Center**

*An introduction to cryo electron microscopy (cryoEM)*

**Enrico Gratton, University of California, Irvine**

*Dynamic super-resolution in optical microscopy*

Please direct all webinar inquiries:  
using Webex CHAT function, or  
[NIH-DOE-bioimaging@nih.gov](mailto:NIH-DOE-bioimaging@nih.gov)



National Institutes of Health



U.S. DEPARTMENT OF  
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# Basic Energy Sciences Scientific User Facilities (12)

Unique research facilities *and* scientific expertise for ultra high-resolution characterization, synthesis, fabrication, theory and modeling of advanced materials

## Lawrence Berkeley National Laboratory

- Advanced Light Source
- Molecular Foundry



## Argonne National Laboratory

- Advanced Photon Source
- Center for Nanoscale Materials



## Brookhaven National Laboratory

- Center for Functional Nanomaterials
- National Synchrotron Light Source-II

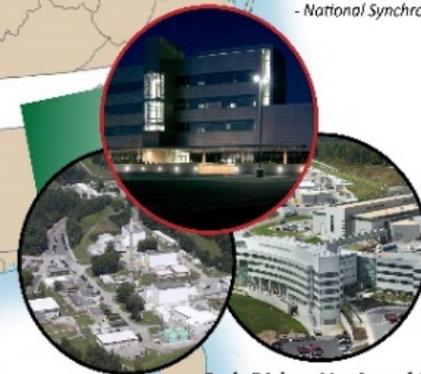
## Sandia National Laboratories

- Core Facility for the Center for Integrated Nanotechnologies



## Los Alamos National Laboratory

- Gateway Facility for the Center for Integrated Nanotechnologies



## Oak Ridge National Laboratory

- Center for Nanophase Materials Sciences
- High Flux Isotope Reactor
- Spallation Neutron Source

## SLAC National Accelerator Laboratory

- Linac Coherent Light Source
- Stanford Synchrotron Radiation Lightsource



5 Light Sources: 4 rings + 1 FEL  
2 Neutron Sources: 1 spallation + 1 reactor  
5 Nanoscale Science Research Centers



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# User Access

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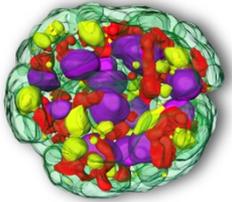
- Available to all researchers at no cost for non-proprietary research
- Proprietary research may be performed at full-cost recovery
- Access based on external peer merit review of proposals

**See Our Website for Details**

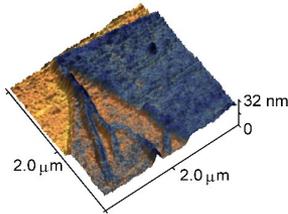
**<https://science.osti.gov/bes/suf/User-Facilities>**



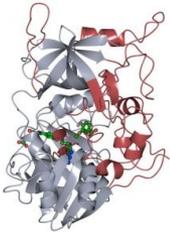
# Some photon and neutron biology techniques, supported by NIH & DOE Biological and Environmental Research (BER)



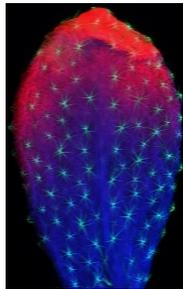
**X-ray  
Tomography**



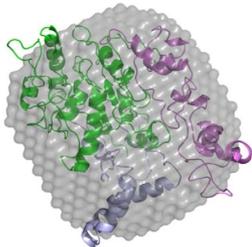
**Infrared Micro-  
spectroscopy**



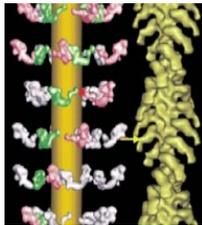
**Crystallography**



**X-ray Fluorescence  
Spectroscopic-Imaging**



**X-ray and Neutron  
and Scattering**

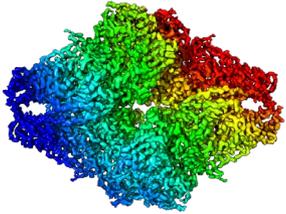


**Fiber Diffraction**

- [Advanced Light Source \(ALS\)](#), Lawrence Berkeley National Laboratory
- [Stanford Synchrotron Radiation Lightsource \(SSRL\)](#), Stanford University
- [Advanced Photon Source \(APS\)](#), Argonne National Laboratory
- [National Synchrotron Light Source \(NSLS-II\)](#), Center for BioMolecular Structure (CBMS)
- [Spallation Neutron Source \(SNS\) and High Flux Isotope Reactor \(HFIR\)](#), Oak Ridge National Laboratory

See also [www.BERStructuralBioPortal.org](http://www.BERStructuralBioPortal.org)

# Transformative High Resolution Cryo-Electron Microscopy



**Cryo-electron  
Microscopy**

## NIH Common Fund Programs

- [National Center for CryoEM Access & Training \(NCCAT\)](#)

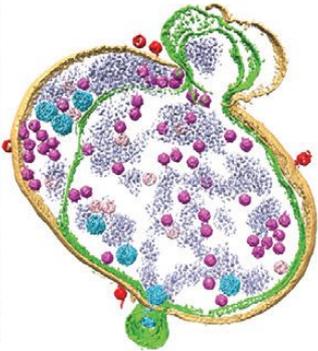
New York Structural Biology Center

- [Stanford-SLAC Cryo-EM Center \(S<sup>2</sup>C<sup>2</sup>\)](#)

Stanford University

- [The Pacific Northwest Center for Cryo-EM \(PNCC\)](#)

Oregon Health & Science University



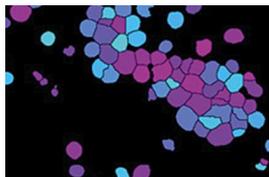
**Cryo-electron  
tomography**

## BER Resource

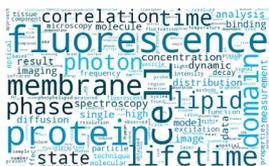
- [Laboratory for Biomolecular Structure](#)

Brookhaven National Laboratory

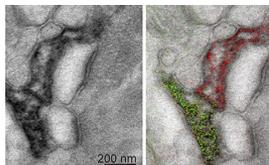
# NIGMS Supported Centers and Resources



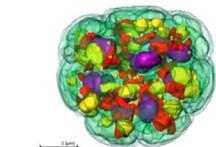
- [Center for Open Bioimage Analysis](#)
  - Broad Institute. University of Wisconsin, Anne E. Carpenter, Ph.D. and Kevin W. Eliceiri, Ph.D., CellProfiler and ImageJ/FIJI



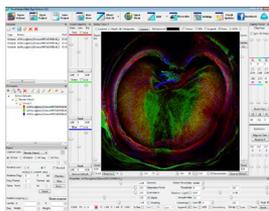
- [Laboratory for Fluorescence Dynamics](#)
  - University of California, Irvine, Enrico Gratton, Ph.D. Light microscope imaging of dynamic processes in cells.



- [National Center for Microscopy and Imaging Research](#)
  - University of California, San Diego, Mark H. Ellisman, Ph.D, . Light and electron microscope imaging macromolecule to cellular structure.



- [National Center for X-ray Tomography](#)
  - Advanced Light Source, Lawrence Berkeley National Laboratory, Carolyn A. Larabell, Ph.D., light and X-ray quantitative imaging of whole, hydrated cells



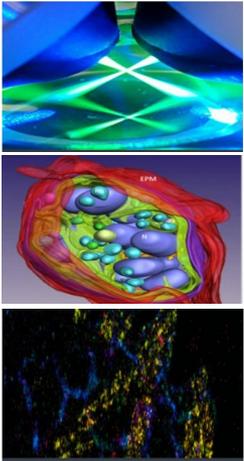
- [Center for Integrative Biomedical Computing](#)
  - University of Utah, Christopher R. Johnson, Ph.D., Rob S. MacLeod, Ph.D., and Ross T. Whitaker, Ph.D., Software tools image-based modeling and visualization





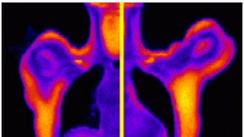
## NIBIB Intramural Labs and Extramural Centers

- Intramural Labs at NIBIB



- Advanced Imaging and Microscopy (AIM) Resource and (Super Resolution Optical Imaging) Hari Shroff, Ph.D.
- Cellular Imaging and Macromolecular Biophysics (LCIMB), (EM AFM) Richard Leapman, Ph.D.
- Section on Biophotonics (Fluorescent Proteins) George Patterson, Ph.D.

- Extramural Resource Centers for Medical Imaging



- Center for Molecular Imaging Technology and Translation (PET/MR) EL Georges Fakhri, Massachusetts General Hospital <http://gordon.mgh.harvard.edu/cmitt/>



- Resource for Molecular Imaging Agents in Precision Medicine, small molecules and theranostic macromolecular agents) Martin Pomper, Johns Hopkins University <https://www.jhpmrc.org/>

# Technology Funding Opportunity Announcements (FOAs)

## [NIBIB Exploratory Research Funding](#)

- NIBIB Exploratory/Developmental Research Grant Program (R21) [PAR-18-433](#)
- NIBIB Trailblazer Award for New and Early Stage Investigators (R21) [PAR-20-084](#)

## [NIBIB Technology Development Funding](#)

- NIBIB Biomedical Technology Resource Centers (P41) [PAR-18-205](#)
- Bioengineering Research Partnerships (U01) [PAR-19-156](#)
- Bioengineering Research Grants (BRG) (R01) [PAR-19-158](#)

## [NIGMS overview -Biomedical Technology Centers](#)

- Limited Competition: NIGMS National and Regional Resources (R24) [PAR-19-301](#)
- Biomedical Technology Development and Dissemination Center (RM1) [PAR-20-104](#)

## [NIGMS Technology Development Programs \(R21 and R01\)](#)

- Exploratory Research for Technology Development (R21) [PAR-19-254](#)
- Focused Technology Research and Development (R01) [PAR-19-253](#)

## [NIH Data Science Biomedical-data-repositories-and-knowledgebases](#)

- Biomedical Data Repository (U24) [PAR-20-089](#)
- Biomedical Knowledgebase (U24) [PAR-20-097](#)



# Future NIH-DOE Bioimaging Webinar, April 15, 2020: Imaging Data Analysis, Management and Knowledge

Contact [michele.mcguirl@nih.gov](mailto:michele.mcguirl@nih.gov) for access information

Speakers:

**Susan Gregurick, NIH Office of Data Science**

*Introduction to data management*

**Anne Carpenter, Broad Institute**

*Center for Open Bioimage Analysis CellProfiler and Image J/Fiji*

**Jamie Sethian, Lawrence Berkeley National Laboratory**

*Interfaces, data to Info*

**J. Swedlow, U.Dundee**

*Open Microscopy Environment, image data and information*

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**Future Request for Information:** Comments on unaddressed research needs, barriers, and novel technologies

# Stefan Vogt, Argonne National Laboratory

- Associate Division Director of the X-ray Science Division at the Advanced Photon Source
- Adjunct Associate Professor at the Feinberg School of Medicine at Northwestern University



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# Bridget Carragher

## New York Structural Biology Center

- Co-Director, National Resource for Automated Molecular Microscopy (NRAMM)
- Co-PI, National Center for CryoEM Access and Training
- Co-Director, Simons Electron Microscopy Center, New York Structural Biology Center, NY, NY
- Adjunct Professor, Columbia University, New York, NY



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[NIH-DOE-bioimaging@nih.gov](mailto:NIH-DOE-bioimaging@nih.gov)

# Enrico Gratton

## University of California, Irvine

- Professor of Biomedical Engineering and Physics
- Principal Investigator of the Laboratory for Fluorescence Dynamics



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