U.S. DEPARTMENT OF ENERGY Argonne National Laboratory is a U.S. Department of Energy laboratory managed by UChicago Argonne, LLC.

APS-U Capabilities

For biological and environmental science

The use of synchrotron-based x-ray techniques over the past 20 years has revolutionized many scientific disciplines, including biology, medicine, material engineering, and environmental science, among others. As research has advanced, x-ray light source technologies have progressed as well. The Advanced Photon Source (APS), a U.S. Department of Energy Office of Science User Facility at Argonne National Laboratory, is undergoing a generational upgrade to take advantage of a new light source design, better instrumentation, and novel methods. When completed, the upgraded APS will be one of world's brightest light source, delivering x-rays up to 500 brighter than today. The upgrade will allow researchers to study samples at higher resolutions and unprecedented spatial and temporal scales.

The Structural Biology Center (SBC) at the APS is a user facility for macromolecular crystallography funded by the DOE Office of Biological and Environmental Research (BER) and supporting structural biology research in national interest areas. However, with the APS upgrade, the SBC plans to expand its portfolio of techniques to embrace the new capabilities and research needs of the broader biological and environmental science community. The upgraded APS will open up opportunities in cell structure and chemistry, environmental microbiology, atmospheric and aerosol research, biogeochemistry and soil structure, and recyclable plastics. Multimodal approaches will be adopted combining x-ray techniques, such as x-ray crystallography, microscopy, and absorption spectroscopy, together with visible light and electron microscopy. This will enable detailed visualization of biological and environmental samples at scales ranging from Angstroms to cm, from picoseconds to seconds. With the x-ray source's high brightness, investigation of dynamics of biological processes will be finally achievable. The APS can address questions related to lignocellulosic biomass synthesis, organization and conversion, cellular trace metals homeostasis, properties of engineered enzymes aiding synthetic biology, microbial role in geochemical processes, transformations of carbon and other nutrients, water movement in soil, and many others.

Currently, the SBC seeks collaborators interested in exploring some tools at the APS, such as macromolecular structural dynamics and imaging of soils, plants, or aerosol particulates. Such projects may already lead to cutting-edge science. They will also allow the SBC to plan a better future user program, including enabling access to the most suitable beamlines and addressing method-development needs. Experiments carried out before installation period begins will prepare the user community and the facility to take full advantage of the upgraded APS when it comes on-line, currently scheduled for 2023.

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Darren Sherrell
Andrzej Joachimiak

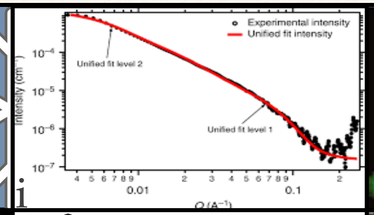
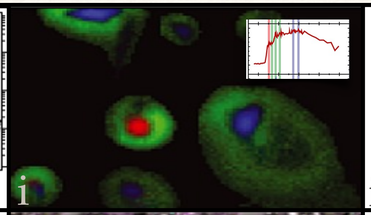
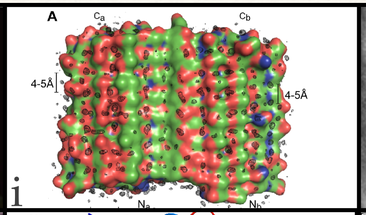
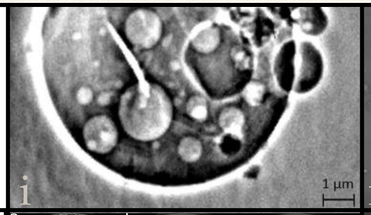
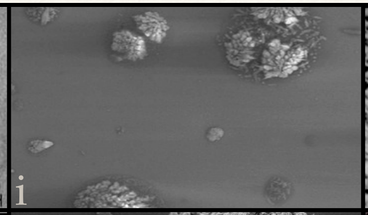
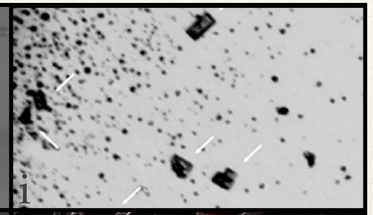
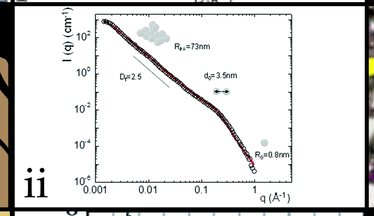
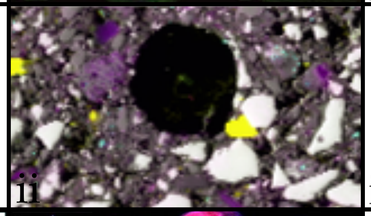
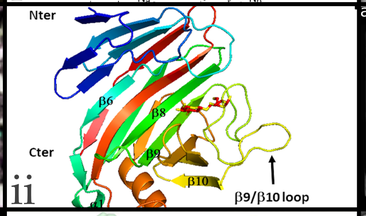
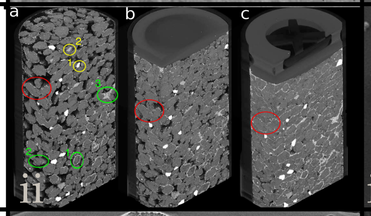
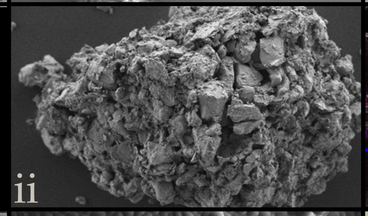
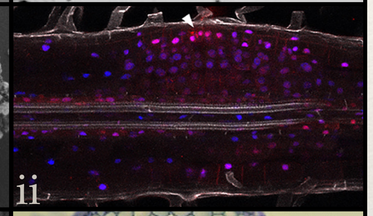
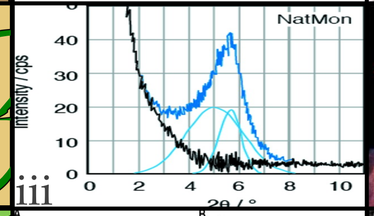
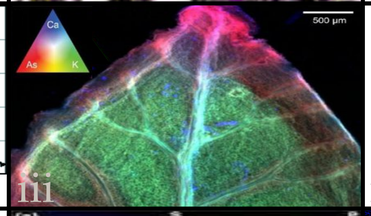
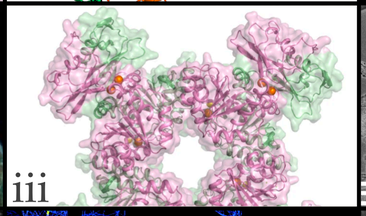
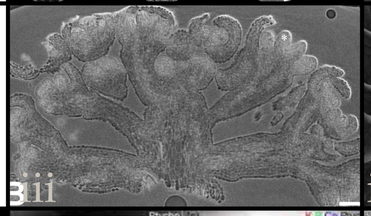
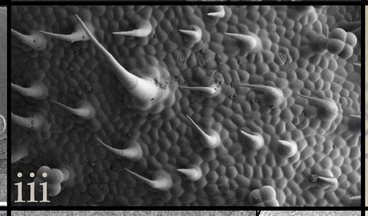
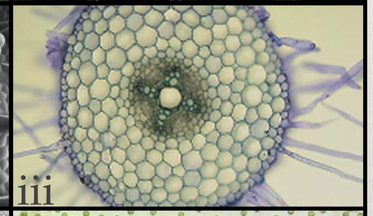
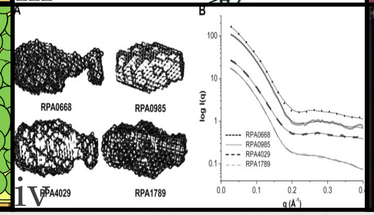
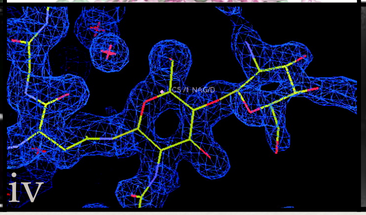
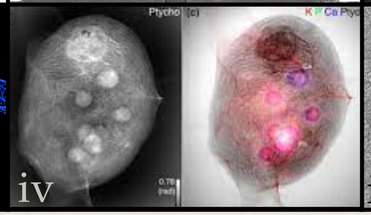
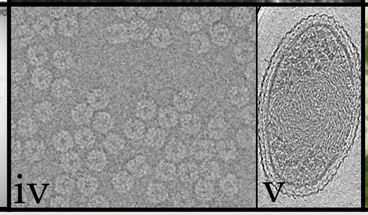
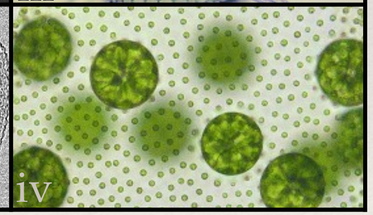
For more information about APS-U opportunities, please refer to the workshops documents:

Workshop on Biological Science Opportunities Provided by the APS Upgrade
Workshop to Identify Opportunities in Biological and Environmental Research Uniquely Enabled by the APS Upgrade

For enquiries about collaborations or capabilities, please contact us at: eBERlight@anl.gov

APS-U Techniques

Complementary

	Solution SAXS	*Point Probe XFM / XAS*	*Crystallographic MX*	*Full-field Imaging XMIC*	*Electron Microscopy EM*	*Non-Destructive Optical MIC*
Atmosphere						
Roots Soils						
Plant physiology						
Microorganisms Cellular Biology						
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i) 10.1038/s41467-019-09066-4
ii) 10.1039/C6EN00589F
iii) 10.1107/S1600576719017266
iv) 10.1074/jbc.M112.352385

i) 10.1002/2014JD021866
ii) 10.1111/nph.16242
iii) 10.1104/pp.18.00759
iv) 10.1038/s41598-017-00569-y

i) 10.1002/2014JD021866
ii) 10.1038/s41598-020-67069-4
iii) 10.1038/s41467-019-11698-5
iv) 10.1139/o11-071

i) 10.1016/j.nimb.2015.07.050
ii) 10.1371/journal.pone.0159948
iii) 10.1371/journal.pone.0075295
iv) 10.1038/s41598-017-00569-y

i) 10.1002/2014JD021866
ii) 10.1002/jpln.201600451
iii) 10.1105/tpc.20.00127
iv) 10.1016/j.sbi.2017.05.016
v) 10.1038/ncomms7372

i) 10.1002/2014JD021866
ii) 10.3389/fpls.2019.01000
iii) 10.1626/pps.11.232
iv) 10.1186/s13227-020-00158-7