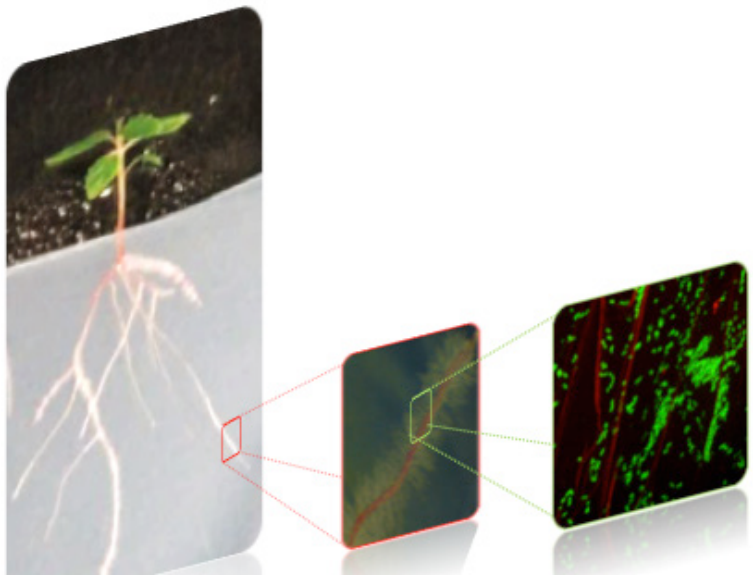
Argonne NATIONAL LABORATORY

BIOSCIENCES DIVISION

Increasing our understanding of the fundamental mechanisms of life



The image shows an aspen seedling growing on a nutritive medium in laboratory conditions (left). An enlarged view of the seedling's root shows abundant root hair (center). Further magnification with a microscope shows the beneficial bacterium *Pseudomonas fluorescens* (bright green) colonizing root hairs. The Argonne Biosciences Division focuses on understanding the molecular mechanisms underlying plant-microbe interactions and how they promote plant growth.

MISSION

The Biosciences Division conducts multidisciplinary research that increases our understanding of the fundamental mechanisms of life and enables valuable advances in bioremediation, climate change, energy production, and the protection of human health, among other applications. Through biomolecular and field research, Biosciences researchers thoroughly analyze natural processes in a variety of environments.

Plant-Microbe Interactions

The tree *Populus tremuloides* (aspen) forms a symbiotic association with some fungi and soil bacteria. During symbiosis, the plant gains nutrients, the microbes consume sugars released by the plant roots into the soil, and the plant becomes more resistant to disease-causing microbes. This mutualistic association between microbes and roots is ecologically and economically important for many tree species because it leads to coordinated resource exchange and enhanced productivity in forest ecosystems.

RANGE OF RESEARCH ACTIVITIES

Structural Biology and Structural Genomics

We characterize protein structures and functions using X-ray diffraction capabilities at the Advanced Photon Source and state-of-the-art protein production facilities; we also employ high-throughput function analysis at the Advanced Protein Characterization Facility to characterize biological and genetics-related proteins.

Computational Biology

We specialize in molecular dynamics—computer simulations of the physical movements of atoms and molecules—and bioinformatics—the collection, study, and storage of biological and genetic information on computers for use in the development of new gene-based drugs. These tools also help us describe how biological molecules contribute to the transformation of environmental contaminants underground; how they affect carbon management in land-based ecosystems; and how they influence human health and pathology.

Environmental Biology

Through field studies and laboratory studies, we link biomolecular processes with observations of ecosystems, as well as geochemical measurements in subsurface and terrestrial ecosystems.

Molecular and Systems Biology

We develop protein engineering and synthetic biology techniques and apply them to enhance advanced biofuel production, biomarker detectors, and bioinspired materials.

Synchrotron-Based Geobiology
We develop and employ synchrotron-based X-ray absorption, X-ray fluorescence, and X-ray imaging techniques at the Advanced Photon Source to investigate geobiological systems in subsurface environments and identify effective approaches for managing carbon in terrestrial ecosystems.

USER FACILITIES

The Biosciences Division manages the Structural Biology Center (SBC) at Argonne's Advanced Photon Source. The SBC is a U.S. Department of Energy Office of Biological and Environmental Research user facility used to study large biological molecules at high resolutions using X-ray diffraction. This high resolution helps us learn about the detailed mechanisms that allow these macromolecules to carry out their functions in living cells and organisms. SBC staff supports users and conducts research to develop and improve data collection and analysis software; develops and implements beamline hardware; and performs crystallographic experiments related to the goals of the facility.
For more information, see http://www.sbc.anl.gov.

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