The Advanced Protein Characterization Facility

at Argonne National Laboratory

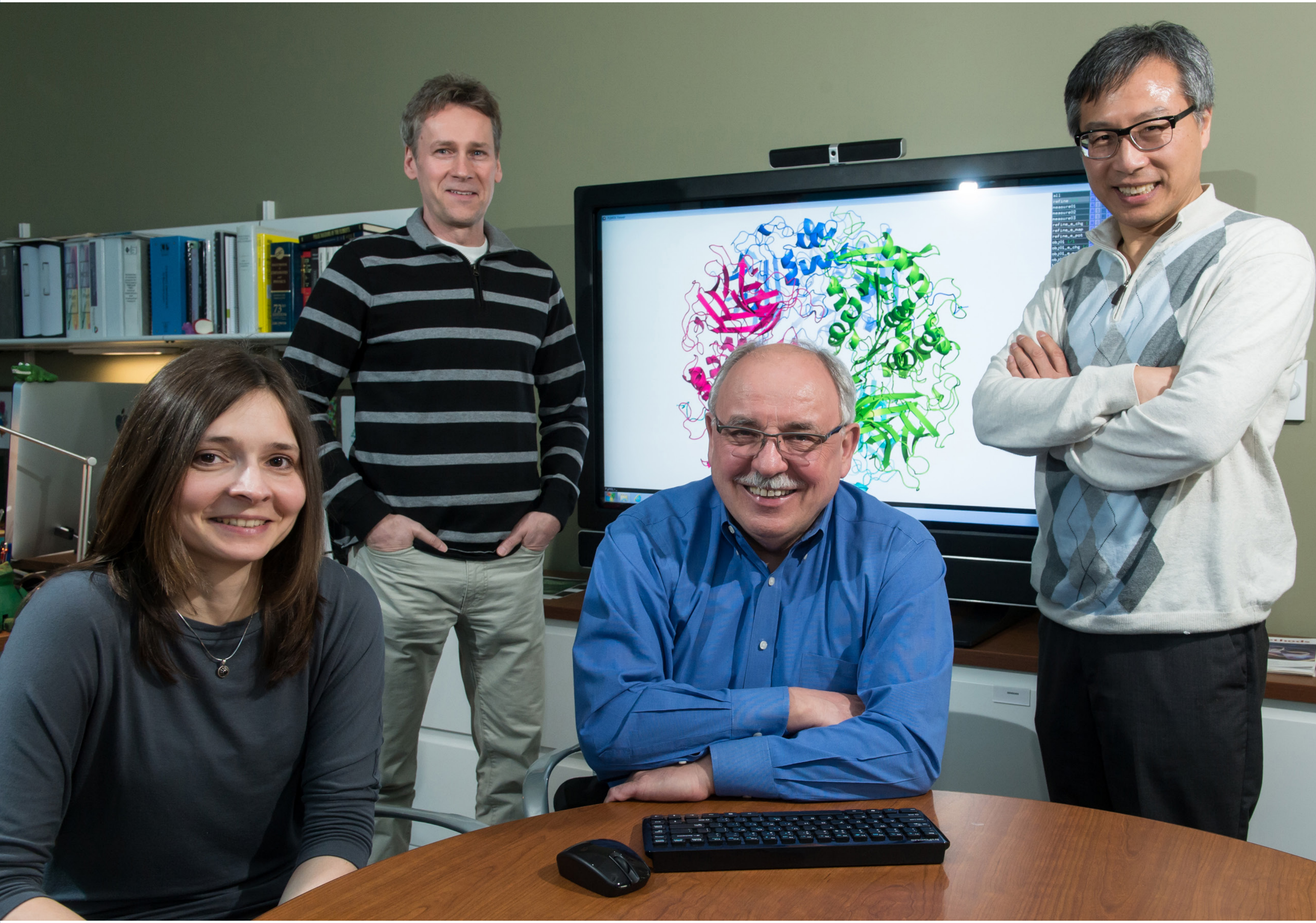
Argonne
NATIONAL LABORATORY

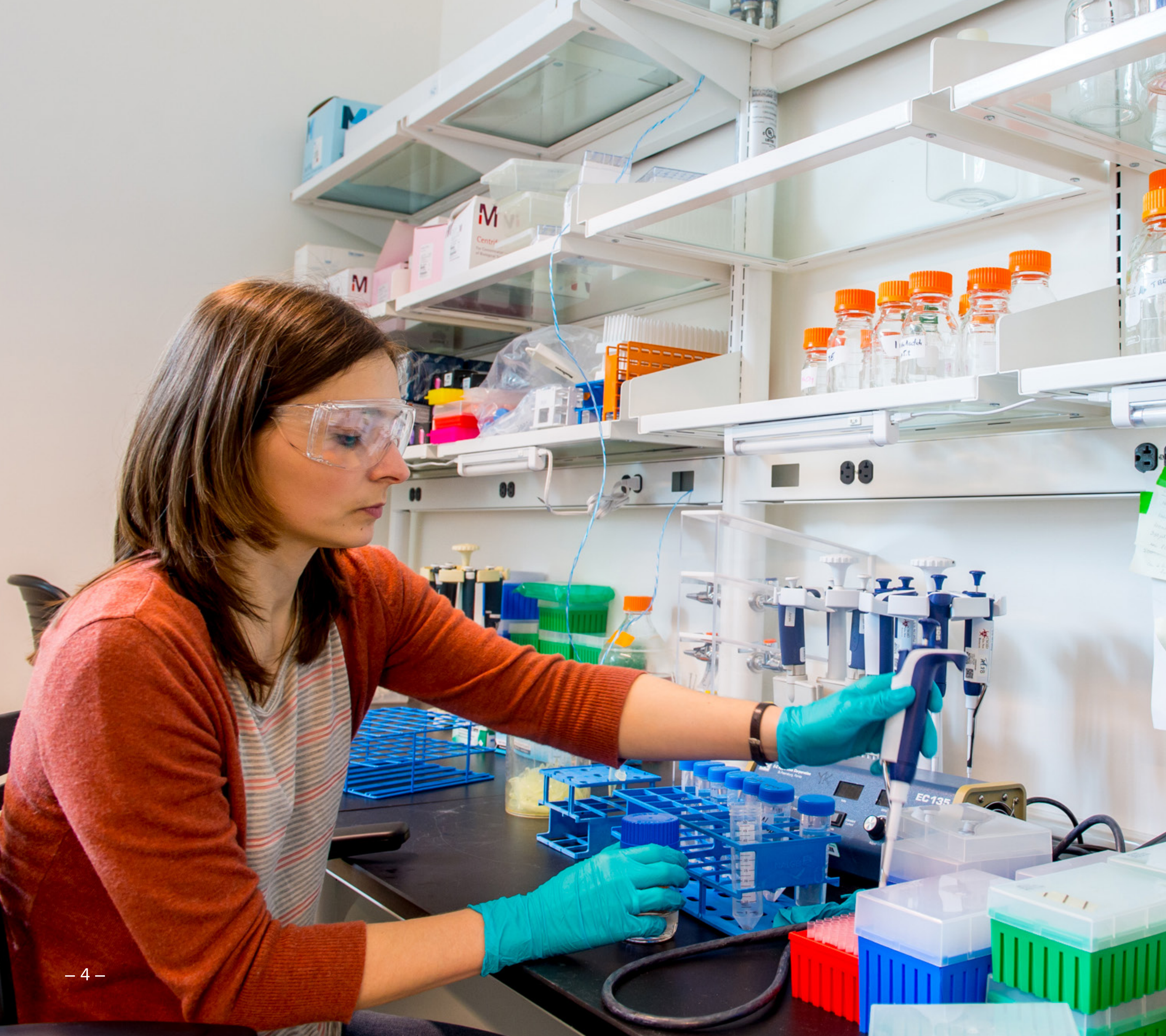
General Project Overview

The Advanced Protein Characterization Facility (APCF) establishes state-of-the-art laboratories, integrated with a scientific collaboration facility, for the production, characterization and crystallization of proteins. Linked to the Advanced Photon Source (APS), the APCF efficiently delivers crystals to the powerful X-ray beamlines of the APS and takes full advantage of Argonne's facilities for determining three-dimensional structures of proteins and other biological macromolecules. The APCF also characterizes protein functions and studies their interactions with other macromolecules and small ligands.

Funded by the State of Illinois, the $34.5-million facility attracts scientists from universities, research institutes and biotech companies from across the nation by offering researchers the most advanced technologies for studying new classes of proteins and protein complexes.

The APCF enhances Argonne's structural biology efforts by providing a carefully designed, highly specialized and adaptable laboratory space devoted to working with the most challenging classes of proteins and macromolecular assemblies, work that was previously limited by existing infrastructure. Furthermore, the APCF has the automated laboratories and modern computational capabilities needed to support emerging Argonne activities in systems and synthetic biology. This state-of-the-art facility provides researchers with the most advanced technology and expertise for protein science experiments in Illinois and the nation.

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Sustainability

Sustainability was a major driver during the design of the APCF, located on the southwestern tip of the Argonne campus. A variety of early sustainable decisions were made that shaped the overall form of the building. For example, the center spine that separates offices from labs brings an abundance of natural light into the center of the building. Where the building needs less light, there are no windows, cutting down on solar heat. The building is also mechanically efficient. Chilled beams, waste heat recovery and ventilation using an Aircuity® system were used wherever possible. Outside the building, the site has permeable paving and several bioswales to contain storm water. Most of the plants are native and irrigation-free to eliminate watering.

Other sustainable features include:

- **SageGlass®.** Electronically tintable glass located along the south façade controls sunlight without shades or blinds. Occupants can manage glare and heat while maintaining a connection to the outdoors. The technology embedded in the glass results in abundant daylight, increased occupant comfort and new levels of energy efficiency.
- **Energy Recovery Wheel.** Energy recovery wheels enable ventilators to provide fresh outdoor air at one-third the cost of conventional systems. Outdoor air raises indoor air quality by reducing indoor air pollution, which improves the health and productivity of building occupants. This technology not only reduces energy costs and heating/cooling loads, but also allows for the scaling down of building system equipment.
- **Interior Environment.** Sustainable features include laboratory casework high in recycled content, as well as non-porous phenolic resin counter tops made from post-consumer waste. High-performance (low-flow) fume hoods may reduce overall energy use. The layout of the building allows 75% of regularly occupied spaces to be lit by natural daylight during normal business hours, and 90% of regularly occupied spaces have views of the outdoors.

Occupants

Argonne, University of Chicago and other visiting scientists engaged in systems, synthetic and structural biology are performing their research in the APCF. Three of the largest research projects are the Midwest Center for Structural Genomics (MCSG), the Center of Structural Genomics of Infectious Diseases (CSGID) and the Structural Biology Center (SBC).

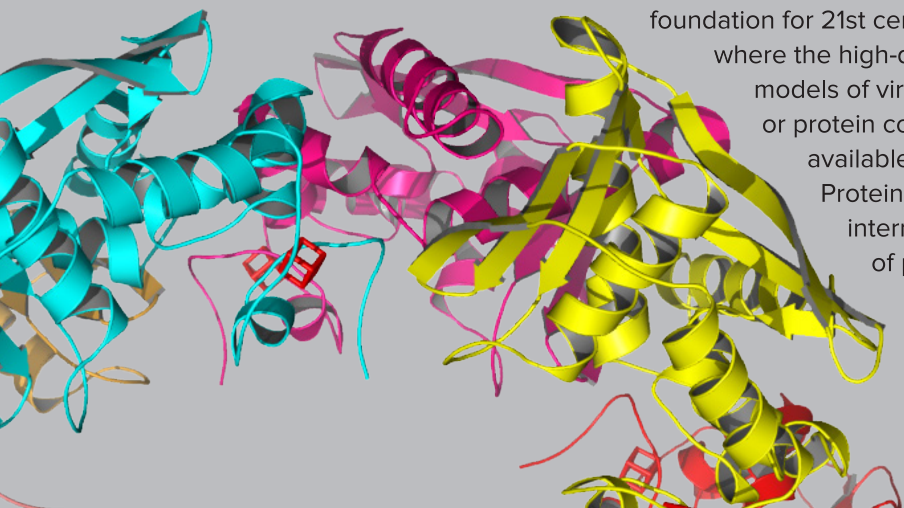
The MCSG, a component of the Protein Structure Initiative (PSI) program, is supported by a grant from the National Institutes of Health (NIH). The MCSG has developed a platform that produces more protein structures than almost any other organization on Earth. Earlier MCSG laboratories were dated and did not provide the space or environmental controls necessary to support the advancement of research programs, development facilities and planned growth. The APCF establishes a state-of-the-art, highly automated laboratory and scientific collaboration facility to produce and characterize proteins and growing protein crystals. Single protein crystals are needed to take full advantage of Argonne's capacity for determining the three-dimensional structures of proteins and other macromolecules.

In addition to the MCSG, the APCF also hosts researchers from the CSGID, also funded by NIH, and the SBC, funded by the U.S. Department of Energy's (DOE) Office of Biological and Environmental Research (BER). The CSGID program focuses on determining the structures of potential protein drug targets and their complexes with inhibitors from human pathogens. The SBC provides advanced, semi-automated data collection and structure determination facilities for the structural biology community at the APS. SBC research focuses on proteins relevant to the BER mission especially plant and bacterial proteins, and on improving hardware and software for data collection at synchrotron beamlines.

Science

Proteins are the cells' molecular machines, and like any machine, it is impossible to understand how a protein works without knowing what it looks like—that is, imaging its three-dimensional structure. The APCF will help to do this more quickly and with higher proficiency than before. The newly designed and optimized space provided by the APCF allows the biologists to establish a highly specialized laboratory devoted to tailored to specific research projects, especially those focused on structure determination of classes of proteins and macromolecular assemblies. The increase in space emboldens plans to pursue additional programmatic support and new equipment. The APCF also supports Argonne's ongoing experimental and computational systems biology work, funded by both DOE and NIH. The facility provides the necessary laboratories and modern computer infrastructure to support this work.

The APCF's long-term goal is to advance the molecular and structural understanding of proteins by providing high-quality structural models for a significant fraction of biomedically and biologically important proteins and protein families. We will continue to improve the structure determination platform so that it can be applied to production of these challenging proteins and protein complexes, including membrane proteins. As part of their mandates, the MCSG, CSGID and SBC will also continue to develop new, advanced technologies, and to refine rapid, highly integrated, and cost-effective methods for structure determination by X-ray crystallography using high-efficiency beamlines at third-generation synchrotron sources and future fourth-generation sources. The APCF's ultimate goal is to build, together with our Protein Structure Initiative colleagues and the systems and structural biology communities, a foundation for 21st century biology where the high-quality structural models of virtually any protein or protein complex will be available through the Protein Data Bank, an international repository of protein structures, or computer modeling.



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http://web.anl.gov/apcf

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