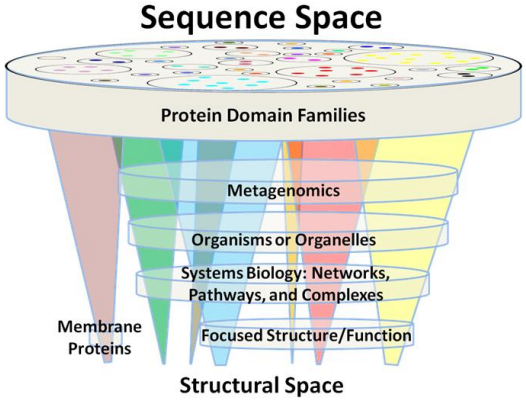
Quo Vadis, Structural Biology?

Argonne NATIONAL LABORATORY | APS

Andrzej Joachimiak

Wednesday, November 13
3:00 p.m.
Bldg. 402 | APS Auditorium



Protein Structure Initiative

Genome sequencing initiatives have significantly expanded the range of protein sequences that we can study, enabling comprehensive studies of complex biological systems and microenvironments. While genome data can provide insights into the functional aspects of complex biological systems, we must also rely on structural observations to more comprehensively understand them. Advances in structural biology, like the development of new X-ray synchrotron facilities with dedicated protein crystallography beamlines, have greatly improved our ability to determine protein structures. Additionally, world-wide Structural Genomics efforts, which utilize a range of cost-effective methods in bioinformatics, molecular biology, proteomics, and crystallization, have created efficient pipelines for structure determination. Cryo-electron microscopy (Cryo-EM) has expanded the range of experimental structures that can be determined, including large, multi-component assemblies. Public databases, containing a large number of unique protein structures, have allowed for the development of new, highly sophisticated algorithms (AlphaFold, Rosetta) for *ab initio* structure prediction, which strongly complement experimental efforts. The shared knowledge and understanding of biological mechanisms that is made available through public databases can inform the development of novel biological functions, as well as help us understand the evolution of biological systems and design synthetic ones. Thanks to advances in synchrotrons, supercomputing, and artificial intelligence, the pace of our understanding of biology may achieve new dimensions. Although there are still challenges to be addressed, the potential solutions and future advances in these areas will continue to be discussed.

Andrzej Joachimiak is an Argonne Distinguished Fellow, Director of the Structural Biology Center at X-ray Sciences Division, Argonne National Laboratory, and Professor at the University of Chicago. He received his M.S. in chemistry (1974), and Ph. D. in bioorganic chemistry (1980) at the University of Adam Mickiewicz, Poznan. He was Postdoctoral Fellow at the University of Chicago 1980-1986; adjunct in the Institute of Bioorganic Chemistry, Poznan (1986-1989) and research professor, at Yale University (1990-93). He received his D.Sc. in molecular biology from the Institute of Biochemistry and Biophysics, Polish Academy of Sciences in Warsaw (1991). In 1993 Dr. Joachimiak joined Argonne and become a University of Chicago professor in 2004. His research focuses on protein structure and function, molecular basis of diseases, enzyme catalysis, and protein interactions. He combines these approaches with biochemical and functional analyses to study biological systems at the atomic level. Andrzej has also contributed to the field of structural genomics. The Argonne-based Midwest Center for Structural Genomics was a highly successful program and component of the NIH-funded Protein Structure Initiative that developed structural biology technologies using synchrotron radiation. The Center determined over 1,000 unique protein structures.

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