School of Molecular Sciences
Arizona State University

SMS 2023 P&T Seminar

Thursday Aug 24 | 1pm | Biodesign Auditorium

Unraveling biomolecular complexity using electron imaging

Recent advancements in cryogenic electron microscopy (cryo-EM) have enabled the visualization of biomolecules in their native-like conditions, offering an unprecedented view of a biomolecular structure at near-atomic resolution in a native-like or cellular context. Our team utilizes this powerful imaging method to study the complexity of various biomolecular systems, gaining mechanistic insight as well as design principles of the biomolecular complexes from evolutionary perspectives. This talk will cover our utilization of cryo-EM imaging to unravel the orchestration of protein interactions and communications to perform their functions. The first part will focus on AAA+ (ATPase associated with diverse cellular activities) ATPase, homomultimers that require ATP to remodel its substrates or engage its diverse functions. The topics include two different types of AAA+ ATPases, spinach Rubisco activase and human p97 ATPase. The biophysical characterizations showed their dynamic nature and the regulation of structural packing and domain movements that impact ATPase functions. The second part of the talk will cover the heteromultimeric complexes, assembled by protein subunits with distinct modularized functions. The topics include the molecular complexes that play critical roles in bioenergetic systems, chloroplast ATP synthase and bacterial photosynthetic supercomplex. Conformational or compositional changes of the involving protein subunits within the complex can result in changes in the efficiency of energy production. The structural view can also provide evolutionary insight into how molecular complexes evolved to adapt to environmental changes by changing their subunit compositions. Overall, cryo-EM structural analysis can offer a comprehensive view and provide the underpinning of the target biomolecular system. This gained knowledge will deepen our understanding of fundamental biological processes and provide prospects for medical and energy applications.

Po-Lin Chiu, PhD

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Po-Lin Chiu is an Assistant Professor in the School of Molecular Sciences at Arizona State University (ASU). He obtained a master's degree in electrical engineering (communication systems and signal processing) from National Taiwan University, followed by a Ph.D. in biophysics (cryo-EM) from the University of California, Davis. He worked with Henning Stahlberg (currently at École Polytechnique fédérale de Lausanne (EPFL), Switzerland) and Thomas Walz (currently at The Rockefeller University, New York, NY) on electron crystallography of membrane proteins to study lipid-protein interaction. At ASU, the Chiu laboratory is interested in structural biophysics, emphasizing not only the structure but also the dynamics and function of biopolymers. The goal is to gain mechanistic and evolutionary insights into complex biological systems. Electron imaging or cryogenic electron microscopy (cryo-EM) is the primary tool employed for probing bio-structural properties of the target at the atomic scale or in the cellular context. His group has been focusing on protein-protein and lipid-protein interactions within various biological systems, including bioenergetics, AAA+ ATPases, and neurotrophin-mediated apoptosis. In parallel, the team is exploring and developing new cryo-EM methods to gain better image reconstructions and high-resolution structural elucidations from the data.

*ZOOM option available: https://asu.zoom.us/j/84890997395