Public outreach event

Single-particle cryo-EM: Visualization of biological molecules in their native states

Joachim Frank (Columbia University)

Host: Leonid Sazanov

The aim of Structural Biology is to explain life processes in terms of macromolecular interactions in the cell. These interactions typically involve more than two partners, and can run up to dozens. A full description will need to characterize all structures on the atomic level, and the way these structures change in the process. Because of the crowded environment of the cell, such characterization is presently only possible when the group of interacting molecules (often organized into processive “molecular machines”) is isolated and studied in vitro. While X-ray crystallography has provided structures of a large number of molecular structures, the need for crystals diffracting to high resolution has severely limited the number of supramolecular assemblies and the range of conformers that can be studied with this technique. Single-particle cryo-electron microscopy is about to fill this gap, allowing functional processes to be studied in great detail without imposing restraints on the structures. There are many examples now for this expansion of Structural Biology toward a full characterization of a functional process.

This presentation will cover concept, history and examples of the present capabilities of single-particle cryo-EM, and its significance for Medicine. It will then briefly cover the future prospects, which include the study of short-lived intermediates in a nonequilibrium system by time-resolved techniques, and the characterization of continuous structural changes using data mining from large ensembles of molecule images.

Biography:

Joachim Frank is a Professor of the Department of Biochemistry and Molecular Biophysics, and a Professor of the Department of Biological Sciences at Columbia University. Dr. Frank’s lab has developed techniques to study the structure and function of biological macromolecules, specializing in mathematical and computational approaches. He has applied these techniques to study the ribosome during the translation of mRNA. In 2017 he shared the Wiley Prize in Biomedical Sciences with Richard Henderson and Marin van Heel. He was also awarded the 2017 Nobel Prize in Chemistry together with Henderson and Jacques Dubochet.
Regular IST shuttle #142: 4:03 pm from U4 Heiligenstadt/public bus stop (return from IST Austria campus at 6:40 and 7:10 pm)
Special IST Lecture shuttle: 4 pm from the Schwedenplatz/night bus stop (return from IST Austria campus at 7 pm)