



Centre for Cryo-electron
Microscopy of Membrane Proteins

SEMINAR SERIES 2022

Assistant Prof. Oliver Clarke

Physiology and Cellular Biophysics

Anesthesiology & the Irving Institute for Clinical and Translational Research

Columbia University

Oliver Clarke is an Assistant Professor of Physiology and Cellular Biophysics (in Anesthesiology and the Irving Institute for Clinical and Translational Research) at Columbia University. He obtained his PhD from the University of Melbourne in 2011, supervised by Jacqui Gulbis and Brian Smith at the Walter and Eliza Hall Institute of Medical Research (WEHI), where he found a passion for membrane protein structural biology.



He joined the group of Wayne Hendrickson for his postdoctoral work (2012-2017), where applied single-particle cryo-EM to understand the architecture and gating of the mammalian ryanodine receptor calcium release channel, before starting his own lab at Columbia in late 2017 focused on the molecular architecture of membrane protein complexes purified from native tissues.

Architecture of the erythrocyte ankyrin-1 complex elucidated by Cryo-EM

The stability and shape of the erythrocyte membrane is provided by the ankyrin-1 complex, but how it tethers the spectrin-actin cytoskeleton to the lipid bilayer and the nature of its association with the band 3 anion exchanger and the Rhesus glycoproteins remains unknown. Here we present structures of ankyrin-1 complexes purified from human erythrocytes, and sub-tomogram averages of the same complexes from native membrane vesicles. We reveal the architecture of a core complex of ankyrin-1, the Rhesus proteins RhAG and RhCE, the band 3 anion exchanger, protein 4.2 and glycophorin A. The distinct T-shaped conformation of membrane-bound ankyrin-1 facilitates recognition of RhCE and unexpectedly, the water channel aquaporin-1. Together, our results uncover the molecular details of ankyrin-1 association with the erythrocyte membrane, and illustrate the mechanism of ankyrin-mediated membrane protein clustering.