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Neutron diffraction as a tool for membrane biophysics in the cold and the dry

Content

Stacks of lipid bilayers in equilibrium with ambient humidity are convenient model systems for examining the partitioning and locus of solubilization of small solvent and solute molecules in the bilayer structure. Membrane neutron diffraction, where 4 or more lamellar peaks are measured under conditions of contrast variation, provides a simple compositional profile of the unit cell of a single bilayer and its attendant solvent (water) layer. The compositional profile is determined by Fourier reconstruction of the unit cell from diffraction data made at three isotopic compositions of water layer. Such insight has also been gained from isolated and stacked plasma membranes. The compositional profiles are dominated by hydrogen atoms thus molecular deuteration provides a powerful method for labelling different hydrogen atoms and is an important adjunct to this technique. This approach has proven well suited to examining the interaction of solvents and solute molecules in the context of anhydro- and cryo- biology. The model free data interpretation at low moisture contents has allowed us to provide important insights into the mode of action of cryoprotectants.

Primary author(s) : Dr. GARVEY, Christopher (Technische Universität München/Maier-Leibnitz Zentrum); Prof. BRYANT, Gary (RMIT University); Dr. GEORGII, Robert (Technische Universität München/Maier-Leibnitz Zentrum)

Presenter(s) : Dr. GARVEY, Christopher (Technische Universität München/Maier-Leibnitz Zentrum)

Submitted by **Prof. GARVEY, Christopher** on **Friday 25 March 2022**