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Membrane protein structure and function

Membranes play host to a range of proteins with vital biological roles, including pumps, channels, carriers, receptors, enzymes and energy transducers, making up around a third of the human genome and two thirds of all drug targets. Recent progress in structural determination via X-ray crystallography and nuclear magnetic resonance spectroscopy has provided a springboard for obtaining a molecular understanding of membrane protein activity. Current developments explore the interplay between membranes of different composition, phase state and properties, and membrane-active proteins and peptides to understand the origins of membrane-based biological function.

This special issue of *Biochimica et Biophysica Acta — Biomembranes*, focuses on some of the key topics in biomembrane research in recent years, including the properties of lipid model membranes and their interactions with proteins and cell-perturbing peptides, and the functions of several key membrane proteins, such as G-protein coupled receptors, ion channels, transporters, receptors, ATPases, and the translocation machinery of protein synthesis. This issue also explores the fundamentals of protein structure, folding, aggregation and function in a membrane environment, showcasing a range of biophysical studies, spanning spectroscopy and computer simulation, which are aiding the elucidation of structure–function relationships for these important biomolecular complexes.

Much of this work was presented at the Membrane Protein Structure and Function Symposium at the American Chemical Society National Meeting in Anaheim, CA, Spring, 2011. The contributors, who are amongst the leading pioneers in membrane biophysics, span a broad range from physical chemistry to physiology, illustrating the broad interest in this field.

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Associate Professor Toby W. Allen (Department of Chemistry, University of California, Davis, USA; and Health Innovations Research Institute and School of Applied Sciences, RMIT University, Melbourne, Australia) is a computational biophysicist and teacher of undergraduate and graduate science. His group specializes in obtaining quantitative descriptions of biological activity using computer simulations. He focuses on protein–lipid interactions to describe the actions of membrane-active proteins and peptides, and the mechanisms of membrane ion transport. He is an active reviewer for many international journals, including Nature and PNAS, as well as grant agencies in the USA, Europe and Australia. He is recipient of the National Science Foundation Career Award, RMIT Vice Chancellor's Senior Research Fellowship, Revson Fellowship, Keck Fellowship and several grants in North America, Australia and Europe. http://ion.ucdavis.edu

Professor Frances Separovic is a Biophysical Chemist who specializes in NMR spectroscopy and membrane biophysics, teaches undergraduate Chemistry, and is Head of the School of Chemistry, University of Melbourne. Frances has developed solid-state NMR techniques to determine the structure and dynamics of membrane components in situ, specializing in peptide antibiotics and toxins within phospholipid membranes. As well as serving as General Treasurer of the Royal Australian Chemical Institute (2008–2010), she was elected to Council of the Biophysical Society (USA) for 2007–2010; Council of International Union of Pure and Applied Biophysics (2002–2005); President of the Australian Society for Biophysics (1999–2001); Director of Australian New Zealand Magnetic Resonance Society (1996–2000, 2010–); and an editorial board member of *Concepts in Magnetic Resonance*, *Biochimica Biophysica Acta — Biomembranes* and *Accounts in Chemical Research*. In 2009, Frances was awarded the Robertson Medal by the Australian Society for Biophysics, ANZMAG Medal in 2011 and elected a Fellow of the Biophysical Society in 2012. http://www.chemistry.unimelb.edu.au/people/separovic.html.

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