

## Preface

Complex life required the formation of cellular compartments in order to concentrate and protect self-replicating molecules and proteins from the external environment. The walls of these cellular compartments needed to be flexible and selectively permeable in order for an organism to survive and thrive. It was a series of self-assembling lipid molecules that was to become this protective barrier. Though the principles of lipid bilayer self-assembly and deformation are well understood today, the fundamental biophysical dynamics at play between differing lipid types and their association with membrane-interacting proteins and peptides provide many avenues for further scientific discovery. This edition of *Methods in Molecular Biology* gives examples of current *in vitro* and *in silico* techniques that are at the forefront of lipid membrane research today.

In this edition, chapters 1-3 are methods and strategies associated with the creation and use of lipid membrane models that are commonly used in research of membrane-bound ion channels and ion carriers, the study of lipid interactions in lipid bilayers and in studies of peptide/protein membrane interactions and for membrane-based sensors. Chapters 4-8 identify electrical impedance spectroscopy strategies and methods to identify how ions and proteins interact with model lipid bilayers. Chapters 9-11 provide guidance on lipid bilayer *in silico* molecular dynamics modelling. Chapters 12-19 detail a range of novel techniques and strategies that explore lipid bilayers characteristics using neutron scattering, IR spectroscopy and atomic force microscopy (AFM). And finally, chapters 20-22 detail unique fluorescence techniques that are coming to prominence to improve our understanding of the structure and function of cell lipid membranes.

I wish to acknowledge all the contributors to this edition of *Methods in Membrane Lipids*. By sharing their knowledge, they have made the sometimes complicated world of lipid membrane biophysics more straightforward for everyone. Special thanks also goes to Mitchell DiPasquale from the University of Windsor, Canada, for providing such a great cover picture for this edition.

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