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# Preface

Studies of membrane transporters have had great impact on our understanding human diseases and the design of effective drugs. About 30% of current clinically marketed drugs are targeting membrane transporters or channels. *Membrane Transporters: Methods and Protocols* provides various practical methodologies for the ongoing research on membrane transporters. To provide readers the most up-to-date information, several emerging fields and methodologies are embraced in this book, including pharmacogenomics, bioinformatics, and microarray technology. Pharmacogenomics studies of membrane transporters are useful in drug discovery and in predicting drug responses in the clinic. In this volume, the current status of pharmacogenomics studies of transporters is reviewed and research methodologies in this field are described.

Transporter classification is important in studying the structure and function of membrane transporters and has thus triggered intensive interest in recent years. *Membrane Transporters: Methods and Protocols* provides a systematic classification of all transmembrane transport proteins found in living organisms on Earth. This classification system will be helpful for further studies on various aspects of membrane transporters, especially for such large-scale gene expression studies as those employing microarray technologies.

Bioinformatics is frequently used in transporter studies and has become indispensable for all kinds of research methods. Commonly used bioinformatics methods, such as databases and tools for sequence analysis and motif studies, are explained in order to facilitate membrane transporters research. Because of heterogeneous sources and tremendous amounts of data, data integration has become one of the most important issues in transporter studies. The brief introduction to data integration methodology offered here can help researchers manage their data to facilitate further knowledge discovery.

In *Membrane Transporters: Methods and Protocols*, the authors not only provide methods and protocols, but also share their valuable hands-on experience with readers. Microarray technology has just begun to bloom in recent years. At present, shared experience in using this relatively new technology is especially helpful. Our book provides guidelines as well as the authors' experience in both microarray experiments and data analysis. We believe our readers will find them useful for understanding, designing, and carrying out their own microarray tests in membrane transporters. Laser capture microdissection

is also described as another recently developed technology useful for the study of transporter gene expression.

Because structural and functional studies have been the main issues in transporter studies and are also essential in pharmacogenomics, methodologies and protocols from various points of view are provided to tackle structure–function problems. For example, for studying the structural biology of membrane transporters, a series of techniques and methodologies are discussed, including small-angle X-ray scattering (SAXS), nuclear magnetic resonance (NMR), and molecular modeling. Some methods for studying the structure–function correlation are described, such as site-directed mutagenesis, immunocytochemistry, confocal microscopy, and kinetics studies, including equilibrium binding.

Some methods go beyond the structure–function study and may have potential implications for development of novel therapeutics, as well as for studying gene–drug interactions and improving drug efficacy. For example, fluorescence techniques can be applied to study interactions between drugs and P-glycoprotein multidrug transporter (Pgp), a transporter protein that plays an important role in drug resistance in many cancer therapies. The adenovirus-mediated gene transfer method in electrophysiological studies of ion channels in mammalian myocardium may help develop therapeutics against heart diseases.

Readers are encouraged to explore integrated views and comprehensive methodologies from different chapters of this book; the methods are not presented as isolated techniques but are complementary. One method often also includes descriptions of several related techniques. For example, studying the expression system of *Xenopus* oocytes uses immunocytochemical, electrophysiological, and kinetic methods. Reconstitution allows detailed characterization of membrane transporters in further depth and allows the use of other techniques such as fluorescence spectroscopy. To measure intracellular pH, which is important for understanding the role of membrane transporters in cellular processes, NMR and fluorescence techniques may also be used.

*Membrane Transporters: Methods and Protocols* strives to deliver to readers not only a collection of practical protocols that can be used immediately in the lab but also critical surveys of key topics by leading researchers in this field. Readers can develop their own workable schemes for their personal studies based on the application of these powerful methodologies. Biomedical researchers in various fields who are interested in membrane transporters, including biochemists, molecular biologists, geneticists, physiologists,

microbiologists, immunologists, bioinformatics researchers, pharmaceutical scientists, and clinical researchers, will find the book useful.

I would like to thank all of the authors for sharing their valuable experience and insights with the research community at large. I would also like to thank series editor John Walker for his help in reviewing the manuscripts.

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