
Preface

Potassium channels are important regulators of membrane excitability, which in turn determines cellular function. They form a super-family of ion channels that are regulated by a diverse range of chemical and physical stimuli. In excess of 80 genes in the human genome encode pore-forming potassium channel subunits. Diversity is further enhanced by alternative splicing of subunit mRNA, heteromeric assembly between pore-forming subunits, or by association with accessory proteins. The basis of several inherited diseases lies in potassium channel gene mutations, and the pharmacological manipulation of potassium channel function is increasingly important as a strategy in the treatment of disease. This provides researchers with the challenge of developing tools and experimental procedures to probe potassium channel function and identify chemicals that modulate their behaviour.

We have progressed since the initial mid-twentieth century studies of delayed rectifier, anomalous rectifier, and leak potassium currents, and now ask questions such as “What does a potassium channel look like?”, “How do changes in membrane potential gate a potassium channel?”, or “Which proteins assemble to form a potassium channel complex in this particular cell?”. Many of these questions cannot be answered by electrophysiological techniques alone, thus scientists have adopted techniques from other disciplines to assist their studies.

This volume describes a range of experimental approaches that have been developed to investigate potassium channel structure, function, pharmacology, cell biology, gene expression, and their role in disease. Many of these techniques study potassium channels as cellular proteins as well as the resultant membrane biophysics. They are proteins that are synthesised according to mRNA sequence, trafficked to the correct location in the cell at the appropriate time, interact with other protein components, change conformation following stimulation, all in addition to providing a conduit for potassium ions to cross membranes. Naturally, content covering the topic of ion channels would not be without electrophysiological techniques, but here they are focused on those that enable the study of intracellular modulation, which is of particular importance to many potassium channels.

All investigators, including new researchers and discipline-hopping scientists, will benefit from this volume. Within the various chapters you will also find protocols for several standard laboratory techniques, such as cell culture, transfection, *Xenopus* oocyte preparation, Western blotting, and whole-cell patch clamp recording. Indeed, the techniques found in this book can be applied to the study of many other types of ion channel. There is an increasing trend to answer scientific questions using a wide range of approaches and it is hoped that the techniques outlined in this volume will help provide finishing touches to research projects or provide new avenues of investigation.

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