

## Preface

---

This book is based on previous versions by W. Schwarz and J. Rettinger entitled ***Foundations of Electrophysiology*** and ***Elektrophysiologie***, which formed the basis of lectures on electrophysiology held at Goethe-University (Frankfurt), the Chinese Academy of Sciences (Shanghai) and Fudan University (Shanghai). Also, this new version is addressed to students of biology, chemistry, and physics who have a special interest in biophysics. Because of the heterogeneity of the readers addressed, we will try to give basic information on the physical as well as the biological background, but not more than necessary.

**Prof. Dr. rer.nat. Wolfgang Schwarz**

**Dr. phil.nat. Jürgen Rettinger**

**Silvia Schwarz**

Frankfurt am Main and Shanghai, December 2015

## About this Book

---

After a brief introductory and historical overview on electrophysiology (► Chap. 1: **Introduction**) basic electrochemical principles for the understanding of this subject are summarized (► Chap. 2: **Basics: Theory**). Thereafter, electrophysiological methods, including principles of data analysis are presented in the third chapter (**Basics: Methods**) ranging from measurements on the whole animal via measurements on single cells with microelectrodes to the patch-clamp technique. This chapter also includes a brief presentation of ion-selective microelectrodes, the carbon-fibre technique and the sniffer-patch method. Modern approaches of electrophysiological techniques are dealt with in the fourth chapter (**Automated Electrophysiology**). In the following ► Chap. 5 (**Ion-Selective Channels**), the major conductance pathways in cell membranes are described with respect to their specific characteristics. The essentials of membrane excitability based on the Hodgkin-Huxley description of an action potential and synaptic transmission are presented in the sixth chapter (**Theory of Excitability**). ► Chapter 7 (**Carrier-mediated Transport**) presents with three examples characteristics of carriers compared to channels and how electrophysiological methods can be used for functional characterization. Finally, in ► Chap. 8 (**Examples of Application of Electrophysiology**) we finish with an exemplary illustration of how a combination of electrophysiology, molecular biology and pharmacology can be applied to learn about structure, function and regulation of the membrane permeabilities that form the basis of cellular function. In addition to the Na,K pump and the GABA transporter, as examples for active transporters, the purinergic receptor P2X and viral ion channels are introduced as examples for ion channels. Each chapter is completed by a set of exercises to serve as a take-home message for recalling important topics.

The book is supplemented by appendices on **Graph Theory (A1)** for analysing reaction schemes, on **The Influence of Electrical and Magnetic Fields on Physiological Function (A2)**, and a **Manual for a Laboratory Course (A3)** in electrophysiology

Electrophysiology

Basics, Modern Approaches and Applications

Rettinger, J.; Schwarz, S.; Schwarz, W.

2016, XIII, 162 p. 158 illus. in color., Hardcover

ISBN: 978-3-319-30011-5