Biochemistry (Moscow), Vol. 70, No. 6, 2005, p. 714. Translated from Biokhimiya, Vol. 70, No. 6, 2005, p. 862.

BOOK REVIEW

Bioelectrochemistry of Membranes

(Walz, D., Teissie, J., and Milazzo, G. (eds.), Birkhauser, Basel-Boston-Berlin, 2004, 240 p.)

This book written by a group of authors from different countries continues a series of reviews describing recent advances in membrane biophysics resulting from electrochemical and electrophysiological studies. The present volume (Vol. 6) concerns mostly the problem of membrane electroporation. Currently, this very interesting issue of basic research is also of importance for applied science, as electroporation has become a widespread technique in biotechnology and medicine. The book involves reviews considering different aspects of electroporation from the theoretical background of this phenomenon to its applications. Besides, it contains some reviews dealing with related issues, namely: membrane structure, electroconformational coupling, and different roles of membrane potential in cell function.

In chapter 1, Yu. A. Chizmadzhev introduces basic ideas of membrane electrophysiology including the origin of two components of membrane electrical potential: a transmembrane difference of electrical potentials and potential drops at the membrane/solution boundaries. Different techniques of measuring electrical potentials on cellular and model membranes are described.

Chapter 3 ("Structure of lipid membranes") written by A. Blume should be noted especially. It is of special interest as a modern introduction to membranology. It describes not only lipid structure, but also modern methods of membrane research. The variety of phase states of membranes for a series of the most typical lipids is characterized in detail. Different model membrane systems and methods of their study are also described. For example, specific characteristics of structure and behavior of liposomes obtained by different conventional methods are presented.

Chapter 4 written by T. Tsong deals with electroconformational coupling. This term was given to the phenomenon of stimulation of activity of K/Na-ATPase by an alternating electrical field of certain frequency that was discovered by the author. The review considers the modern state of this problem with an accent on theoretical modeling of the phenomenon.

In chapter 5, Yu. A. Chizmadzhev, D. Walz, and J. Teissie give a phenomenological description of electroporation and consider its mechanism. It is noteworthy that many works deal with the problem of electroporation of model planar bilayer lipid membranes, since it has been shown that rupture of a lipid bilayer underlies the electrical breakdown of both planar and natural membranes. These works have provided the basis for quantitative description of electroporation, including the formation of a hydrophilic lipid pore.

In the concluding chapter, J. Teissie describes peculiarities of electroporation of cellular membranes in detail. In contrast to the case of model membranes, at present it is early to speak about a thorough study of electroporation of cellular membranes. This is mostly due to sophisticated geometry of electrical field applied to cells. The electrical breakdown of cellular membranes, unlike that of model membranes, is often reversible, which potentiates it as a method of gene and protein delivery into cells. The review involves modern techniques of cell electroporation, in particular, the method of electropulsation. The book as a whole allows a reader to gain insight into the theory and practice of application of electroporation to living systems.

The book can be recommended as a guide for researchers, physicians, and students working in academic, industrial, and medical laboratories.

Yuri N. Antonenko, PhD

0006-2979/05/7006-0714