

nevertheless encompasses elements fundamental to our understanding of membrane function. What is the cellular role of microtubules and microfilaments, for example, or again, what do we know of the mechanism of membrane fusion? Perhaps the use of illustrations and a less fragmentary treatment might have added even more to the narrative.

Two chapters deal with the provocative question of cell growth and transformation. The first by Pardee and Rozengurt attempts, fairly successfully, to present an overall statement of the process of cell division without getting too 'bogged down' in the confusing minutiae which fill the literature. The second from Brady and Fishman is a more detailed analysis of the biochemical changes in membrane components which often accompany transformation. Perhaps due to the conflicting nature of current evidence the narrative at times appears a little confusing.

Finally, Strominger gives a compact description of

the structure and biosynthesis of the bacterial cell wall as seen through the effect of various antibiotics on the process. This refreshing approach allows for a very tidy and readable account.

Two comments arise forcefully on reading this volume. The first, voiced by most authors, emphasises how little concrete information we actually possess despite the encouraging start to research in these various areas. Secondly, it is apparent that the pace of discovery is very rapid, for many of the questions raised in the text have now been, at least partially, answered — only to raise new ones! It is with great anticipation, therefore, that one awaits the second edition of the promised series. It is to be hoped, however, that the long time-lag between the preparation of the various chapters and their eventual publication can be significantly shortened.

J. B. C. Findlay

*MTP International Review of Science. Biochemistry Series One. Vol. 3.*

*Energy Transducing Mechanisms*

Edited by E. Racker

Butterworths; London: University Park Press; Baltimore, 1975

190 pages. £10.45

This volume contains five chapters, written by different authors. A high standard of presentation is maintained throughout, and it is to the credit of the editor, E. Racker, that the various contributions complement one another and gel together to form a useful overview of the subject.

"Electron Transport and Energy-dependent Responses of Deep and Shallow Probes of Biological Membranes" by B. Chance deals particularly with non-toxic extrinsic probes, such as 1-anilinonaphthalene-8-sulphonate, 12-(9-anthroyl)stearate and 2-(*N*-methylaniline)naphthalene-6-sulphonate and others, and the use of fluorescence, e.s.r., n.m.r. and X-ray diffraction to follow the changes in these probes caused by alterations in the membrane during

energy transduction. This chapter starts with a useful account of the practical limitations and a comparison of the diagnostic value of each method. In a final section, the theoretical basis of these methods is discussed, with particular reference to the cyanine dyes, such as the carbocyanins and merocyanins, which report changes in membrane change by changes in their own fluorescence and absorption. Thus the chapter comprises a useful review of the rationale and methodology behind the recent investigations on membrane function in the squid axon by Cohen et al., and in chromatophores and submitochondrial particles by B. Chance et al.

The second chapter, "Energy Coupling in Biological Membranes: Current State and Perspectives", by

V. P. Skulachev, is concerned chiefly with the reconstitution of model systems. It methodically interprets the evidence upon which we base the chemiosmotic hypothesis. Again, an introductory section on methodology, although brief, is valuable.

Chapter 3 is entitled "Electrical Excitability in Lipid Bilayers and Cell Membranes", by P. Mueller. The concept of transmembrane ionic gradients is now central to all theories of energy transduction. It is also generally accepted that the membrane is permeable to ions in specific regions, and that this permeability is under specific control, i.e. the permeable sections are gated. The author shows how the kinetics of gating in artificial systems match the Hodgkin and Huxley equation. Thereafter, the broad aim of this chapter is to support the contention that the mechanism by which the membrane opens and closes in artificial lipid bilayers is essentially the same as that in natural membranes. Two alternatives for the gating process, configurational change or aggregation, are discussed, and analyzed mathematically. There is a valuable description of the structure-activity relationships of various gating translocators, such as alamethicin, nystatin and DJ400B.

Y. Tonomura and A. Inoue are responsible for chapter 4 entitled "Energy Transducing Mechanisms in Muscle". Evidence for the substructure of the myosin molecule is reviewed. The reaction mechanism of myosin-ATPase is discussed from the standpoint of the ATPase reaction in the steady state, and the formation, decomposition and structure of the reactive myosin-phosphate-ADP complex. Similarly, the reaction mechanism of actomyosin-ATPase is discussed. Only the last section deals directly with the energy transducing mechanism; the treatment is concise, but I should have preferred more information on the page, rather than being fobbed off with literature references. For example, biochemical studies on the reaction between myosin, actin and ATP in relationship to the three possible contractile processes, are assigned to a brief mention and a reference to Tonomura's admittedly excellent book.

The last chapter on "Control of Energy Transducing Systems", by Racker is, of necessity, short. The preceeding four chapters clearly illustrate the worldwide intensive investigation of energy transducing systems, yet the control of these systems has curiously received little attention. Glycolysis and the Pasteur effect, the control of glyceraldehyde 3-phosphate oxidation and the control of glucose and fructose 6-phosphate phosphorylation are clearly reviewed. Attention is drawn to the recent observation that several uncouplers of oxidative phosphorylation inhibit the phosphate-ATP exchange associated with the action of glyceraldehyde 3-phosphate dehydrogenase. The author poses the question of whether these substances may enter a hydrophobic active site on the enzyme. Also he reminds us that we still do not know the fate of the proton which should be released during the reaction of NAD with an SH group of the enzyme. The effect of various uncouplers and ionophores on the ion permeability of artificial liposomes and proteoliposomes is described as a basis to our present understanding of the control of electron transport and oxidative phosphorylation. It is also explained why the so-called Warburg effect has been neglected for so long, and the author suggests that it could be re-investigated with profit. A working hypothesis is presented: various lesions may result in high aerobic glycolysis; the resulting low intracellular pH affects the control of metabolism and growth; the excretion of lactic acid by the tumour may damage host cells and facilitate infiltration. The remainder of the chapter is then devoted to the control of energy production and utilization in tumour cells.

This book should be recommended reading for final year biochemistry students, as well as research workers. However, another chapter on energy transduction in photosynthesis would not have been out of place. There is no dead weight and the choice of topics and authors is a triumph of editorship.

T. A. Scott