The book is at its best when dealing with the authors' own considerable research, much of it in collaboration with Ann Hanwell, on control of avian salt gland secretion. Their description of attempts to locate the osmoreceptors responsible for initiation of salt gland secretion is a case in point. As with most topics, they take a historical approach and trace the search for osmoreceptors through its various convolutions. They then describe elegant experiments demonstrating that the receptors are not located in the head, but rather in or near the heart. Also in typical fashion, they evaluate the prospects for further discoveries in this area.

There are still many unanswered questions concerning salt glands, and some of them are rather fundamental. Upon seeing such chapter titles as "The mechanism of secretion" and "The evolution of salt glands," the reader may get his hopes up only to find that firm conclusions are not forthcoming. This is not to suggest that the book is premature or that the authors have been negligent. Rather, it is to be hoped that it will soon be possible to write an even more definitive treatise on this challenging subject. Indeed, Peaker and Linzell's book should hasten that day.

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Electrophysiology

Electric Current Flow in Excitable Cells. J. J. B. JACK, D. NOBLE, and R. W. TSIEN. Clarendon (Oxford University Press), New York, 1975. xvi, 502 pp., illus. $45.

Books in an experimental science like physiology are usually elementary texts, collections of reviews, or compilations of previously published results. It is not common for a book to be a significant contribution to current research. It is almost unprecedented for a single book to be simultaneously a useful text, a significant review, and an original contribution to research. This "monograph" by Jack, Noble, and Tsien is remarkable in that it succeeds in each of these respects. It is a superb advanced text, presenting difficult material in a lucid form understandable to all who read it with care; it is a useful review of several developing fields; and it makes a number of original contributions. This combination of attributes suggests that the book will have a decisive effect on the development of electrophysiology: it may well serve as a dictionary of paradigms for future work in the field.

The book starts with a discussion of linear cable theory. The necessary mathematical apparatus is presented in an appendix, but in the absence of problems it is doubtful that a neophyte will develop enough facility from the appendix to master the rest of the book. One can criticize this initial section on a number of other grounds—particularly its failure to use two-port theory to describe the properties of finite cables. But such criticisms miss the essential point: these chapters represent an important synthesis of widely known but rarely published results, and they present the results in a form easily accessible to scientists without an outstanding mathematical background. The section illustrates the utility of linear analysis with brilliant reviews of two areas of considerable research activity: the use of linear circuit analysis to determine the pathways for current flow in striated muscle, and mathematical modeling of nerve cells. The review of the former is unfortunately already out of date. The review on mathematical modeling is a most useful synthesis, but implicitly shows the need for more experimental work designed to falsify one or the other of the theoretical models.

The book then proceeds to discuss the nonlinear properties of excitable cells, the properties most directly involved in the function of the cells. The review sections of these chapters necessarily are both more descriptive and more speculative than the earlier parts of the book. Such is the lack of knowledge of molecular processes in biological membranes that more rigorous analysis does not seem possible. In this area the authors make their largest number of original contributions. While many of the contributions represent the beginning rather than the summation of lines of research, they seem no less valuable for that.

It is in this regard, though, that a defect of the book becomes apparent. The extensions of these new lines of research, and much other work in electrophysiology, clearly would benefit by contributions from physical and mathematical scientists with a knowledge of electrical phenomena. Such colleagues, however, often have some difficulty in identifying important biological problems, both because of the novelty of the design of the systems (the designer being an illogical evolutionary process) and because of the novelty of the field. Much of the novelty of electrophysiology stems from its proprietary language developed in isolation from other fields. The authors define and develop the language of electrophysiology well, but they make little attempt to make it more palatable to the physical or mathematical scientist. It would be a particular shame if this one defect prevented physical scientists from taking advantage of the greatest single attribute of the book, its identification of a wealth of important problems waiting to be solved.

For the biologist interested in the electrical properties of cells, excitable or not, this book is indispensable. Let us hope that a number of physical and mathematical scientists will find it as valuable.

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