volume is an abbreviated version of the important points of discussion pertaining to each section, edited by the chairmen of the respective sessions (section 2, on central neurons, is far too brief), and finally a résumé of a few related papers published subsequent to the symposium.

Although both Malmfors and Thoenen speak English quite well, it is the native language of neither editor, and the book would have been improved by a careful reading to eliminate the frequent errors in spelling, style, and typesetting. These detract slightly from the readability but not at all from the general utility of the book, which will close gaps in the knowledge of even the best-informed specialist. For research workers who tamper casually with catecholamines it will prove more reliable and comprehensive than a telephone call to the nearest pharmacologist for the best recipe to extinguish adrenergic function. Both the methodology and the functional results pertaining to an important research tool are collected as well as possible in this volume, and the importance and breadth of the material included are greater than the title may imply.

LUCAS S. VAN ORDEN III
Department of Pharmacology, University of Iowa, Iowa City

Antimalarial Agents

Chemotherapy and Drug Resistance in Malaria. W. PETERS. Academic Press, New York, 1970. xviii, 876 pp., illus. $39.50.

Studies carried out about a decade ago demonstrated conclusively that certain strains of *Plasmodium falciparum*, in parts of South America and in parts of Southeast Asia, were resistant to chloroquine and to other widely used synthetic antimalarial agents. These observations, reinforced by problems with drug-resistant malaria parasites subsequently encountered by American military personnel in Southeast Asia, shattered complacency with antimalarial drugs that had developed during the 1950's and contributed to a marked resurgence of investigative interest in malaria. The 1960's witnessed a rejuvenation of basic research on malaria and of intensive efforts aimed at the development of new antimalarial agents.

A rekindling of older investigative approaches together with the successful application of a variety of new experimental techniques yielded a wealth of new information about the effects, limitations, and mechanisms of action of, and about resistance to, antimalarial drugs. This book provides a timely and comprehensive summary and discussion of earlier and more recent data pertinent primarily to drug resistance. It is a valuable compendium of otherwise widely scattered information relating to the biology of malaria parasites; host-drug-parasite interactions; older and newer methods for assessing effects of antimalarial drugs in vivo or in vitro; experimental techniques for inducing drug resistance; results and implications of studies of malaria parasites of lower animals; results of studies of parasites that cause human malaria; the use of drug combinations in an effort to thwart the emergence of drug-resistant parasites; mechanisms of action of and of resistance to antimalarial drugs; entomological, immunological, and genetic aspects of drug resistance; and the impact of drug resistance on malaria control and eradication programs.

Those well versed in malaria will not have great difficulty spotting occasional arguable statements; overall, however, such instances will prove remarkably few in view of the immense amount of information considered. Coverage of different aspects of the subject is thorough, use of tables is extensive, and illustrations are numerous and excellent. Although references are not numbered, my count indicates that 1709 are cited.

This book is in essence a very detailed progress report that provides considerable insight into methodology and the state of our knowledge relating to drug resistance in malaria as it existed at the end of the 1960's. It attests both to the notable advances that have been made on multiple investigative fronts and to the substantial extent to which our knowledge remains incomplete despite these advances. Although research carried out during the 1960's provided a great deal of useful new information about antimalarial drugs and drug resistance, many fundamental questions remain only partially answered and many pressing needs remain largely unmet. We need, for example, deeper understanding of the mechanisms involved in resistance to antimalarial drugs, more information about the factors that influence the geographic spread of drug-resistant parasites, better means with which to combat drug-resistant parasites, and more adequate insight into how currently available means can best be utilized.

The resurgence of malaria research during the 1960's offers hope that much-needed additional progress will take place during the 1970's. A major question, however, is whether it will be possible to sustain during the 1970's the investigative momentum developed during the 1960's. Peters begins by noting that problems with malaria during wartime have often provided the stimuli for accelerated research in malaria. He concludes by pointing out that malaria is likely to remain a formidable public health problem for some time. Perhaps one might add as a footnote the hope that the cyclic ups and downs of malaria research coincident with the beginnings and endings of wars will at long last be blunted so that exigencies of war will not constitute a prerequisite for waging a sustained investigative assault on malaria during the 1970's.

ROBIN D. POWELL
Department of Internal Medicine, College of Medicine, University of Iowa, and *Veterans Administration Hospital, Iowa City*

Biophysics

Membranes and Ion Transport. E. EDWARD BITTAR, Ed. Wiley-Interscience, New York, 1970–71. In 3 vols. Vol. 1, xvi, 484 pp., illus. $22. Vol. 2, xiv, 296 pp., illus. $15.25. Vol. 3, xiv, 382 pp., illus. $18.

Though this three-volume work, dedicated to the late Edward Conway, is written primarily for the novice, many a membranologist should find it highly informative and generally interesting. Considering the dynamic nature of the field and the voluminous literature on ions and membranes, the heroic task of selecting subject material and imposing a reasonably consistent viewpoint on 34 contributing authors has been well done. Many of the contributors approach their subjects by comparison of traditional findings and concepts with current information, rendering gently persuasive arguments for alterations of existing theory. Though this informational rather than overtly critical approach is inherently sound, the reluctance of a few authors to offer substantive critical comment appears excessive. The reader, particularly the novice, is not

best served by this benign commentary.

In the first major section of volume 1 the biogenesis and nature of biological membranes are discussed, with attention being drawn to necessary modifications of the simple bimolecular leaflet idea. Inadequacies of existing models are carefully brought out with documentation from recent investigations. Additional vigor is lent this theme by a competent chapter relating the properties of black lipid films to living membranes. Also of interest here is the chapter by Irving Klotz dealing with the state of water as a molecular environment.

In the three chapters of section 2, on theoretical aspects of transport phenomena, the general principles of irreversible thermodynamics are developed and then applied to active transport, isotope fluxes, and oxidative phosphorylation. Coupling between transport and chemical reactions is expounded in a chapter by Peter Mitchell. Since the theoretical physical-chemical relationships among active ion fluxes, passive ion fluxes, metabolic processes, and membrane potentials are, to say the least, unclear in the minds of some, the lucid discussion in this portion of the book will be as salutary for established membrane physiologists as it will be challenging, if not a bit perplexing, for the novice.

The final subdivision of volume 1 deals with mechanisms of active transport. This section characterizes sodium-potassium-activated adenosine triphosphatase and provides a prodigious description of the occurrence and properties of this enzyme as it exists in a wide variety of cells and tissues. P. C. Caldwell presents and astutely criticizes pertinent models for sodium-potassium transport. Also offered in this section is a chapter discussing sodium-, potassium-, and chloride-linked electrogenic pumps found in a number of cells and tissues. Coupling between transport of organic molecules and ions is described by H. N. Christensen. This well-documented discussion of data concerning amino acid transport systems might have been enhanced by the addition of a diagrammatic representation embodying this erudite author's view of ion-coupled organic molecular transport. Hexose transport and the bifunctional mobile carrier concept are not specifically treated. This omission seems inconsistent with the editor's otherwise sapient choice of subject matter.

The second volume constitutes a well-organized compendium of ion movements and the physiologic roles of ions in tissues, cells, and organelles. Its first section is a group of seven chapters dealing respectively with skeletal muscle, smooth muscle, heart muscle, nerve, brain, red blood cells, and liver. These chapters generally consist of a discussion of morphology, where it is relevant, followed by a consideration of the localization, transport, and physiological role of major cations such as sodium, potassium, calcium, and magnesium. In some cases chloride, bicarbonate, and other anions are also evaluated. The chapters are consistently good and timely. Especially refreshing are the spicy critical comments of P. J. Goodford in the presentation on smooth muscle and the fine treatment by R. M. Marchbanks of brain metabolism and ion transport. Subdivision 2 of the volume offers two interesting chapters describing ion-related phenomena in mitochondrial and nuclear membranes. In general some portions of volume 2 appear a bit verbose, and their didactic value might have been enhanced by more liberal use of figures and diagrams.

The third and final volume of the series begins with an analysis of ions and complex tissues. Its first section consists of six chapters specifically concerned with frog skin and toad bladder, renal tubules, intestine and gall bladder, gastric mucosa, cochlea, and ciliary processes. As in volume 2 the chapters generally start with morphologic considerations. They are especially well endowed with electron micrographs and excellent drawings. In discussing the involvement of major cations and anions in the function of given tissues these chapters maintain uniform high quality and are not only informative but pleasurable to read. One of the numerous highlights of this section is the fine offering by J. G. Forte concerning hydrochloric acid secretion by gastric mucosa.

Subdivision 2 of volume 3 consists of a single chapter in which D. A. T. Dick treats water transfer in cells and organelles and some physiologic correlates of this flow. Of particular value to many readers will be the well-developed discussion of the mechanisms by which water traverses biological membranes.

As a finale to the series, section 3 takes up more integrative aspects of membrane transport. The first chapter of this division explores the relationship between active transport and other processes such as cellular metabolism, maintenance of cell volume, sugar and amino acid transport, and the secretory functions of various tissues. One chapter addresses itself to the ionic requirements of protein biosynthesis. Hormonal regulation of ion transport is discussed by E. E. Bittar, who gives an especially interesting account of the sodium-related actions of vasopressin, insulin, and aldosterone.

Subsection 4 of the last volume consists of a single unit summarizing the properties of the cell surface. In this rewarding chapter D. Gingell develops the concept of the transducer action of surface potentials. With respect to this point he presents arguments favoring the idea that changes in surface potentials are involved in biological phenomena such as pinocytosis, contractile responses at the surface of amphibian eggs, and transformation of Naegleria.

Perhaps the best way to characterize this book might be to quote the editor's description of it as "an attempt to deal with notable advances that have already been made and to treat the subject both systematically and critically." In my opinion this goal is successfully achieved.

ALAN R. FREEMAN
Departments of Psychiatry and
Physiology, Indiana University Medical Center, Indianapolis

Statistics for Geneticists

Probability Models and Statistical Methods in Genetics. REGINA C. ELANDT-JOHNSON. Wiley, New York, 1971. xx, 592 pp., illus. $24.95. Wiley Series in Applied Probability and Statistics.

In this lengthy book Elandt-Johnson introduces the elements of statistics and probability theory and applies them to various models arising in qualitative genetics. The book is meant to be self-contained and suitable for geneticists with little or no statistical background. The chapters on genetic models cover such topics as equilibrium models in panmictic populations, joint distribution of relatives, inbreeding, and natural selection and mutation in natural populations. The statistical chapters cover most of the standard theory of estimation and hypothesis testing, the applications including allele frequency estimation with a special section on human blood groups, detection of linkage, segregation ratios, and histocom-