in ducks. Beer's earlier chapter shows some progress in understanding gull displays by noting their variations more carefully, but one is left with bewilderment. McKinney begins to sort out displays by spatial analysis. Why does the male green-winged teal do so many different things in the vicinity of the female? McKinney's data show convincingly that the angular orientation of the male's position relative to the female, his distance from her, and the orientation of his body relative to her all play a part in dictating the exact display given. McKinney also emphasizes that rape is a common, normal reproductive strategy in some ducks, a piece of knowledge without which reproductive behavior would seem chaotic.

In one sense, these chapters are truly "essays in honour of Professor Niko Tinbergen," showing he was so far ahead of his times in thinking about behavior that his followers have made little new progress. Deeper honor is paid here and there with new ideas that stem from the foundation laid by the mentor. If McKinney's chapter foretells the future, we may really be blazing a new trail where Tinbergen left off, rather than trimming branches along the old path.

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Biological Membranes

Membrane Biogenesis. Mitochondria, Chloroplasts, and Bacteria. ALEXANDER TZAGOLOFF, Ed. Plenum, New York, 1975. xviii, 460 pp., illus. $29.50.

With the emergence of the "fluid mosaic model," it has become clear that biological membranes are highly dynamic supramolecular structures whose biosynthesis and assembly pose new types of questions for the cell and molecular biologist. Among the matters that need explanation are: the means by which the cell handles the synthesis of membrane proteins and transports them, as well as phospholipids, from their location of synthesis to their point of deposition within the membrane; the degree to which the synthesis of membrane lipids and proteins is coordinated; the role played by the more hydrophobic (integral) membrane proteins in the attachment of the more hydrophilic (peripheral) membrane proteins to the membrane; the mechanism (or mechanisms) by which membrane proteins and lipids are assembled so as to form an asymmetric, bimolecular leaflet; and the nature of the protein-protein and protein-lipid interactions that must ultimately determine where and when new proteins and lipids are inserted into the "fluid mosaic." Add to these questions relating to the organization of genes (both structural and regulatory) that code for membrane components and, in the case of mitochondria and chloroplast membranes, the intracellular location (extranuclear or nuclear) of the genes involved, and one has a glimpse of the framework within which the newly emerging field of membrane biogenesis is developing.

The appearance of a book on membrane biogenesis is timely because this field is still somewhat fragmented as a result of the wide assortment of experimental systems and approaches in use. It was with this in mind that Tzagoloff assembled this collection of reviews dealing with the in vivo biogenesis of three popular experimental membrane systems: mitochondrial, chloroplast, and bacterial.

One of the strengths of the book lies in its emphasis on experimental approach and its detailed consideration of the problems that can be encountered in studying membrane biogenesis in vivo. These qualities are perhaps most evident in the papers by Ellis on the biosynthesis of membrane proteins by isolated chloroplasts and by Weiss and co-workers on the biosynthesis of two of the electron transport components (cytochrome c oxidase and cytochrome b) of the inner mitochondrial membrane. Although this approach to reviewing new developments in a field is of great heuristic value, it is regrettable that many authors have chosen not to discuss their results in the general context of membrane biogenesis or to draw upon the results of parallel experiments with other experimental systems. The introductory chapter by Tzagoloff compensates in part for this shortcoming by integrating the results derived from all the other chapters into a useful, albeit brief, overview of membrane biogenesis. Other integrative papers include the excellent ones by Mindich on the use of bacterial mutants which are auxotrophic for glycerol to study the coordination between membrane protein and phospholipid synthesis and by Ohad on the development of photosynthetic membranes.

This book has two obvious weaknesses. First, some important subjects (for example, turnover of membrane constituents and biogenesis of the endoplasmic reticulum and plasma membrane) have been omitted. And second, some authors have devoted sizable portions of their reviews to subjects of no immediate relevance to membrane biogenesis (for example, the evolution of extra chromosomal genomes and the mechanisms of ethidium mutagenesis in mitochondria).

On the whole, this volume should be of interest to teachers and scientists concerned with cell biology, membrane biochemistry, and organelle biogenesis, and it should be particularly useful to students encountering the field for the first time.

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Actions of Drugs

Cellular Pharmacology of Excitable Tissues. TOSHIO NARAHASHI, Ed. Thomas, Springfield, Ill., 1975. x, 538 pp., illus. $35.50.

This collection of reviews encompasses much of the field of cellular pharmacology. There are chapters on the synaptic physiology of the motor end plate, the autonomic nerve-effector junction, the autonomic ganglia, and the central nervous system; on smooth muscle, cardiac, and squid axon membranes; and on electromechanical coupling and contractile mechanisms in smooth and skeletal muscle. A great deal of information is presented, generally lucidly, and anyone concerned with cellular pharmacology, including graduate and medical students and neurophysiologists, should read the book.

The title is misleading, or at least overly narrow, since the book is largely physiology. In most of the chapters a reader will look in vain for lists of compounds and their action on a particular system or mechanism. After describing the details of normal functioning of a system, most of the authors more commonly discuss the action of a potassium ion than a drug, a nontherapeutic agent than a therapeutic one. This is not a criticism, since other sources of material on actions of drugs are available. But cellular pharmacology stripped of most of this material is indistinguishable from physiology.

In all collections of papers quality, style, and approach vary. In this book there is more variation than necessary. Bianchi, in a particularly fine chapter on the pharmacology of the contraction of skeletal muscle, and Wit and Hoffman, in their chapter on the pharmacology of the cardiac action potential, do analyze the actions of numerous agents, including many of the principal therapeutic ones. Most chapters are broad reviews, but those of Somlyo and Narahashi are

based almost entirely on work in their own laboratories. Somlyo does describe work that has taken up a large part of the efforts of a large laboratory for many years. Narahashi, however, limits his chapter to recent work in his laboratory on agents that depolarize nerve membranes. Although it is very interesting, the chapter presents only a small part of the research in his group, a still smaller part of research on axonology in general. This book could use a substantial chapter on neural action potential mechanisms and the ways in which agents interfere with them.

Several of the chapters suffer from aging. They appear to have been written in 1973 and to be based almost entirely on material published in or before 1972. Even when a field moves rapidly, a good review may retain its value for many years. Parsons's chapter on the vertebrate motor end plate suffers, however, from the failure to discuss experiments involving the analysis of synaptic noise. Katz, Stevens, and others have used such analyses to good effect and have thereby expanded our understanding of the problems Parsons discusses.

Finally, Wit and Hoffman's chapter suffers from the presence of some confusing physiology mixed with the fine pharmacology. Cardiac action potentials in their variety and complexity are admittedly exceptionally difficult to study and describe, but this chapter handles the problems only moderately well.

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Particle Physics

Proceedings of the Sixth Hawaii Topical Conference in Particle Physics. Honolulu, Aug. 1975. P. N. DOBSON, JR., S. PAKVASA, V. Z. PETERSON, and S. F. TUAN, Eds. University Press of Hawaii, Honolulu, 1976. x, 562 pp., illus. Paper, $12.

This reasonably priced, timely book presents four in-depth reviews of areas of recent activity in particle physics.

One of the most exciting developments in high energy physics over the last several years has been the advent of experiments utilizing neutrinos as probes of particle structure. Because these experiments are so recent, the lectures on neutrino physics in this book are among the few overviews of this important work that are now available.

The theoretical basis of neutrino physics is outlined in beautifully written notes by Stephen L. Adler. Starting from scratch, Adler develops inclusive scattering theory, quark parton ideas, models of neutrino production of pions, and neutral current phenomenology in a careful pedagogical fashion. The account should prove useful to those already working in the field as well as to those attempting to learn it. A simple discussion of quark models of hadrons is also presented. These lectures are superb.

Complementary to Adler's account is an experimental review of neutrino data by the leader of one of the principal neutrino efforts—B. C. Barish of Caltech. Barish presents data primarily from his own experiment, but also from that of the Harvard-Penn-Wisconsin-Fermilab collaboration, both performed at the National Accelerator Laboratory. Barish's discussion is especially illuminating because together with the data plots it presents an account of the advantages and limitations of the experimental configurations.

The third series of lectures, by Samuel C. C. Ting, is also quite timely. Ting deals with properties of the recently (1974) discovered J(3095) resonance, the narrowness of which strongly suggests the existence of a totally new quark degree of freedom. Ting's discussion is disappointing, however, because what could have been an exciting mixture of experimental results and theoretical speculations is primarily a presentation of the raw experimental facts with little or no clarifying theoretical commentary.

Finally, gauge theory is presented by Chen Ning Yang. He emphasizes that the field tensor $F_{\mu\nu}$ underdescribes electromagnetism—as evidenced by the Bohm-Aharanov effect—and advocates a description in terms of a path-dependent, nonintegrable phase factor. This approach leads to magnetic monopoles (the possible experimental discovery of which was announced during the conference) and to the Dirac quantization condition. Finally, these results are elegantly generalized to non-Abelian groups and to a gauge theory of gravitation. The connection of such models with physics is unclear at present, but the mathematics is beautifully expounded.

None of these lectures is for the uninitiated. But for readers with a graduate level knowledge of physics they provide a useful introduction to some of the frontiers of modern physics, and they should prove especially valuable to students working in high energy physics. I am delighted to add this volume to my library.

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Physics of Instabilities

Fluctuations, Instabilities, and Phase Transitions. Proceedings of a NATO Advanced Study Institute, Geilo, Norway, Apr. 1975. TORMOD RISTE, Ed. Plenum, New York, 1975. viii, 390 pp., illus. $29.50. NATO Advanced Study Institutes Series B, vol. 11.

The physics of instabilities in equilibrium systems has been extensively studied in the past two decades. Theoretical methods and experimental techniques have been developed for studying phase transitions in various physical systems, such as magnetic crystals, fluid mixtures, liquid crystals, and in systems exhibiting structural phase transitions. As was pointed out by R. Landauer in 1961 and independently by others later, there are certain analogies between phase transitions in equilibrium systems and instabilities in nonequilibrium systems. The advanced techniques developed in the field of phase transitions might, therefore, be useful in studying instabilities in nonequilibrium systems.

In order to create an interest in and to encourage a wider use of these techniques, a summer school on Fluctuations, Instabilities, and Phase Transitions was organized. This book consists of the 19 papers presented at the summer school and deals with two main topics: dynamics of first-order phase transitions and hydrodynamic instabilities.

The first part of the book is devoted to dynamics of first-order transitions. Theories of spinoidal decomposition in unstable systems and nucleation in metastable systems are discussed, and results of some recent experiments on phase separation are presented.

The second part of the volume deals with instabilities in nonequilibrium systems. Although these instabilities occur in a variety of physical systems, such as Gunn oscillators and lasers, most of the papers deal with certain types of hydrodynamic instabilities. The only exception is the paper by R. Graham, which deals with optical instabilities as well. When a small external "force" (such as a temperature gradient or an electric field) is applied to a system initially in thermodynamic equilibrium, the system settles down into some nonequilibrium steady state. As the "force" is increased, the system is carried through a sequence of nonequilibrium steady states that differ from one another by their flow character. The hydrodynamic instabilities discussed in this volume are those that lead to clearly structured flows (Rayleigh-Benard, Taylor). Instabilities that lead to a turbulent state