

pattern of cardiac innervation from hagfish to primate as well as the differential distribution of the sympathetic and parasympathetic nerves, the former predominantly ventricular and the latter mainly atrial in termination. At a finer level, the extensiveness of the terminal varicosities is also described in the book, along with the fact that every muscle cell appears to receive a nerve terminal. This point can be verified in the micrographs in spite of the somewhat murky reproduction of many of the illustrations.

The broader objective of the work, however, is to provide the anatomic details which "are necessary for a re-evaluation of cardiac physiology in health and disease." It is in the attainment of this goal that the book has fallen short. The same decade which saw the light microscopic studies of Hirsch also saw the fluorescent histochemical amine studies of the Karolinska group and the more recent electron microscopic observations of Thaemert, Burnstock, and others. These works are quite pertinent to the monograph and would have made possible meaningful interpretation of the results. There was an opportunity in this monograph to demonstrate the continuity between classical and modern anatomical studies and the dependence of one upon the other. Because the opportunity was missed, because the bridge between the two morphologies was not built, the monograph fails to reveal the applicability of current anatomical knowledge to cardiac physiology and is, overall, a disappointment.

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## Neuropharmacology

**The Pharmacology of Synapses.** J. W. PHILLIS. Pergamon, New York, 1970. xii, 360 pp. + plates. \$16. International Series of Monographs in Pure and Applied Biology: Zoology, vol. 43.

At a time when synaptic pharmacology has become highly fashionable, and correspondingly complex and controversial, Phillis has dared to write a monograph covering a large part of the total field. It is clear that he is a man of courage. Moreover, the result will be valuable to investigators as well as to students. However, it should be clear that the title is a misnomer. It used to

be said that a drug could be defined as a substance which, when injected into a dog, produced a paper. Now, apparently, the substances that qualify, with few exceptions, are those that can be injected microionophoretically. Thus this book will disappoint anyone hoping to be enlightened about the mode of action of anesthetics, sedatives, or psychoactive drugs, all of which presumably act on synapses. Only with the final conclusions does the author explicitly state that he was concerned primarily with studies related to compounds which are putative synaptic transmitters.

The book divides roughly into three portions. Nearly half is concerned with acetylcholine and monoamine metabolism and with peripheral cholinergic and adrenergic synapses. About the same proportion is devoted to pharmacological studies on neurons in the central nervous system. To this is added a rather straightforward account of studies of junctional pharmacology in invertebrates, and there is also some consideration of candidates for transmitter function such as serotonin, histamine, substance P, and prostaglandins.

The discussion of amine metabolism and peripheral cholinergic and adrenergic systems lies somewhere between that found in most current pharmacology textbooks and that in many recent reviews; more extensive and documented than the former, it lacks much of the detailed consideration of controversial subjects to be found in the latter. It is disappointing that the author has largely omitted calling attention to the many gaping holes that still exist in our present understanding of even the most studied systems. For example, it is only since this book was published that the ionic mechanism of the muscarinic excitatory postsynaptic potential in sympathetic ganglia has been clarified. The student reading this book would be unaware that the problem existed. Surely it is in a monograph such as this that an author has the opportunity to consider not only those questions that have been answered but also those that have not.

The pharmacology of neurons in the central nervous system is the author's own area of special interest, and he provides an extensive review of the actions on neurons of ionophoretically applied acetylcholine, catecholamines, amino acids, and other substances which can excite or depress action potential frequency. It cannot be held against the author that the main effect

on the reader is one of depression rather than excitation. After so much work, by so many investigators, one feels that by now there should be some unequivocal evidence as to the identity of transmitters at anatomically and physiologically defined central synapses. Even five years ago one could accept tentatively the simplifying assumption that when a substance inhibited or excited a neuron it did so by a direct action on that cell, and perhaps by interacting with receptors for an endogenous transmitter. At the time, everyone seemed aware that any action just might be indirect, secondary to an action on nerve terminals, glia, or even neighboring neurons. Today, however, one looks in vain for experimental evidence justifying that earlier assumption. Many investigators still seem to think that it is sufficient to accumulate counts of cells excited or inhibited by this or that agent, in this or that area of the brain. Is it possible they have become committed to techniques which are incapable of providing any real answers?

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## Russian Survey

**Molecules and Life.** An Introduction to Molecular Biology. MIKHAIL V. VOL'KENSHTEIN. Translated from the Russian edition (Moscow, 1965) by Serge N. Timasheff. Plenum, New York, 1970. xiv, 514 pp., illus. \$15.

"The purpose of this book is to explain molecular biophysics to all who might wish to learn about it, to biologists, to physicists, to chemists." This is the author's preface, written in Leningrad in 1964. The author is a distinguished Russian scientist, who has himself made extensive contributions to the theory of chain macromolecules. One might expect from this that the book would penetrate to the frontiers of our present understanding of the physics of the molecules of life, but it is apparent that Vol'kenshtein had a different aim in mind. This book is a survey of the whole field of molecular biology, starting with an elementary description of "cells, viruses, and heredity," amino acids and proteins, and the code. Biophysics is represented by chapters on the physics of macromolecules, of proteins, and of nucleic acids. Even the chapters that have "physics" in their

titles contain large amounts of elementary descriptive material. There are also discussions of immunology, of allosterism, and of mechanochemical processes (for example, muscle and mitosis).

It is interesting that molecular biology seen through Russian eyes looks much the same as it does in the West, except for some pointed mentions of Russian priority ("In 1892, the Russian botanist, Ivanovskii, observed that the juice of a tobacco plant that was diseased with the mosaic disease . . . could infect healthy plants even after this juice had been passed through the finest filters"), and for some lingering echoes of the Lysenko controversy.

Covering such a vast range, the discussion is necessarily compressed, and the author seldom allows himself the leisure to explore points of interest in detail, even in those areas in which he himself has contributed greatly. Oppressed by such discipline, much of the "life" in the title seems to have escaped from the text. One can only hope that next time Vol'kenshtein will devote his admirable talents to a deeper-going, even if narrower, treatment.

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## Polymer Formation

**Principles of Polymerization.** GEORGE ODIAN. McGraw-Hill, New York, 1970. xviii, 652 pp., illus. \$18.50.

*Principles of Polymerization* is a comprehensive treatise on the kinetics and mechanisms of polymer-forming reactions. It begins with the classical kinetic and statistical treatment of step polymerization and continues with a similar discussion of radical chain polymerization. The presentation of subsequent topics follows the regular pattern of polymer chemistry texts—*anionic, cationic, and ring-opening polymerization, and so on.*

The uniqueness of Odian's approach—that which gives this volume a distinct "personality"—is in its emphasis on the use of different polymerization techniques to reach specific end-product objectives. Included in the discussion of each polymerization method is a concise description of the advantages and flexibility it offers the chemist. This is of particular value for students because it makes clear the latitude afforded by intelligent use of

polymerization variables. The numerous alternatives for synthesizing macromolecules become valuable means for meeting one's objectives rather than a morass of facts that must be mastered.

The problems at the conclusion of each section warrant special comment. They were thoughtfully written and cover key points raised in the text. The reader's mastery of the subject matter will be not only tested but increased by diligent attention to these exercises. As is stated in the preface to the book, a solutions manual for the problems is available from the author.

Odian has presented each subject in its proper perspective. Books on polymerization often overemphasize given aspects of the subject (usually the authors' own research interests); this text presents a balanced description of the different branches of polymerization chemistry—a treatment that is consistent with the degree of importance of and state of knowledge in each area. Fact and theory also are presented in a well-ordered, complementary fashion.

The one exception to the generalization made above is the discussion of stereo-specific polymerizations, which jumps from broad speculation to simple presentation of empirical facts with little in between. This, however, is a reflection of the state of knowledge in this area.

In summary, to the expert the text will serve as a clear, orderly review of polymerization chemistry; to the student it will be of value as a good introductory text—assuming that supplementary material (or a complementary course) in polymer physics and characterization is available.

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## The Magnetization Process

**Magnetic Domains.** R. S. TEBBLE. Methuen, London, 1969 (U.S. distributor, Barnes and Noble, New York). xii, 100 pp. + plates. \$4. Methuen's Monographs on Physical Subjects.

*Magnetic Domains* is a descriptive primer for people who are not students of solid state physics but who may, for one reason or another, have a need to understand the basic phenomena of the formation and changes of magnetic domains and the corresponding impact on magnetization curves. A brief chap-

ter on techniques for domain observation is included which is admirably simplified for an audience that will not need to produce domain photographs but may wish to interpret them. Chapter 1 attempts, in 13 pages, to ascribe the magnetic moment to spins, and the cooperative phenomena are explained in terms of a Weiss internal field. At most a sophomore-level course in electromagnetism and a corresponding laboratory familiarity are assumed in the presentation.

Chapters 3 through 6 of the book contain the heart of the matter, discussing the energetics of domains, their resulting shapes and configurations, and how they change in applied magnetic fields to yield the observed magnetization curves. It may be fair to say that these chapters are an attempt to cover at a lower level the excellent work of Kittel and Galt in the Seitz-Turnbull series (which is of course intended for physicists). Although one can always suggest minor changes in the topics covered and the order of presentation, the book as a whole accomplishes this objective. Many excellent figures and micrographs complement the presentation.

The book will certainly prove valuable to nonphysicists in need of a framework of understanding of magnetic domain phenomena.

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## Nuclear Events

**Excitation Mechanisms of the Nucleus.** Electromagnetic and Weak Interactions. JUDAH M. EISENBERG and WALTER GREINER. North-Holland, Amsterdam, and Elsevier, New York, 1970. xii, 372 pp., illus. \$19.25. Nuclear Theory, vol. 2.

This book is volume 2 of a series of three books, Nuclear Theory, by the authors. It covers a fairly wide range of topics, some of which are not adequately discussed in other currently available books. As the authors write in their preface (with slight changes added by the reviewer): "The job of finding out how the basic theoretical concepts of nuclear structure physics were welded into detailed quantitative predictions about nuclear properties is becoming increasingly difficult. This is so because the vast and indigestible literature of nuclear physics is being