

in the former. Considering the financial state of science, it is interesting that several of the authors indicate the potential medical or social value of research on their subjects. This may contribute to the motivation of researchers tackling biological problems.

ALAN HOOPER

*Department of Genetics
and Cell Biology,
University of Minnesota, St. Paul*

Biological Compounds

Aspects of Terpenoid Chemistry and Biochemistry. Proceedings of a Phytochemical Society symposium, Liverpool, Apr. 1970. T. W. GOODWIN, Ed. Academic Press, New York, 1971. xiv, 442 pp., illus. \$24.50.

Terpenoids and Steroids. Vol. 1. A Review of the Literature Published between Sept. 1969 and Aug. 1970. K. H. OVERTON and seven others. Chemical Society, London, 1970. xii, 558 pp., illus. £11. A Specialist Periodical Report.

Perhaps I am getting old, but I regret to find lately as I peruse new technical books that the trend is simply toward cramming more and more facts onto each page; a consequence of this is that the books are more difficult and far less enjoyable to read. Regrettably, this is the case for the two volumes under review. The purpose of these volumes is identical—to review the literature of their subject. The first volume covers a four-year span; the second comprises coverage of only 12 months.

Goodwin's volume consists of 12 contributions by researchers in various disciplines from Europe and the United States. A record of the first symposium, entitled *Terpenoids in Plants*, was reviewed by me in 1967 (*Science* **158**, 1558). In four years, sufficient new material became available to warrant another symposium on essentially the same topic, and, surprisingly enough, there is little actual overlap in the material presented at the two symposiums. Of the two new works, the symposium proceedings is the more readable, some effort having been made by the editor and the various contributors to move from sentence to sentence with the hope that the reader will stay with it.

The book places emphasis on the insect hormones and carotenoids. Pfiffner's chapter enlarges one's appreciation of the nature and multifaceted role of the

juvenile hormones in insects. Nonexperts in this field, such as this reviewer, must stumble through mountains of tongue-twisting words to follow the text, but the fascination of the subject sweeps one along. Rees adds an additional chapter on the ecdysones, the insect moulting hormones. Goodwin's interest in the carotenoids is evident in that over one-fourth of the book is devoted to various topics of carotenoid chemistry and biochemistry. Recently, several C₅₀ carotenoids have been isolated and their structures determined. A thought-provoking aspect of this is that to date these C₅₀ compounds have been found only in bacteria and especially in Gram-positive, aerobic forms. All are nonphotosynthetic.

After reading Francis's chapter on monoterpene biosynthesis one can only remark yet again how little we know of the function and relationship of the monoterpenes to the overall physiology of the plant—and we must wait still longer to find the answers.

Overton's book is simply heavy going. Its deadpan presentation of the facts make it difficult and dreary reading. The "editor" considers himself as a "senior reporter" and his seven associates as more simply "reporters," and that's exactly what they do—report. Although the book offers little interpretation or evaluation of the reported research, the coverage appears to be thorough and accurate. The plenitude of structural formulas should prove quite useful to workers in the field.

The space is divided about equally between terpenoids and steroids. The first part of the book is further divided into chapters based on structural and biogenetic relationships—covering monoterpenoids, sesquiterpenoids, and so on—and biosynthesis of terpenoids and steroids. The second part consists of only two chapters, on steroid properties and reactions and steroid synthesis.

Both volumes contain excellent line drawings and have clear, well-executed printing. The indexes of both seem quite complete and are easy to use. If one accepts these books not as works to enjoy but simply (and to me with some distaste) as "reference works," then one can get on with using them as I presume they were intended to be used.

RICHARD A. BERNHARD

*Department of Food Science
and Technology,
University of California, Davis*

Developmental Sequences

Changing Syntheses in Development. A symposium, Albany, N.Y., June 1970. MEREDITH N. RUNNER, Ed. Academic Press, New York, 1971. xiv, 272 pp., illus. \$13.50. *Developmental Biology*, supplement 4.

The major questions posed in this book are the traditional questions of development biology: how cells become different from one another during embryogenesis, how they organize into identifiable organs, and how, once differentiated, they respond to external stimuli. These problems are approached and discussed at levels ranging from the molecular biology of gene transcription, to cell dependence upon or response to hormones, to electron microscopic studies of cell and tissue organization. In spite of the diversity of the systems and approaches presented, the articles are related by the unifying theme implicit in the title of the book: they all stress sequential developmental events, whether at the biochemical, the cellular, or the morphological level.

Several of the papers present systematic descriptions of the developmental events and are valuable contributions for the information they contain. A few of the authors develop models in an effort to explain the changes they observe. Flickinger, for example, presents a provocative and speculative argument for the role of redundant nucleotide sequences during early amphibian embryogenesis. He suggests that most "DNA-like" RNA from very early embryos is transcribed from more redundant, evolutionarily old DNA sequences and that restriction of embryonic competence results from a restriction of transcription of these sequences as they become late-replicating. Bernfield and Wessells have neatly combined cytochemical and other biochemical studies with observations from light and electron microscopy to help elucidate the forces involved in the formation and maintenance of salivary gland epithelial structure. They find two independent factors, a mucopolysaccharide-protein complex at the epithelial surface and organized microfilaments, that appear to play a requisite role.

The most basic form of cell differentiation is the transition from germ cell to somatic cell. *Volvox*, a colonial flagellate, consists of only these two cell types, although the reproductive cells may be asexual, male, or female.

In his investigation of the mechanisms of sex determination Starr is fully exploiting the advantages offered by this system. The cells are haploid, and their sexuality makes them amenable to genetic analysis and the isolation of developmental mutants. Of particular interest is the production of an inducer, usually by males, which triggers the differentiation of the sexual response. This inducer appears to be proteinaceous with a molecular weight of approximately 30,000 and is effective at a concentration of $10^{-15}M$.

A few of the papers are presented at an esoteric level and appear to be directed to the specialists in their fields. The majority, however, are written so that they can be appreciated by biologists with developmental interests other than those discussed, or by students with a year or more of graduate training. For the latter, this book would be particularly informative, since it describes a wide spectrum of biological systems that are being used to study the fundamental problems of development.

PETER J. STAMBROOK

*Department of Embryology,
Carnegie Institution of Washington,
Baltimore, Maryland*

Neurochemistry

Neurotransmitter-Receptor Interactions. D. J. TRIGGLE. Academic Press, New York, 1971. x, 610 pp., illus. \$26.

This book ranges much more widely than its title may suggest. It begins with a detailed description of the interaction of macromolecules and ligands in aqueous solution, and this is followed by a section on the mechanisms of enzyme reactions, with emphasis on the approaches developed by Koshland and by Monod, Wyman, and Changeux. The properties of cell membranes, particularly excitable membranes, are then introduced, with a brief discussion of membrane models. The major chapters give detailed accounts of the actions of acetylcholine, norepinephrine, and their congeners, with much information about structure-activity relationships and about the effects of these agents on membrane permeability and conductance and on enzyme-mediated processes, particularly those involving adenyl cyclase. Next there is an account of the role of calcium in neurotrans-

mitter action and excitation-contraction coupling. The final chapter summarizes initial studies on the isolation and characterization of receptors.

To attempt a comprehensive and accurate account of all these matters is a formidable task, and Triggles is to be congratulated on his success. The breadth and detail of his book will be of considerable value to research workers as a general review of the field through 1970, and his lucid style will be appreciated by many students of pharmacology and physiology. One may regret that desensitization and rate theory are not discussed, but there are only a few significant omissions in the subjects covered; for example, there is no reference to A. B. Steinbach's work on the effect of local anesthetics on the action of acetylcholine at neuromuscular junctions. Intentionally the discussions are limited to work with agents acting at adrenergic and cholinergic synapses; information concerning other transmitters and transmitter-candidates, 5-hydroxytryptamine, gamma-aminobutyric acid, glycine, glutamate, and so on, must be sought elsewhere.

A major obstacle to advances in this general field has been the fact that the tissue responses actually observed (usually muscle contraction or relaxation, but more recently changes in membrane potential or conductance, or enzyme activation) have been one or more steps removed from that of receptor activation, so that deductions about the first step or steps have had to be based on indirect evidence. This has resulted in a multiplicity of hypotheses about the initial events. Triggles has presented the different suggestions that have been made, together with the assumptions and evidence on which they are based. An example is the author's own proposal that the contraction of several smooth muscles is directly proportional to the number of receptors occupied by the agonist involved, as first suggested by A. J. Clark. The evidence supporting this somewhat controversial idea is presented side by side with an account of the work of Nickerson, Stephenson, and Furchgott, who came to a quite different conclusion, namely that few receptors need to be occupied even for large responses. Many readers may be surprised to find that such basic issues are still unresolved, but direct methods to establish the numbers of receptors in innervated and denervated tissues have only been developed in 1971, and

the newest techniques in this accelerating field, including studies of isolated receptor proteins, have just begun to provide direct information about receptor structure, drug-receptor interactions, conformational changes, and receptor-response coupling.

Everything considered, therefore, this book reflects credit on both its author and its publisher.

D. H. JENKINSON

L. T. POTTER

University College, London, England

Paleontology: A Commentary

Vertebrate Paleozoology. EVERETT C. OLSON. Wiley-Interscience, New York, 1971. xvi, 840 pp., illus. \$29.95.

This is not a textbook. One will not learn the kinds of fossil vertebrates from it; such knowledge is assumed. The book is rather a commentary on the state of the science, with extensive coverage of some aspects and complete omission of others.

After a brief overview and a hundred pages on the functional evolution of the major body systems, there is a major section on the classification of the vertebrates. Unfortunately the emphasis is on classification per se rather than on the phyletic and the comparative adaptive and structural bases for classification. These come out to some extent for the reptiles and their near relatives, a group on which Olson is one of the two leading workers, but for the rest, form rather than content is focal.

The second half of the book treats four topics in some depth. Here is Olson at his best, with an integration of function, phylogeny, morphology, ecology, and other approaches in a thoroughly comparative manner. In addition to a discussion of his well-known work on the origins of tetrapods and mammals, there is an extensive section on aquatic biology and a shorter one on biogeography. Comparisons among different groups accentuate what is not known as well as what is, and critical evaluation precludes the false comfort of certainty.

Bones are the data but not the meaning. It may surprise even many paleontologists how much life can be hidden within their plaster jackets.

LEIGH VAN VALEN

*Committee on Evolutionary Biology,
University of Chicago, Chicago, Illinois*