

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.

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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.

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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.

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