

ing paper on retinal specializations in fishes and speculates on the relationships of these specializations to aquatic vision. The possible adaptations are outlined clearly and in such a way as to suggest hypotheses and appropriate methodology for testing them.

Overall, the book is uneven in coverage and depth. It will be of interest to a few specialists, but it cannot be recommended to the biologist interested in an overall view of vision in fishes.

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## Regulating Nervous Activity

**Cholinergic Mechanisms.** Papers from a symposium, Boldern, Switzerland, Mar. 1974. P. G. WASER, Ed. Raven, New York, 1975. xviii, 556 pp., illus. \$29.50.

This symposium proceedings opens with a historical survey by Bo Holmstedt of some of the less well known traditions in research on cholinergic functions. The paper reminds us of the surprising fact that, although the synthesis of acetylcholine in vitro was achieved by Adolf von Baeyer in 1867, the control of that process in vivo has yet to be fully elucidated. The study of acetylcholine metabolism in vivo had to be postponed until the recent development of the sophisticated methods reviewed in this volume by Donald J. Jenden. The availability of these methods has invigorated acetylcholine research, although our understanding of central cholinergic neurons still lags behind our knowledge of brain monoamines.

The topics covered in the book include the morphology of cholinergic synapses; methods for determining the acetylcholine and choline contents of tissues; the formation, transport, and uptake of choline; the synthesis, turnover, structure-activity relations, enzymology, and receptor interactions of acetylcholine; the therapy of anticholinesterase poisoning; and various pharmacological and behavioral phenomena associated with cholinergic neurons. The papers vary in degree of specialization and complexity. There are only a few reviews, such as F. Fonnum's "Review of recent progress in the synthesis, storage, and release of acetylcholine" and A. G. Karczmar's "Cholinergic influences on behaviour." Most of the 52 papers describe specific research projects, and the results of many of these have appeared in journals. Nevertheless, a collection of key results

of the acetylcholine research of the past four years is a useful addition to the library of any neuroscientist.

Furthermore, the book includes studies on widely different systems, ranging from the electric organ of *Torpedo marmorata*, to the neuromuscular junction, to the mammalian brain. Most interesting to this reader are freeze-etch electron micrographic studies of synaptic junctions; the possibility of isolating cholinergic receptors and of localizing choline acetyltransferase and acetylcholine histochemically; the study of acetylcholine biochemistry in the mammalian brain; and, finally, the evidence that central cholinergic neurons are involved in controlling various behavioral states.

In the two years since the symposium took place, many new findings have been published that amplify our knowledge of the topics discussed in this book. One example is the identification of precursor availability as a factor in controlling the rate of acetylcholine synthesis in vivo; another topic that is receiving new attention is the involvement of cholinergic mechanisms in various neurological diseases.

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