Book Reviews

The Nervous System

Principles of Neural Science. ERIC R. KANDEL and JAMES H. SCHWARTZ. Elsevier/North-Holland, New York, 1981. xxxvi, 734 pp., illus. Cloth, $60; paper, $29.95.

Neuroscience is in many ways a new discipline, and most of its dramatic growth and exciting progress, particularly at the cellular level, have been achieved in the last two decades. Eric Kandel and his colleagues at Columbia have contributed significantly to this recent progress. Their experimental work, and Kandel's tireless and effective explanations of it through his many books, articles, and lectures, have made the mollusk *Aplysia* a widely known model for the study of cellular aspects of synaptic modification and learning. Before the recent growth of neuroscience, however, and before the proliferation of neuroscience courses at universities and colleges, an older pedagogical tradition existed: the study of the nervous system as part of the basic science curriculum in medical schools. Medical science courses in general have not had an enviable reputation. Traditionally, a series of reluctant lecturers force feeds large numbers of facts to students who are impatient for clinical work and curious mostly about what will be required for the next exam. But what happens when practitioners of the vital "new" neuroscience, including some gifted lecturers, teach a traditional medical course? This book, based on Columbia's neural science course, provides some clues.

The book is scaled to its vast subject, the human nervous system. There are 692 double-column pages, 52 chapters, three appendixes, and 20 authors. The topics range from axons (chapter 2) to zeitgebers (chapter 38), ions (chapter 3) to instincts (chapter 46). The chapters are grouped in eight major sections: an overview (introductory), cell biology (membrane properties, synapses), sensory systems (touch, vision, and audition, but omitting olfaction and taste), motor systems (spinal reflexes, motor cortex, cerebellum, basal ganglia), brainstem and reticular core (cranial nerves, oculomotor and vestibular systems), hypothalamic and limbic systems (emotion, motivation, sleep and dreaming), development (including sexual differentiation and aging), and behavior (innate patterns, learning, behavioral disorders). Scattered through the physiological chapters are occasional clinical chapters that will be particularly welcome to medical students.

In spite of the vast terrain and the large number of authors, the editors have successfully created an even, consistent, neutral tone; one does not always notice when authorship changes between chapters. Above all, the editors seem to have striven for clarity in the style of the text, in declarative section headings, in summary paragraphs, in typography, and in a complete set of new illustrations. The division of chapters among specialists does, however, create occasional problems, particularly in segregating structure and function when they ought to be dealt with together. For example, a lengthy description of synaptic morphology is separated from the pertinent physiology, and structural facts about the visual system (size classes of retinal ganglion cells, patchy distribution of geniculate afferents to the cortex) are presented before the students learn the functional importance of those facts (X/Y/W cells, ocular dominance columns). The authors may also be overly optimistic about the utility of introducing formal algebraic models of synaptic currents to students who have not yet developed an intuitive understanding of channels and ion movements. Nevertheless, the book is an impressive undertaking and a generally successful contribution to its primary audience of medical students.

But is this also a book for other neuroscience students? It matches the syllabus of physiological psychology courses, but its level is too difficult for most psychology undergraduates unless they have a substantial background in biology. It would suit a graduate survey course in neuroscience, although it does have a few drawbacks for this role. It is difficult to find sources for statements in the text, since most chapters do not refer explicitly to the useful bibliographies that accompany them; footnotes might have helped. Also, because of its mammalian emphasis, the book does not present the invertebrate examples that would clarify many topics; ironically, *Aplysia* is not even in the index, although its neurons do provide a few brief examples. Finally, some of the redrawn, semi-schematic physiological recordings are not very accurate, and they have lost the iconographic richness of the familiar originals, which often have come to stand for entire concepts.

For an introductory neuroscience course, however, I believe this good book has a more serious drawback. As Lewis Thomas has pointed out, the pace of science is such that much of what our students will learn in their lifetimes will be discovered after their schooling ends. Consequently, it is important that we teach future scientists how a field advances as well as the field's current set of facts. This book's success is in presenting a synthesized survey of current "important facts and the fundamental concepts." Only occasionally do its chapters attempt the more stimulating task of showing the intellectual endeavor that underlies those facts (and given the vast terrain to be covered, it is hard to see how the chapters could do more). But some chapters do provide more vitality: Kandel's description of how Katz and Miledi worked out the presynaptic role of calcium shows an experimental puzzle being solved, his chapter on central vision reproduces the historical development of the field, and his chapter on synapse formation captures the interaction between hypothesis and experiments. Other contributors succeed in presenting opposing ideas: Rowland on myasthenia gravis, Carew on the role of spinal reflexes, and D. Kelly on sleep and dreams are some of them. Yet certain puzzles or controversies that might intrigue and challenge students do not appear; there is no mention of the hypothesis that the visual cortex is a spatial-frequency analyzer, for example. Of course, neuroscientists will differ on which topics are essential, but the general point is that a book that must survey everything cannot readily dwell in depth on the intellectual basis of a field, even if that might be more useful for many students. Thus, the book may not be the best introduction to neuroscience for nonmedical students. However, we probably do prefer that our future physicians know a little about everything, and this very comprehensive, clear, and occasionally lively book will serve them well.

RICHARD F. OLIVO
Department of Biological Sciences,
Smith College,
Northampton, Massachusetts 01063