

The book is clearly written, generally well illustrated, using sufficient photographs of gross, microscopic and ultrastructural pathology. There is, however, a distinct lack of correlation of the pathology with modern imaging techniques, computerized tomographic scans, magnetic resonance imaging or arteriography. Ultrasound correlations with perinatal pathology would also be useful. The current interest in the use of immunocytochemistry is ignored. Each chapter has an up-to-date extensive reference list of pertinent articles.

A comprehensive chapter on the dementias, which joins Alzheimer's disease to other dementing illnesses and the slow virus disorders would be welcome. The chapter on Trauma should be better illustrated and some of the pathophysiologic mechanisms better-developed.

Overall, this textbook is welcome as a medium level textbook of neuropathology and will serve neuropathologists as well as histopathologists, clinical neurologists and neurosurgeons well.

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MEMORY SYSTEMS OF THE BRAIN, 1985. Edited by Norman M. Weinberger, James L. McGaugh and Gary Lynch. Published by The Guilford Press, New York. 514 pages. \$83 Cdn. approx.

This book consists of a collection of papers from the Second (1984) Conference on the Neurobiology of Learning and Memory, organized by the University of California, Irvine's Center for the Neurobiology of Learning and Memory. The book contains three major Sections, each dealing with somewhat related aspects of learning and memory. Each Section consists of four or five chapters by leading scholars in the field which describe aspects of their own work, and the implications of that work in the context of brain mechanisms of learning and memory. An additional four or five Chapters of Critical Commentaries, each of which takes a somewhat broader view of the preceding material, serve to round out each Section. A well-written introductory chapter by the book's Editors provides a clear overview of the outline and themes of the book. These themes include cross-species similarities and differences in the physiological bases of learning and memory; and the question as to whether memory is of a unitary nature or whether there are multiple memory systems within the brain. The strong unstated theme of the book is that the brain is the physiological basis of learning and memory, and that it should be possible to demonstrate very tight structure-function relationships for all aspects of learning or memory in any species.

Each of the chapters in the first Section, *Brain Systems and Learning*, considers different possibilities for the physiological bases of learning and memory. Thus, Alkon discusses the chemical changes in the peripheral nerve cells of the nudibranch mollusc, *Hermissenda* that follow classical conditioning of a foot contraction response, while Greenough discusses structural changes to neural synapses that occur in rats following training on specific tasks. Abraham & Goddard provide clear evidence for the long-term electrical changes that can take place in the hippocampal formation following electrical stimulation of this region. The functional role of the hippocampus is also considered in this section, with Deadwyler suggesting that

it has a role as a limited-capacity storage buffer for new information, and Barnes & McNaughton proposing that it acts as a limited-capacity storage system from which the neocortex draws information. The idea that the brain has more than one type of memory system is raised in the chapter by Abraham & Goddard, where they note that four different long-term effects can be found following electrical stimulation of the hippocampal region. Greenough has parallel comments related to the possibility that different types of memories may have different temporal durations in the brain.

The second section, *Comparative Aspects of Learning and Memory*, focuses on the surprisingly complex memory systems of a variety of relatively simple organisms. Cook, Delaney, & Gelperin focus on conditioning in the slug, *Limax*, and point up the importance of predictability between stimulus and response in obtaining good conditioning. They conclude that similar mechanisms of learning must therefore be in force in a variety of different species, and that studies of the nervous systems of simple invertebrates should be able to provide information that is applicable to more complex systems. McPhail echoes this view in his chapter, where he suggests that different phyla of animals show close similarities in terms of their learning capacities. Rosenzweig & Glickman, however, take just the opposite view. Gould's chapter describes the bee's extraordinary memory for the location and distinctive features of flowers. Shettleworth notes the phenomenal ability that birds have to remember the spatial location of food over very long time intervals, then goes on to discuss spatial memory in a number of other species including the rat. The issue of multiple memory systems reemerges in the chapter by Rescorla, where he notes that a variety of dissimilar associations are made by individual animals during conditioning, and that these different types of learning may each follow different rules. Staddon suggests that learning is based on inferences derived from two sets of rules, one set being specific to the ecological niche of the particular species, the other set being of a more general nature. Cross echoes a similar theme in his view that learning consists of adjustments of instinctual behaviors to variations in ecological niche.

The final Section of the book, *Learning, Memory and Cognitive Processes*, takes as its theme that different forms of learning and memory do exist and that these may well depend upon different neuronal underpinnings. Gallagher suggests that the manipulation of endogenous opioid systems in rats have comparable effects upon a variety of different types of learning. Mackintosh proposes that different forms of learning may involve different neuronal systems in animals. The chapters by Schacter and Weiskrantz both focus on the wealth of evidence from the human amnesic literature that points clearly towards at least two dissociable memory systems in the human brain.

I found this book to be a pleasure to read. It is well laid out, very free of typographical errors, and full of stimulating and controversial discussions. The treatment is relatively advanced, but each chapter provides sufficient background introduction to permit a clear understanding of the rest of the material for the intelligent reader. The critical commentaries, for the most part, serve to illuminate the rest of the material.

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