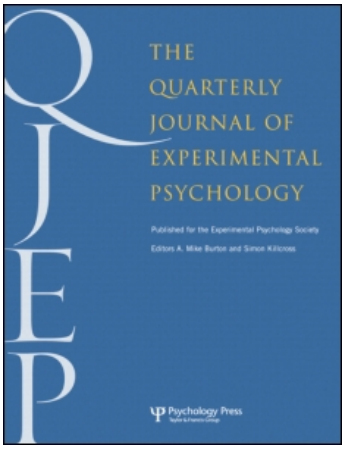

The Quarterly Journal of Experimental Psychology Section B
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713871626

Book Review

To cite this Article 'Book Review', The Quarterly Journal of Experimental Psychology Section B, 48: 1, 93 — 94
To link to this Article: DOI: 10.1080/14640749508401439
URL: http://dx.doi.org/10.1080/14640749508401439

THE QUARTERLY JOURNAL OF EXPERIMENTAL PSYCHOLOGY, 1995, *48B* (1), 93–94

Book Review

McGaugh, J.L., Weinberger, N.M. & Lynch, G. (Eds.). (1992). *Brain organization and memory: Cells, systems and circuits.* New York: Oxford University Press. Pp. 409. ISBN 0–19–507712–1, £25.00 (Pbk); ISBN 0–19–505496–2, £65.00 (Hbk).

This book covers a wide range of approaches to the study of memory. It essentially deals with the relationship between functional and mechanistic descriptions of memory. Although intermediate levels of description are possible, the bottom line of this problem must be to relate what is known about long-term adaptive changes in neurons to similar changes in behaviour. The connection between phenomena at these two levels is widely assumed to lie in the way neurons interact with each other to produce collectively organized patterns of activity. The form of such interactions is determined by the dynamics of neurons, by the architectures of the brain regions that those neurons comprise, and by the circuits connecting those regions. A range of computational models can then be used to explain how particular collective neural behaviours might arise in various brain systems and play a role in memory.

Things are not, of course, that simple. To do what I have outlined above requires formal descriptions of electrical activity in neurons, neurotransmission, activity-dependent adaptive interactions between neurons, qualitative and quantitative anatomies of a range of brain regions implicated in memory and the circuits between them, the information to be memorized, the stimulus–response characteristics of recall, and a compatible computational model. The 21 chapters in the book go some way towards providing these descriptions, testing their validity, suggesting computational models, and exploring what insights can be gained from applying them. After an introductory chapter by Jan Bureš on anomalous findings in the neurobiology of memory, the rest of the book is arranged in three sections: "Forms of memory", "Regulation of cortical function in memory", and "Representations: Beyond the single cell". Each section consists of an introduction and three or four major chapters, followed by some shorter commentaries and alternative perspectives. The extent to which the authors take an explicitly computational stance varies from chapter to chapter, as does the extent to which chapters deal directly with *memory* or with related areas. The breadth of topics and perspectives covered, particularly in the shorter commentaries, is admirable and drives home the difficulty of partitioning off *memory* from the processes that form and use it both at mechanistic and functional levels. Of course, a book on the neurobiology of memory would not be complete without chapters on the mechanisms that can be uncovered by work on synaptic plasticity in *Aplysia*, adaptive processes underlying the development of the visual system, or hippocampal function. In addition, major chapters also deal with functional distinctions between types of memory demonstrated by work on conditioning, or the selective effects of conditions such as Alzheimer's disease or Korsakoff's syndrome, and with computational models that may be applied to memory such as associative and self-organizing neural-networks. It is, however, the less obvious chapters that distinguish the book. For example, a chapter by Gerstein outlines the practical problems of detecting interactions between the activities of multiple neurons that may allow some of the computational models discussed in other chapters to be tested directly. It is also refreshing to see discussions of the limitations of neural network models' ability to represent an ordered syntax of relationships between entities and, indeed, on the question of whether we should even expect entities in the outside world to be represented as something distinct from the activity of detecting and responding to them. Other chapters also point out the

assumptions often implicitly made about the nature of representations in models of memory—distinctions between the sensory and the psychological components of events and the association of events with complex contexts and with more basic contextual information, such as temporal and spatial tags.

It should now be clear that this book covers a great range of topics, for the most part very well. Although computational concepts and models appear regularly throughout the book, there is little reason for the experimental psychologist to feel intimidated by the mathematics used. This is by no means a textbook. However, it could be usefully employed as source material in a final undergraduate year course on the neurobiology of memory and is recommended reading for anyone wishing to get a feeling for the current state of the subject in one package.

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