

# Book Review: Large-Scale Neuronal Theories of the Brain

*TRENDS IN NEUROSCIENCES*

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The subject matter of this book, the use of a bottom-up approach rooted in neurobiological knowledge to explain higher brain functions, gained a lot of popularity in recent years. This was evidenced by the large crowds attending the "Toward a Neurobiology of Visual Consciousness" symposium organized by one of the authors (Koch) during the recent Meeting of the Society for Neuroscience in Miami. Unfortunately, several speakers in this symposium seemed to induce a state of reduced consciousness accompanied by slow and loud breathing in many attendees... Luckily this is not the case with the book. Most chapters are entertaining and written in a style and language which makes them readable to a general neurobiology audience. Only a few chapters contain mathematical equations and these can often be skipped without problems, except for the endless concatenation of equations in the chapter about "a cortical theory" (the whole cortex reduced to one equation!) by C.F. Stevens. However, the title of the book is a misnomer. "Theories of Visual Cortex" would be much more appropriate. The chapter by Llinás and Ribary on the correspondence between wakefulness and REM sleep is the only one that does not talk about vision in one way or another. While it may be justified to assume that visual cortex is a model for cerebral cortex in general, there is no excuse in a book that claims to be about the brain for disregarding structures which have co-evolved with the cortex, such as the basal ganglia, hippocampus and cerebellum. The only non-cortical structure that gets any attention is the thalamus. This imbalance probably reflects the origin of the book, i.e. a small workshop sponsored in 1992 by the Office of Naval Research. This might also explain the quite illogical order of the chapters. The book provides a good, but incomplete (e.g. Abeles' synfire chains are nowhere to be found) introduction to current thinking about cortical function. I found the chapters on interactive vision by Churchland, Ramachandran and Sejnowski, on pattern theory by Mumford, on bidirectional seeking by Ullman and on temporal correlations by Singer the most interesting. These authors succeed well in using detailed

neurophysiological and anatomical data to formulate plausible theories of cortical function. They generate specific predictions and put their theory into a broader perspective. Except for the chapter by Singer, reviews of these authors' theories are not accessible elsewhere.

The chapters on object recognition by Poggio and Hurlbert and on visual attention by Van Essen, Anderson and Olshausen are more a top-down approach that are related to machine vision and therefore a bit out of context in this book. Most of the remaining chapters are shortened versions of the authors' theories which have been presented better elsewhere (e.g. the in itself interesting work on visual memory retrieval by Damasio and Damasio), or, even worse, updates on the current state of the authors' theories which assume that the reader is familiar with the authors' older work (e.g. the chapter on consciousness by Koch and Crick and the vague neuronal theories of the mind by Posner and Rothbart).

Reading through this book one becomes aware of the large potential for convergence between the theories presented by the different authors. For example, half the chapters discuss the importance of the interaction between ascending and descending pathways in visual recognition. The book lacks a summarizing chapter that compares these different theories and makes clear their commonalities and critical differences. Instead of proposing yet another wild idea on the neuronal basis of consciousness (for those who are out of touch, Koch and Crick have dropped neuronal oscillations and now favor the bursting pyramidal neurons in layers 5 and 6), it might be more useful to organize a new workshop and lock up the attendees until they agree on a large-scale unifying neuronal theory of cortex!