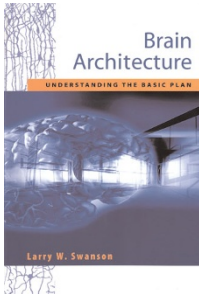


A whirlwind tour of the nervous system



Brain Architecture: Understanding the Basic Plan

By Larry W. Swanson
Oxford University Press, 2003 \$29.95
paperback, pp 263
ISBN 0195105052

Reviewed by Kenneth C. Catania

A compelling overview of nervous system architecture and function in a short and readable text? I must admit, I didn't think it could be done. So it was with some trepidation that I agreed to review Swanson's *Brain Architecture*, half expecting a dense compilation of the details of human neuroanatomy. Instead I was pleasantly surprised by the comparative and evolutionary approach used to introduce the major concepts, and I was drawn in by the historical context in which this story is told.

Brain Architecture provides a clearly written and logically organized overview of the major functional subdivisions of the vertebrate nervous system, accompanied by a commentary on historical views of brain function. Each of the 11 chapters begins with a relevant historical quotation, and these teasers are backed up by well-targeted suggestions for further reading that range from the works of Aristotle to reviews of current topics in the neurosciences. The readings have obviously been assembled by a connoisseur. The chapters are nicely illustrated with black and white figures, sensibly subtitled, and are often followed by a brief summary of the major points.

Although the book focuses on vertebrates, especially humans, it is kicked off with a review of the simplest nervous systems, including a humbling reminder that even single-celled organisms are adept at sensing and responding to their environments. Swanson introduces neurons, networks and the basic vertebrate plan (chapters 2–4) and manages to touch on animal diversity, development, and evolution in the process. This introduction is brief, but the important

concepts are outlined and relevant additional readings are suggested.

After this introduction, Chapter 5 lays the groundwork for the remainder of the text by presenting a model for the interaction between different functional systems and their role in the production of behavior. The straightforward relationship between the motor system and behavior is explained, and the more elaborate influences of three additional systems are outlined. These include a behavioral state control system, a sensory system, and a cognitive system, all of which have a combined influence on the motor system—and thus behavior. Having provided this framework, much of the remainder of the text details how each system is anatomically and functionally organized and how it fits into the model. Two short concluding chapters discuss modifiability and gene networks. Finally, three appendices review how anatomical positions are described in humans and other vertebrates, naming and classification in the nervous system, and methods for analyzing brain architecture.

Swanson's writing style and his ability to present complicated systems and relationships will make this book particularly accessible to students, and generally useful to anyone interested in the neurosciences. However, readers should not expect this short text to even approach a comprehensive treatment of the wide-ranging subjects discussed (some sections, like the three-page chapter on gene networks, are disappointingly superficial). *Brain Architecture* would be appropriate as a supplement for a range of neuroscience courses. It also struck me as a useful book to recommend to my own graduate students.

Despite its potentially widespread appeal, there are some parts of this text that will not sit well with many biologists. Swanson suggests evolution has “culminated in

the appearance of modern humans” and that the cerebral cortex is “the crowning glory of evolution.” These kinds of remarks, though few, may not seem trivial to many biologists and comparative neuroanatomists battling ladder-like views of evolution. Yet in most other places, the treatment of evolution is more progressive (no pun intended). The possibility of simplification is pointed out, the shortcomings of using extant species as representatives of the ancestral state are acknowledged, and even the commonly used term neocortex is replaced with the directionally neutral “isocortex.”

Though Swanson touches on a number of aspects of behavior, some may feel the ‘explanatory net’ was cast too wide when behaviors are discussed, and I would have liked to have seen more suggested readings in this area. Although Swanson often acknowledges that we have only a vague understanding of the relationships between many behaviors and neural architecture, there are areas where explanations of these relationships are stretched. This was most apparent in descriptions of the motor system where, for example, groups of central pattern generators (for locomotion, eye movements, and postural adjustment) are invoked for “foraging”, and others (for reaching, grasping, and manipulating) are suggested for “behavior after a goal has been approached.” Assigning central pattern generators to these categories is an oversimplification, given the wide range of behaviors in which such central pattern generators would be involved.

More generally I was surprised at the relative lack of emphasis on the sensory system (one of four systems in Swanson's model) as an influence on the cognitive system. This was only briefly discussed in different sections from a predominantly anatomical standpoint. Given the important influence of the sensory system on the cognitive system during protracted human development (for example the critical role of audition for language acquisition), one might expect the sensory system to take a more central role in the model. But this book is, after all, about brain architecture—and perhaps one should expect a concentration on the central sources of behavior rather than the environmental influences that may have ultimately shaped them.

Overall Swanson has done a commendable job distilling the essential principles from an exceptionally complex subject, making the brevity of this book one of its greatest strengths. It will be a welcome addition to the libraries of students and anyone interested in the basic organization of the brain.

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