

BOOK REVIEW

The Mind's Machine: Foundations of Brain and Behavior

By Neil V. Watson and S. Marc Breedlove

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We approached the review of *The Mind's Machine* from the perspectives of a behavioral neuroscientist (DAW) and a cellular/systems neurobiologist (BRJ). Our different backgrounds allowed us to address the educational value of this text for neuroscience educators from different intellectual disciplines. This book is a condensed version of *Biological Psychology* by Breedlove and Watson (2013). It is 180 pages shorter, with some reorganization and the deletion of specific chapters on evolution and development. As in the larger book, *The Mind's Machine* is well written with high quality illustrations. One of the attractive features of the book is the clear organization of the topics by the presence of headings that express the main point of each paragraph, and these point the student to the critical information on the topic.

Innovative features of the book include a clever "visual summary" page at the end of each chapter to recap the main points. There are also UPC barcodes that provide smart phone access to the text's well-developed website (2e.mindsmachine.com) containing study resources, greater depth of material, activities, animations, the *Brain Explorer* neuroanatomy program, and video clips. There are some clever exercises that animate the sequential brain processes involved in making a series of perceptual and motor actions, and *Brain Explorer* activities that ask the student to identify relevant neuroanatomical locations pertaining to the chapter topics. The "A Step Further" feature sends readers to the website for more detailed information and gives an encyclopedic feel to the book without adding too much information up front. This feature is, however, frustrating at times when the discussion flow of an interesting topic ends abruptly with directions to the book's website for further information. A running list of key terms and their definitions placed in the outer margins of most chapter pages reinforce concepts introduced in the main text. The "how's it going" review questions at the end of each chapter section are straightforward and pointedly engage students to refresh important facts and themes in the text. The "researchers at work" sections introduce the scientific method as they reveal basic brain principles. The introductory stories that begin chapters are interesting and enticing hooks to introduce the reader to a chapter's material. The book may appear very "busy" at first with the illustrations, boxes and compact summary figures, but the good organization and writing style gently guide the reader through the material. It is written with a refreshing

(sometimes silly) sense of humor that can surprise and pull the reader back to the text in a drifting moment.

In terms of content, this text is unusually strong in the areas of hormonal influences on behavior, and the chapter on reproductive behavior is developed in substantial depth. In comparison, most of the other chapters are more cursory and are limited to basic information. The chapter on sensorimotor processes integrates information about the motor and somatosensory systems; some instructors might find this less satisfying than the tradition of placing the somatosensory system in a parallel organization with the other sensory systems and of treating the motor system in a separate chapter. Some instructors might be frustrated by the limited coverage of certain concepts and in the combination of several topics into individual chapters (e.g., memory, learning, and development). The instructor who wants more thorough coverage might prefer a more traditional textbook dealing with behavioral neuroscience. The coverage of physiological processes related to behavior is mostly clear and effectively explained. Material on molecular and intracellular processes is not provided, however, making the text less attractive to those instructors taking a neurobiological approach in the courses. The short appendix on molecular biology is a nice summary for the beginning student of major techniques in cell biology.

As a cellular neurophysiologist, one of us (BRJ) grimaced occasionally when reading the Neurophysiology chapter (3). It is not as tightly written as other chapters and has some statements about neuronal excitability that are either in error or that need clarification. For example, the text indicates that the resting potential (RP) is at the potassium equilibrium potential, but to be accurate, students should learn that the membrane has limited permeability to other ions, leading to an adjustment in the RP. A second error is the statement that the action potential (AP) is prevented from going in the antidromic direction because the membrane has too few voltage-gated Na⁺ channels; in fact, it is because too few Na⁺ channels have recovered from inactivation. Third, channels mediating excitatory postsynaptic potentials are not Na⁺ channels, but they allow both Na⁺ and K⁺ through (as indicated in Table 3.2 instead of the main text). Two areas in which the material should be expanded include the observation that APs exhibit lower amplitudes during the relative refractory period due to Na⁺ channel inactivation. The other issue to be clarified is that most of

the time in synaptic delay is due to Ca^{2+} entry into the terminal after the start of the presynaptic AP, the other synaptic transmission steps are much faster. Tweaks in this chapter would bring it up to the level of the rest of the book. A short discussion in this introductory text of the "Behavioral State" network (Swanson, 2012) as a control system determining everything from cognition to mood to metabolic homeostasis (Silverthorn, 2016) would add more depth for beginning students. Most of the information on the diffuse neuromodulatory systems is in this book, but it is not unified to address this overarching control of brain function.

The book is worth serious consideration for first courses in behavioral neuroscience for students who have limited background in natural sciences. The book's marketing as a biological psychology text may mask its usefulness for teaching undergraduates from diverse majors studying

neuroscience. For example, this book would also be a good supplementary text to provide a deeper context for biology and engineering students who take more classical neurophysiology courses at universities.

REFERENCES

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