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Book Reviews

Neurobiology of Monotremes. Ken W. S. Ashwell, editor.

Collingwood, Australia: CSIRO Publishing, 2013. 522 pp. ISBN 9780643103115 (hardcover), $277.00.

The Platypus and other monotremes have fascinated, entranced, and puzzled Western biologists since John Hunter, then Governor of a penal colony in New South Wales sent a sketch and skin to the Philosophical Society of Newcastle-upon-Tyne in 1798. Neurobiologists are no exception to this. In the *Neurobiology of Monotremes,* Editor (and author) Ken Ashwell has produced a superb and lucid text that effectively reviews the state of monotreme neuroscience, articulates current puzzles, and looks toward future experiments. A particular highlight is the final three chapters in which Ashwell, Craig Hardman, and Anne Musser present for the first time atlases for the central and peripheral nervous system of platypus and echidnas using the techniques of Paxinos and Watson (2007).

This review will go further into great detail about the book's contents, given its high price (277 US dollars list!). The bottom line is that the *Neurobiology of Monotremes* comes highly recommended not only for the specialist, but also for anyone interested in broader questions of the evolution of brain and behavior and of sensory adaptation to the environment.

The book is organized into 17 chapters, plus an index, references, glossary, list of abbreviations for the atlas' plates, and of great interest to the specialist, supplementary tables and figures of detailed measurements ranging from the diameters of platypus' eggs to sequences of developmental events. Reminiscent of Ashwell's (2010) book on Marsupials, the book begins in Chapter 1 with a discussion of monotreme evolution and classification by Musser. This is a critical chapter given that monotreme taxonomy and classification has long been debated, given the taxon's sparse fossil record coupled with a remarkable combination of unique specializations and evolutionarily retained features. This chapter, and the Preface preceding it, begins building a central argument of the book, namely, that monotremes are not living, primitive fossils but rather highly specialized creatures that show remarkable adaptations. Importantly, Chapter 1 ends with a revised taxonomy of monotremes, although Musser makes a particular point of emphasizing that it is interim.

In Chapter 2, Stewart Nicol tackles monotreme' behavior and ecology. This chapter should have particular interest to behavioral neuroendocrinologists and those in related fields, given that monotreme' reproduction, mating system and behavior, and maternal care are well covered, especially when complemented by Griffiths (1999). There are also sections on monotremes' distribution and diet, and short sections on behavioral observations of wild and captive animals and cognition. It ends with a discussion of how monotremes, and in particular the echidna, exhibit a large brain mass as a function of basal metabolic rate and that this, among other features, suggests the capacity for complex behavior.

Chapter 3 focuses on the embryology and post-hatching development of the monotremes and is a welcome update to the chapter in Griffiths' (1979) book. Readers more familiar with well-researched and easily obtainable animals such as the rat or chicken may feel a bit frustrated by the relative lack of information on the monotremes, but Ashwell does a solid job of organizing the available information into a coherent chapter. One section that does seem out of place is a discussion of the seasonality of monotremes' reproduction. Nevertheless, the discussion of the monotreme's triphasic development is clear, and greatly assisted by the inclusion of time-lines of the major events.

The book continues by systematically addressing monotreme neurobiology in Chapters 4 through 13. Chapter 4 is an overview of the structure and evolution of monotremes' nervous system. This chapter not only helps place Chapters 5–12 in context, but contains an important discussion of how the brain characters of monotremes compare with those of other mammals. One section that I found particularly interesting was a section regarding cellular populations of the monotreme brain. This heavily featured an electron microscopy study by Lambeth and Blunt (1975) who found only a single type of macroglia in the platypus, suggesting that further studies of the glia of monotremes would be

worthwhile. Chapter 5 then covers the peripheral nervous system, spinal cord, brainstem, and cerebellum; and Chapter 6 follows with the diencephalon and deep telencephalic structures. Particular strengths of Chapter 6 include the discussion regarding the expansion of the trigeminal somatosensory thalamus in the platypus, and the amygdala. Chapter 7 continues with the cerebral cortex and claustrum/endopiriform complex. This is a comprehensive chapter ranging from monotreme cortical gyrification (or the lack thereof), to the various parts of the cortex (including a strong discussion of the large frontal cortex of the echidna), to the claustrum and to neuronal morphology. The visual system from the retina to the cortex is covered in Chapter 8, including development and evolution.

The most robust of the chapters dedicated to specific aspects of the monotremes' nervous system is Chapter 9, covering the somatosensory and electrosensory systems. This makes sense. After all, monotremes clearly exhibit electroreception, although there are clear questions regarding the extent that it is used in the wild. The chapter begins with an overview, comparing monotreme' electroreception to that of other animals, and addresses the anatomy and physiology of the electroreceptors and mechanosensors located on the platypus bill, and the relevant neural circuit. They then tackle what I believe is the most important question about this structure: how does the platypus use its bill and its electrosensors and mechanosensors in the wild. Over the course of about four pages, Ashwell and Hardman address the threshold problem, the bill as an antenna and telereceptor, and ultimately arrive at the conclusion that the bill's electrosensory and mechanosensory systems act in combination to detect moving, living prey. The second part of the chapter addresses the same topics in the echidna. After reviewing development, evolution, and the integration of somatosensation in the central nervous system, the chapter concludes with future avenues of research.

Chapters 10 through 12 then review, respectively, the auditory and vestibular systems, the olfactory and gustatory systems, and the hypothalamus, neuroendocrine interface, and autonomic regulation. Chapter 13 then offers a short review on monotremes and the evolution of sleep. Chapter 14 is Ashwell's general reflections on monotreme neurobiology. In this chapter Ashwell addresses some of the most important questions of monotreme neuroscience, namely evolutionary origin, phylogeny, the mosaic of retained features, and environmental adaptations, ontogeny, and the importance of electroreception. Importantly, here Ashwell again articulates one of the principal arguments of the book, that the "primitive" label does not accurately describe brain or behavior of monotremes. The chapter then fittingly concludes with questions for the future, and the book finishes with the aforementioned atlases of the platypus' and echidnas' central and peripheral nervous systems, divided across three chapters.

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Cooperation and its Evolution. K. Sterelny, R. Joyce, B. Calcott and B. Fraser, editors.

Cambridge, MA/London, UK: Massachusetts Institute of Technology Press, 2013. 608 pp. ISBN 9780262018531 (hardcover), $55.00 (Kindle); $47.02.

Cooperation among individuals presents a potential challenge to the theory of evolution through natural selection. How do individuals benefit from cooperating? Sometimes the answer is straightforward, for instance by joining groups individuals can share in the costs of vigilance for predators—so all benefit. In other cases, individuals that cooperate may incur a cost but will benefit if previous recipients later repay their debt. This opens up the question of whether and when to cooperate (Prisoner's Dilemma)—a topic that runs across biology, philosophy,

Neurobiology of Monotreme has been added to your Cart. Add to Cart. Buy Now.Â The monotremes are an unusual and evolutionarily important group of mammals showing striking behavioral and physiological adaptations to their niches. This book brings together current information on the development, structure, function and behavioral ecology of the monotremes. Read more. About the Author. The first physiological observations showed monotremes had low body temperatures and metabolic rates, and the consensus was that they were at a stage of physiological development intermediate between â€œhigher mammalsâ€ and â€œlower vertebrates.â€Â In 1803, the French anatomist Ã‰tienne Geoffroy Saint-Hilaire decided that the newly described echidna and platypus should be placed in a separate order, the monotremes, intermediate between reptiles and mammals. Neurobiology of Monotremes brings together current information on the development, structure, function and behavioural ecology of the monotremes. The monotremes are an unusual and evolutionarily important group of mammals showing striking behavioural and physiological adaptations to their niches. They are the only mammals exhibiting electroreception (in the trigeminal sensory pathways) and the echidna shows distinctive olfactory specialisations.