

ious to know more about bird cognitive neurobiology, and how that field might advance.

Having said that, my overall assessment remains very positive. I found I learned a great deal from reading this volume: about cognition in general and birds in particular. The individual chapters are all strong and the book is so well assembled that it was an enjoyable study.

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OTHER MINDS: THE OCTOPUS, THE SEA, AND THE DEEP ORIGINS OF CONSCIOUSNESS.

By Peter Godfrey-Smith. New York: Farrar, Straus and Giroux. \$27.00. x + 255 p. + 8 pl.; ill.; index. ISBN: 978-0-374-22776-0 (hc); 978-0-374-71280-8 (eb).

The geographic center of this book on the origins of consciousness is a surreal diving locale off the coast of Sydney: Octopolis. Here Godfrey-Smith, a philosopher of biology and avid scuba diver, communes with octopuses, who—uncharacteristically for an ordinarily solitary creature—have a variety of interactions with one another and with their neoprene-clad human observers. The behaviors experienced, observed, and recorded—battles, curious touches, and psychedelic displays—give rise to questions about their origin, physiological basis, and function that the author answers by drawing upon the relevant biological, philosophical, and psychological research. He also documents these striking displays and behaviors in a series of color and black-and-white photographs. The volume is pervaded by a sense of the author's out-and-out wonder at these creatures, and the photographs and prose work together to help readers realize and appreciate their profound strangeness. Spoiler alert: did you know that there are species of octopus who see with their skin?

Following in the footsteps of the pragmatist philosopher and psychologist William James, Godfrey-Smith starts from the assumption that the key to tackling the origins (note the plural) and nature of consciousness is to examine it as something that has evolved—and multiple times at that. This motivates his investigation of independent origins, precursors, and partial or unclear cases of consciousness drawn from across the tree of life. What is at stake here are not only the origins of consciousness, but of multicellularity, animality, sentience, and cognition. Communication theory is put to good explanatory use. Intercellular communication began in the sea, but was internalized when multicellularity evolved. To make the point that communication depends on features of both the sender and the receiver, the seemingly limitless (visual) expressive ability of octopuses and cuttlefish is meaningfully contrasted

with the more limited (vocal) repertoire of the baboon, who nonetheless has a sophisticated ability to interpret and respond to sequences of calls.

For biologists, this book will serve as a point of entry into what has traditionally been thought of as a philosophical problem—the origin and nature of consciousness. The strategy is a Darwinian one: partly speculative and partly empirical. The precursors to the possibility of subjective experience—how it feels to be an organism of a given kind—are shown to be present in such rudimentary aspects of perceptual psychology as the ability to separate out the effects of the perceiver's own position and movement from the visual properties of the object of perception. Keeping track of one's own states is thus part and parcel of tracking the external world, providing raw material for the evolution of subjective experience. For philosophers, this work will serve as yet another example of philosophical naturalism in action, the methodological perspective that helps itself to what science has to say, but uses that only as a set of starting assumptions for a deep dive into the philosophical question at issue. Godfrey-Smith draws broadly upon the scientific literature, neatly tucked away and dwelt upon in extensive endnotes, clearing the way for his lucid prose to penetrate the murk surrounding consciousness.

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## ANATOMY AND PHYSIOLOGY

DIVING PHYSIOLOGY OF MARINE MAMMALS AND SEABIRDS.

By Paul J. Ponganis. Cambridge and New York: Cambridge University Press. \$140.00. xv + 333 p.; ill.; index. ISBN: 978-0-521-76555-8. 2015.

It was a pleasure to read this extensive book on the diving physiology of marine mammals and birds. It is the most in-depth review of diving physiology that I have seen in many years in that it covers both the long history of diving studies, and the most recent advances in this field. Unlike other contemporary books about marine mammals, Ponganis targets the explicit field of diving physiology and all of the chapters relate to that phenomenon. For example, the section on thermal physiology looks at temperature regulation as it relates to diving ability and the section on hydrodynamics and drag focus how those factors play into reducing diving metabolism. There have been entire reviews written about each of the 13 sub-