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How Vertebrates Left the Water

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having false beliefs carries costs. Being overly motivated to pursue the uninterested person in front of you entails that if a better option comes along, one is insufficiently motivated to leave the current interaction, which may lead to a nonoptimal outcome. Generally, having false beliefs can influence any number of decisions that turn on that belief, and a better design would be to have true beliefs—or, at least, the best estimate of what is true—and to design the motivational system to maximize the expected value. This would allow the retention of the true belief while still allowing the pursuit of low-probability but high-payoff options.

The costs of false beliefs would seem to be important, yet they are given scarce attention in terms of the theoretical development. The book is filled, in contrast, with accounts of the costs of false beliefs to their owners, as in the case of the hapless crew of Flight 90, and those around the owners of these false beliefs. In this sense, *The Folly of Fools* is an odd juxtaposition of an argument about the advantages, in biological terms, of self-deception coupled with an array of all the many disadvantages of self-deception as it appears in the real world.

Although this combination might appear to represent a logical contradiction, there are many reasons that minds well designed for human ancestral environments might produce unpleasant and unhealthful outcomes, given the many ways in which modern environments differ from those of the past (Burnham and Phelan 2000). It seems plausible that our minds are eager to adopt false beliefs because of the powers of persuasion, but that this process misfires to horrible effect in the present. Additional work to shed light on these issues will be needed, and an important aspect of the book is that it points to new paths for future researchers to follow.

Finally, just as critics in psychology and cognitive science will object to some of the ideas that Trivers presents, others—perhaps many—will object to his politics, including such claims as "after World War II, the Zionists appear to have adopted a secret plan for the ethnic cleansing of Palestine, by force of arms, terror, encirclement, starvation, and murder" (p. 238). It would be a shame if these sorts of political remarks were sufficient to deter interested readers from exploring the scientific ideas in this book. *The Folly of Fools* is an important example of how thinking about evolved function can yield new insights into important aspects of human social behavior. At least, I hope that readers will think so; it is possible that, given my own interests, I might be deceiving myself (Kurzban 2010).

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EVOLUTIONARY HISTORY AND THE CONQUEST OF LAND

How Vertebrates Left the Water. Michel Laurin. University of California Press, 2010. 216 pp., illus. $34.95 (ISBN 9780520266476 cloth).

Extinct species constitute more than 99 percent of the living forms that have inhabited this planet, according to various estimates. Paleontology therefore plays a central role in documenting the history of life on Earth. *How Vertebrates Left the Water* is a very readable summary of what we know about the past conquest of dry land by vertebrates, told through the eyes and mind of paleontologist Michel Laurin. The title of the book spotlights a fascinating focus, but in many ways, the book itself "is an attempt to show how much paleontological, paleobiological, and evolutionary research relies on data compiled from fossils that were previously described" (p. 167). Much of the text is about modern paleontology and methodological issues; the discussion of these is prominent and transcends the evolutionary subject used to lure the reader.

Laurin is a vertebrate paleontologist interested in the origin and phylogeny of tetrapods, paleobiology, and phylogenetic nomenclature. He has worked on the anatomy and relationships of Paleozoic tetrapods, and has studied the origins of various higher extant taxa, such as lissamphibians, turtles, and archosaurs. As an undergraduate at the Université de Montréal, he focused on comparative anatomy and systematics and later received his PhD in the Department of Zoology at the University of Toronto, where he researched the osteology of seymouriamorphs and its implications for the origin of amniotes and where he was mentored and inspired by Robert Reisz. Since 1998, Laurin has worked as a research scientist for the National Center for Scientific Research in Paris, where he investigates the paleohistology of bone, phylogenetic nomenclature, and comparative evolutionary biology.

The conquest of land by forms that evolved from aquatic ancestors represents a fascinating drama in Earth's history of life. The gradual transition during the last few hundreds of millions of years was initiated by simple forms, to be followed later by more complex organisms, including the vertebrates. The book summarizes what we know about this history and includes a frank discussion of both the

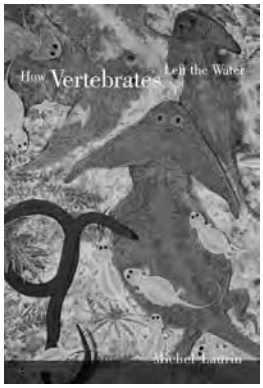
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weaknesses in our methods of learning and the gaps of knowledge pertaining to this evolutionary process. We learn that the challenge of modern paleontologists has been to test various previously formulated theories of explanation using more or less indirect methods. *How Vertebrates Left the Water* is intended for students learning the basics of paleontology, systematics, and evolutionary biology, not just specifically for those interested in the details of the water-to-land transition.

Historical and conceptual elements are woven throughout the book, beginning with a discussion of how evolutionary history can be reconstructed. The volume provides a foundation of classification methods, vertebrate taxonomy, and phylogenetic nomenclature, including some discussion of the PhyloCode (*www.ohio.edu/phylocode*). We learn about evolutionary trees and the methods to construct them. Paleontological and molecular dating is covered, and a chronology of key events along the geological time scale is presented. Our focus is then directed to the Paleozoic era, in which plants and various animal groups—including vertebrates—became terrestrially dominant. Numerous descriptive elements are also found in the book, and modes of reproduction; skeletal parts; bone histology; structural descriptions of eggs, lungs, and skin; explanations of sensory organs; and descriptions of the taxa of fossils (e.g., sarcopterygians, stegocephalians, temnospondyls, seymouriamorphs, embolomeres, lepospondyls, diadectomorphs) are incorporated.

Phylogenetic controversies embody an important part of this book's discussions; Laurin attempts to explain the delay of scientific progress related to various interpretations of evolutionary pathways and contexts. Some controversies are not yet resolved, but the dialogue adds a welcome element of scholarly rigor and value to the book. In a single chapter that treats the evolution of the vertebrate limb, no fewer than 12 controversies are identified and discussed. Generally speaking, each controversial topic includes some mention of historical thought, the generation and testing of a hypothesis, and the results from selected studies leading to specific conclusions. Readers also encounter opinions regarding favored hypotheses, alternative hypotheses, and the weight of tradition regarding widely established theories.



The fossil record provides an important, albeit incomplete, account of the phylogeny associated with water-to-air transitions during Earth's early history, and it is the core of *How Vertebrates Left the Water*. Laurin discusses the process of transition in contexts of terrestrial adaptation and the related concept of *exaptation*, and we read about the evolution of locomotor systems related to girdle and limb changes, the loss of gills, terrestrial lung and skin features, changes in jaw suspension, and so on. Although an overview is given on these subjects, much research and detail has been excluded that could have given the book more balance and heft in light of its title. There is no reference, for example, to the earlier book by Gordon and Olson (1995), or to the edited volume by Mittal and colleagues (1999). The evolutionary ideas of Robert Inger, Karel Liem, Gordon Ultsch, Lauren Chapman, George Hughes, among others, could have added depth to the discussion of evolutionary process, but none are mentioned.

Other shortcomings of the book include a lack of clarity in the overall phylogeny of the various fossil clades that are discussed and the occasional ambiguity for some antecedents and in some of the conclusions. The final chapter of the book, on "Synthesis and Conclusions," ends with a two-page discussion of modern paleontology and the "Indiana Jones" stereotype. This prose defends the usefulness of paleontology, but, to me, it seems unnecessarily defensive and somewhat anticlimactic.

Nonetheless, Laurin's treatment of *How Vertebrates Left the Water* provides a generally well-written and -illustrated synthesis of an interesting evolutionary topic, crafted from the perspective of a talented and qualified paleontologist. I do not hesitate to suggest that readers with an interest in evolution, paleontology, vertebrate morphology, or the fossil record will want to add this book to their bookshelf.

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WORKING TOWARD AN INTEGRATIVE UNDERSTANDING OF WORK IN LIVING SYSTEMS

Work Meets Life: Exploring the Integrative Study of Work in Living Systems. Robert Levin, Simon Laughlin, Christina De La Rocha, and Alan Blackwell, eds. MIT Press, 2011. 272 pp., illus. $30.00 (ISBN 9780262014120 cloth).

In *Work Meets Life: Exploring the Integrative Study of Work in Living Systems*, Robert Levin and his multidisciplinary colleagues set out on a quest to develop integrative links among varied scientific perspectives on work in living systems—from cellular

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