

a constructivist approach, emphasizing exploration, first-hand investigation, and authentic inquiry along with reading and writing in science, may lead to a deeper understanding of the concepts. While eight suggested investigations are included in this text, Nelstead seems to acknowledge that this might not be enough to truly provide opportunities for students to explore concepts firsthand. Included in the preface is a short section on “enrichment activities,” which includes the statement, “understanding will be enhanced and memory will be strengthened when students engage with the content in activities outside the text” (p. xviii). Teachers intending to follow best practices for inquiry-infused science teaching will still find this a very valuable text for background reading and development of conceptual understanding related to Earth science topics.

I thoroughly enjoyed reading this text, and I believe Christians teaching science will find it a valuable resource. It may prove to be an excellent textbook choice for an earth science course for students in grades 7–9, and I would recommend that science teachers in Christian schools examine it for themselves for possible adoption. Christians involved in teaching science at other grade levels or in different types of schools would also benefit from this text as a resource to keep on the shelf. I believe that anyone interested in a thoughtful elaboration of Earth science that holds a biblical perspective as integral to that study would benefit from reading this book.

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PALEOBIOLOGY

CETACEAN PALEOBIOLOGY by Felix G. Marx, Olivier Lambert, and Mark D. Uhen. Chichester, UK: Wiley-Blackwell, 2016. 345 pages, including contents, preface, color plates, and index. Hardcover; \$149.95. ISBN: 9781118561270.

Cetaceans, including modern whales, dolphins, and porpoises, have long been enigmatic animals. In the first edition of *On the Origin of Species* (1859), Charles Darwin speculated how natural selection could have given rise to aquatic mammals like cetaceans, but his example, which was based on observations of black bears swimming in the water and eating insects, was so ridiculed that he removed much of it from subsequent editions. Some key cetacean fossils, hinting at their terrestrial ancestry, were recovered in the mid-to-late nineteenth and early twentieth centuries, but the origin of cetaceans was largely considered a mystery well into the mid-twentieth century. Discoveries of fossils in Pakistan and Egypt in the 1970s and 1980s spurred renewed interest in the early history of these animals, and in the past several decades, the evolu-

tion of cetaceans has become one of the most widely cited examples of large-scale evolutionary change evident in the fossil record.

Cetacean Paleobiology is a detailed look at what is currently known about this remarkable evolutionary transition based on the fossil record. The book aims to provide a complete and thorough overview of cetacean evolution, including basic principles of anatomy and taxonomy, summaries of extinct and modern families, explanations of techniques and concepts used to study fossils, detailed analyses of the fossil record, and various case studies. It was cowritten by three authors who have focused on different aspects of cetacean evolution. Felix Marx has worked primarily on the fossil record of the earliest baleen whales (mysticetes), while Olivier Lambert has studied principally the fossils of extinct toothed whales (odontocetes). Mark Uhen has focused his work on the earliest known cetaceans (archaeocetes), which bridge the gap between the terrestrial ancestors of cetaceans and the first fully aquatic forms. Between the three of them, they provide expertise on virtually all aspects of the cetacean fossil record.

Chapter 1 provides a brief overview of cetaceans and how different forms are classified. It includes a short introduction to functional anatomy and a thorough discourse on the methodology that is used to infer evolutionary relationships. This chapter also introduces some of the methods that are used to infer habitat and feeding preferences in fossil animals, including a detailed explanation of stable isotope ratios, and discusses the interplay between evolutionary trends and the biotic and abiotic factors that drive them.

The cetacean fossil record is detailed in chapter 2, and it includes a brief history of exploration and some of the key early figures involved in studying whale fossils. The basics of fossilization are discussed along with its major effects on the fossil record of cetaceans. Much of the chapter is devoted to descriptions of major cetacean fossil localities in the world, including sites such as Wadi Al-Hitan in Egypt, deposits all along the southeastern coast of the United States, and the Pisco and Sacaco basins in Peru.

I suspect that, for many readers, it is in chapter 3, which involves a detailed look at morphology, that the rubber meets the road. The chapter begins with an overview of the skeleton before moving into a detailed look at the skull. The ear region, which is vital for understanding cetacean taxonomy and ecology, is described in extensive detail. Comparatively little of the chapter is devoted to the postcranial skeleton, but the discussion of osteological correlates of soft tissue structures (e.g., muscles, baleen, brain) is

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welcome. The anatomical overviews get complicated pretty quickly, but this may be unavoidable in most cases. Here, and throughout the text, the authors seek to mitigate these challenges by highlighting, in bold, key terms that may be unfamiliar to the reader, although occasionally some jargon slips into the text without being highlighted or defined. Throughout this chapter, photos and illustrations are used to demonstrate the structures being described. The labeled photos are of the highest quality, and although the line drawings of various skulls and skeletons are more simplified than I would like, they are sufficient for illustrating what they are intended to show.

The longest chapter of the book is chapter 4, which covers cetacean phylogeny and taxonomy. The authors systematically work through the various groups of extinct and modern cetaceans, beginning with the oldest forms (archaeocetes) and continuing through different groups of baleen and toothed whales up to the present. The summaries for some groups are brief, but most of them are fairly extensive. Throughout the chapter, the skulls of representatives from the different groups are illustrated with accompanying phylogenies to help keep track of the proposed relationships among the different groups. (Life reconstructions of many of these fossils are also included among the 16 full-color plates at the center of the book.) This chapter concludes with a short discussion of the current consensus and conflicts in cetacean phylogenetics. After completing this chapter, it is difficult not to come away with a sense of awe for the immense amount of biological and ecological diversity in the history of cetaceans.

The next several chapters discuss particular topics related to various aspects of cetacean ecology and evolution. Chapter 5 includes a more detailed discussion of several key cetacean fossils along with some nice photographs, but it focuses mostly on certain key innovations and developments in cetacean history. These discussions include the various lines of evidence for changes in locomotion, terrestrial competency, habitat preference, and sensory systems. This chapter also details the development of baleen for feeding in mysticetes, the evolution of echolocation in odontocetes, and the radiations of freshwater cetaceans. Chapter 6 focuses primarily on the evolution of different feeding strategies, but also includes briefer discussions of reproduction, migration, sexual dimorphism, and diving. The authors take a step back in chapter 7 to look more broadly at larger-scale patterns of biodiversity between the Eocene and the present. Hypotheses for the drivers of these radiations and extinctions are discussed, and the stratigraphic ranges of all known cetacean families are documented. Trends in the evolution of body size and brain size are covered, as are biogeographic

patterns and instances of convergent evolution. In chapter 8, the authors explore some of the insights that the fossil record can give into the evolution of development in cetaceans. This chapter includes discussion of limb development, vertebral column regionalization, tooth morphology, and changes in the relative timing of developmental events.

The book ends with a very brief summary and synthesis in chapter 9. The key breakthroughs and discoveries “that finally cracked the cetacean conundrum” (p. 302) are highlighted, and the authors compiled the many cases discussed in prior chapters in order to describe the overall arc of cetacean evolution from their first forays into the water until now. This conclusion discusses the connection between humans and cetaceans, including the role that studying cetacean history can have in guiding future decisions about cetacean conservation.

In sum, this book is impressive in both its scope and depth. Given its well-written summaries and its copious citations and references, it will quickly become a go-to resource for researchers, graduate students, and undergraduate students interested in the evolution of these marvelous marine mammals. Professors and teachers who are not specialists will find much here that they could discuss with their students when looking at the evidence for evolution. However, this may be a difficult book to work through for individuals who do not have much background in the biological or physical sciences. Given its steep price tag, this book is unlikely to find a home on the shelf of a nonspecialist, but it is still well worth a read. It takes just a quick perusal of this book to make sufficiently clear why the evolution of cetaceans has become one of the most compelling examples of large-scale evolutionary change.

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PHILOSOPHY & THEOLOGY

HOW CAN PHYSICS UNDERLIE THE MIND? Top-Down Causation in the Human Context by George Ellis. Heidelberg, Germany: Springer-Verlag, 2016. 501 pages. Hardcover; \$79.99. ISBN: 9783662498071.

In this *magnum opus*, as Philip Clayton described it in his endorsement, George Ellis lays out the case for top-down causation from an emergentist perspective. For decades he has been one of the leading proponents of emergence, a philosophical perspective that lies between strong reductionism on the one hand and vitalism on the other. Reductionist critics of emergence had claimed that the properties and substances that emerged from more fundamental