

Return to the Sea: The Life and Evolutionary Times of Marine Mammals.

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("Some simple math and statistics"), he shows how to calculate the probabilities of inherited traits, using as an example the alleles for pigmentation in a population of flowers. He explains fossil-dating methods and shows the importance of Occam's razor in avoiding creationist miscalculations concerning Earth's age. He demonstrates how base sequences of DNA are used to determine ancestral relationships in the construction of phylogenetic trees. After explaining molecular clocks and the roles of mutation and natural selection in speciation, Fitch concludes with six "intriguing observations" of the fossil record (e.g., a continuing increase in diversity and complexity) and 10 requirements for explaining these observations scientifically.

In chapter 4 ("Young-Earth' creationism"), the only chapter devoted exclusively to critiquing creationism, Fitch reviews the standard litany of problems stemming from biblical literalism, such as the meaning of the Hebrew word for *day* and the contradictions between Genesis 1 and Genesis 2. Although intelligent design is a form of old-Earth creationism, he includes it here, commenting briefly on William Dembski's rejection of the criticism that *intelligent design* implies *optimal design* and more extensively on Michael Behe's concept of *irreducible complexity*. After briefly discussing the anthropic principle, Fitch resumes his critique of well-known creationist claims such as the impossibility of macroevolution, the supposed absence of transitional fossils, and the equation of evolution with atheism. He devotes some time at the end of the chapter to theological issues and, in an epilogue, gives the last word to St. Augustine by offering a short excerpt from *The Literal Meaning of Genesis* (1982), in which Augustine warned fellow Christians against biblical literalism.

The book contains some copy-editing errors, including an incorrect death date of 1832 for Charles Darwin. Fitch provides a glossary and a reference list of standard creationist and anticreationist works, along with classic and contemporary science

sources. Given the intended audience of scientifically and theologically naive students, the references are somewhat dated and uneven. For example, Fitch includes a 1983 graduate-level monograph on hemoglobin, whereas a book such as biologist Joel W. Martin's *The Prism and the Rainbow* (2010), an explanation of evolution for Christian students, would have been a helpful addition.

The Three Failures of Creationism presents no new or unique material. Although some parts will be accessible to students, other parts (e.g., the previously mentioned chapter 3) are probably beyond the comprehension and attention span of many of the high school seniors and college undergraduates who are Fitch's target audience. The book also lacks a coherent structure, which makes Fitch's discussion difficult to follow. On the whole, other critiques of creationism and introductions to evolution are available that will be more helpful to students.

References cited

- Martin JW. 2010. *The Prism and the Rainbow: A Christian Explains Why Evolution Is Not a Threat*. Johns Hopkins University Press.
 Saint Augustine. 1982. *The Literal Meaning of Genesis*, vol. 1. Taylor JH, trans. Ancient Christian Writers, vol. 41. Paulist Press.

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FROM FINS TO LEGS AND BACK AGAIN

Return to the Sea: The Life and Evolutionary Times of Marine Mammals. Annalisa Berta. University of California Press, 2012. 224 pp., illus. \$44.95 (ISBN 9780520270572 cloth).

Some 55 million years ago, in the Early Eocene epoch, a number of mammals forsook their terrestrial

homes to return to life in the sea, beginning one of the strangest and most interesting chapters in evolutionary history. They were the ancestors of today's marine mammals, which (unlike fishes and most other aquatic creatures) arose from land-living, air-breathing animals. On the shallow shores of the ancient Tethys Sea, which stretched across what is now southern Asia and the Middle East, slender, cat-sized creatures gave rise to the cetaceans (whales, dolphins, and porpoises), and squat, elongate elephant relatives evolved into sirenians (manatees and dugongs). These and other fascinating creatures are described in Annalisa Berta's wide-ranging and fact-packed new book, *Return to the Sea: The Life and Evolutionary Times of Marine Mammals*.

Berta is a professor of biology at San Diego State University, where she specializes in vertebrate morphology and evolution—fields of expertise that figure prominently in this engaging tour through the highlights of marine mammal history. How did these ancestors survive the tremendous challenges of their new environment? In turns serious and playful, Berta outlines many of the extraordinary adaptations that enabled these animals—and their living descendants—to survive and thrive. For example, walrus have countercurrent heat exchangers in their flippers, and the males make gong-like sounds to attract females. Blue whales are born with rudimentary teeth, which are later reabsorbed, before they grow 300 plates of filtering baleen, which are made of the same keratin as are in our hair and fingernails. Sperm whales can dive close to two miles deep and can stay below the surface for over two hours, all on a single breath of air. Abundant facts are woven into a compelling story of the history and biology of marine mammals that will delight while it informs readers.

Berta writes in an engaging, jargon-free style, which makes the book readily accessible to students and teachers at both the graduate and the undergraduate levels, but it is especially

recommended for undergraduate students just learning, for example, the difference between crown and stem groups. Even specialists who may lack a firm grasp of the evolutionary history of marine mammals can find space on their bookshelf for this volume. Given that marine mammals are one of the most widely used examples of major evolutionary transitions—with numerous intermediary fossils bearing now-lost limbs and other former features—most biologists and educators will view this evidence-based book to be as useful as it is stimulating.

Return to the Sea covers a lot of ground. Lessons are presented on the biology of seals, whales, sea otters, polar bears, and other marine mammals living and extinct, with excellent coverage given to basic anatomy, physiology, ecology, and behavior. Lavish illustrations of long-gone species, especially Carl Buell's softly shaded yet detailed paintings of fossil reconstructions and James Sumich's crisp line drawings, are compelling. The highlight and theme of the book, however, is the discussion of the many factors involved in the origin and radiation of various marine mammal lineages. Berta's expertise in paleontology substantiates her accounts of the different species through time, which ties the expansive material in the book together.

It is Berta's presentation of these lineages that directs the book toward the fundamental concepts of evolution within speciation, exaptation, and extinction. She uses marine mammals as the cast of characters with which to demonstrate such ideas as pae-domorphosis (in porpoises), mating leks (in walruses), and regulatory *Hox* and *PITX1* genes (presumably relating to the loss of limbs). There is also a heavy dose of oceanography, including upwellings, the deep scattering layer, and marine sanctuaries, but the marine mammals take center stage. Berta moves briskly through the anatomical descriptions of these creatures, from lobed kidneys to compartmentalized

stomachs, then onto their vocal communications (e.g., pops, clicks, and whistles).

Although a bibliography is absent, the book ends with a slim list of recommendations for further reading, which contains excellent online sources. The book is not without errors, including some mistaken figure captions. One switches the families of whale and megamouth sharks; another misidentifies an ancient giant dugong. Readers unfamiliar with all of the living marine mammals described in the text would have been well served by a table (or an appendix) listing extant species or by additional evolutionary tree diagrams. Most of all, I found myself wanting richer descriptions, and especially more illustrations, of lesser-known fossil species, including desmostylians and aquatic sloths. These are minor quibbles, however, particularly for such a wide-ranging, readable survey.



In some ways, Berta's book is reminiscent of Carl Zimmer's equally recommended *At the Water's Edge: Fish with Fingers, Whales with Legs, and How Life Came Ashore but Then Went Back to Sea* (Free Press, 1999), although Zimmer's book delves into many asides, has few figures, and is now a bit outdated. The information in *Return to the Sea* is admirably up to date, in terms of both paleontological findings and current research methods, which range from satellite telemetry to DNA barcoding and fingerprinting. An entire chapter is devoted to fossil dating techniques and other key elements of paleontology; another is focused on conservation

issues, especially those involving human impacts (e.g., anthropogenic sound, fisheries bycatch, strandings, military sonar). This last of six sections reveals many recent discoveries, some of which are optimistic (e.g., whales may play a key role in marine nitrogen recycling) and some alarming. Sea lions are now threatened (from overfishing) by a junk-food diet that lacks fatty fish. Climate change threatens ice-bound algae that feed krill, which, in turn, feed many whales and other marine mammals.

Berta explains that the first marine mammals likely turned to the sea in search of food. It would be a shame if a lack of food now doomed these remarkable creatures. Then again, perhaps resources might now lure some species back onto land, continuing—with a new twist—the long and enthralling evolutionary story of marine mammals.

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THE MYSTERY OF EUKARYOTIC CELL ORIGIN

Secret Chambers: The Inside Story of Cells and Complex Life. Martin Brasier. Oxford University Press, 2012. 298 pp., illus. \$29.95 (ISBN 9780199644001 cloth).

A scientific question can be viewed as a puzzle, and a book about a scientific discovery can be written as a puzzle revealed. Martin Brasier's new book, *Secret Chambers: The Inside Story of Cells and Complex Life*, is presented as a detective's quest for answers to one of the great scientific mysteries: How did a complex compartmentalized (i.e., eukaryotic) cell originate and evolve into the many diverse life forms that we see today? In this search, the book uniquely takes both the reader

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