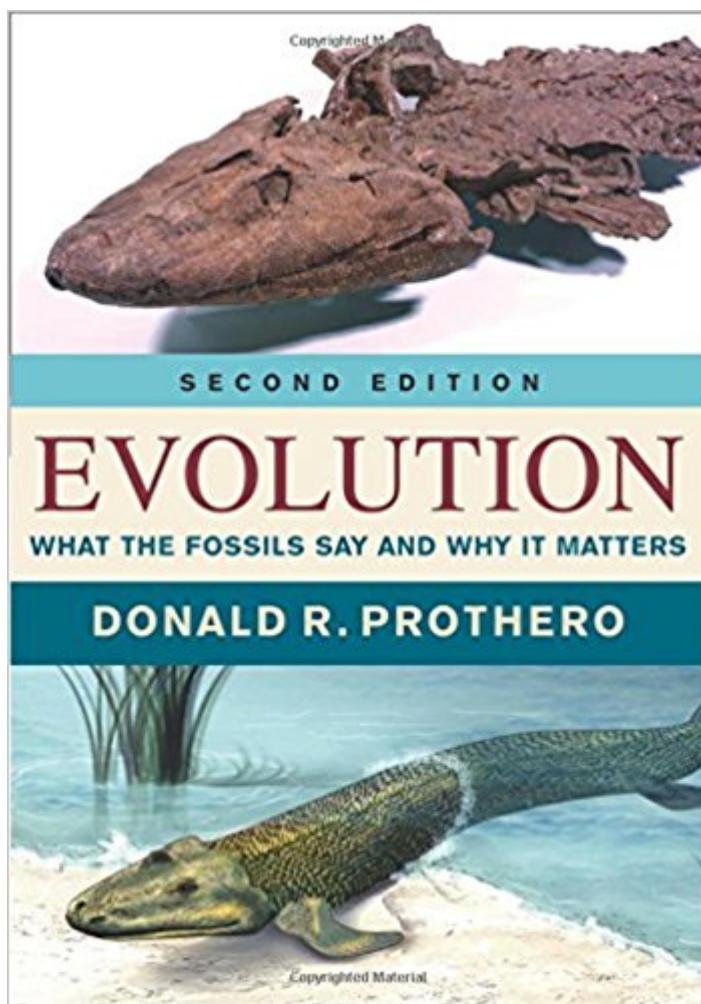


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# Evolution: What The Fossils Say And Why It Matters



## Synopsis

Donald R. Prothero's *Evolution* is an entertaining and rigorous history of the transitional forms and series found in the fossil record. Its engaging narrative of scientific discovery and well-grounded analysis has led to the book's widespread adoption in courses that teach the nature and value of fossil evidence for evolution. *Evolution* tackles systematics and cladistics, rock dating, neo-Darwinism, and macroevolution. It includes extensive coverage of the primordial soup, invertebrate transitions, the development of the backbone, the reign of the dinosaurs, and the transformation from early hominid to modern human. The book also details the many alleged "missing links" in the fossil record, including some of the most recent discoveries that flesh out the fossil timeline and the evolutionary process. In this second edition, Prothero describes new transitional fossils from various periods, vividly depicting such bizarre creatures as the *Odontochelys*, or the "turtle on the half shell"; fossil snakes with legs; and the "Frogamander," a new example of amphibian transition. Prothero's discussion of intelligent design arguments includes more historical examples and careful examination of the "experiments" and observations that are exploited by creationists seeking to undermine sound science education. With new perspectives, Prothero reframes creationism as a case study in denialism and pseudoscience rather than a field with its own intellectual dynamism. The first edition was hailed as an exemplary exploration of the fossil evidence for evolution, and this second edition will be welcome in the libraries of scholars, teachers, and general readers who stand up for sound science in this post-truth era.

## Book Information

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## Customer Reviews

Prothero, a geologist at Occidental College (After the Dinosaurs), explains how rich the fossil record has become. His goal is two-fold. First, he wants to demonstrate the wide variety of transitional forms that have been found, many within the past 20 years. Second, he aims to discredit the creationist movement. I have tried to document how they routinely distort or deny the evidence, quote out of context, and do many other dishonest and unethical thingsâ "all in the name of pushing their crusade. He accomplishes both of his goals (though he can be repetitious regarding the creationists), and his descriptions of recent research, much of it his own, are compelling. Prothero explains that the Cambrian explosion of life forms was anything but an explosion, and presents the impressive transitional fossils between reptiles and birds, along with striking evidence for mammalian evolution, including the relationship among hominid groups. With good science and some specific rebuttals to creationist arguments, this book demonstrates the importance of paleontology to the study of evolution. 208 illus. (Nov.) Copyright Â© Reed Business Information, a division of Reed Elsevier Inc. All rights reserved. --This text refers to the Digital edition.

If you're one of these people who likes to read Dawkins, Gould, and Darwin, I would highly recommend this book. If you doubted that evolution was true before, and then you looked at this book, I don't see how you could possibly continue to question it. (Jerry Coyne, author of *Faith Versus Fact: Why Science and Religion Are Incompatible*) This is a wonderful book that beautifully explains in laypersonâ™s terms the vast evidence for evolution in the paleontological record. Its publication comes at a critical time. By concentrating the diverse scientific literature into numerous lucid examples, Donald R. Prothero does the fields of geology, biology, and science education a major service. He provides a unique source that will be invaluable to college professors and high school teachers alike, and because his book provides abundant, clearly described examples of evolution in the fossil record, and also synthesizes important information about the Bible, it will make a valuable addition to any scientistâ™s library. (Bruce Lieberman, University of Kansas) Donald R. Prothero not only is one of the leading evolutionary scientists of our time, he also writes with clarity, and his prose sparkles. Protheroâ™s book is more thorough and comprehensive than any other book for the general public on the evolution versus creationism controversy. (Michael Shermer, publisher of *Skeptic* magazine, monthly columnist for *Scientific American*, and author of *Why Darwin Matters: The Case Against Intelligent Design*)

I seem to simply agree with what so many reviewers have already said. This is such an extraordinary book and of such excellent presentation that, like some other reviewers, I wish Prothero would have included more stuff in it, going to 500 or 600 pages for instance. It is such a pleasure to read and revisit that, coming to the end at page 359, I felt disappointed that there was no more. The quality of this book is astounding and pure joy to read and consult. And like some other reviewers, I have never taken creationism and ID as credible opponents of evolution. They're just a social phenomenon with roots in the religious history of the US, and their pretense of being a valid refutation of the science of evolution is simply ridiculous. To me, Bill Maher had the right approach in his Religulous DVD: at best denounce the absurdity of the ludicrous beliefs of advocates of creationism and ID. And so, looking above all for the facts and Prothero's expertise of the fossil record, I feel there's a bit too much space wasted on demolishing creationism, as this debunking takes away pages that would have been better used in presenting more valuable info on the fossils record, with more trees, more pictures, and more photos. The 12 color plates are sources of sheer pleasure, but I personally regret that there are not enough of them. The photos are superb, and the drawings of great artistic clarity. The trees describing the classifications of fossils and their groupings are masterly. Again, I wish there were more of them. In most of them the geologic time scale is usually shown in some manner with dates in millions of years (MY) ago related to its significant time phases:- the 3 key eras (Paleozoic 550-251, Mesozoic 251-66, Cenozoic 66-present);- or the 13 periods (Vendian 600-550, Cambrian 550-488, Ordovician 488-444, Silurian 444-416, Devonian 416-360, Mississippian 360-318, Pennsylvanian 318-300, Permian 300-251, Triassic 251-200, Jurassic 200-145, Cretaceous 145-66, Tertiary 66-2, Quaternary 2-present);- or the 7 epochs of the last, Cenozoic, era (Paleocene 66-56, Eocene 56-34, Oligocene 34-23, Miocene 23-5, Pliocene 5-2, Pleistocene 2-0.01, Holocene 0.01-present). These persistent reminders of the time scale in MY with its 23 names do provide us with a constant framing of past events which contributes greatly to firming up in our minds a clear picture of geologic time and geologic history. The short bibliographical references presented after each chapter as "Further Reading", and the 11-page general bibliography at the end of the book are invaluable, even though they miss many excellent books that have appeared since the book's publication in the 2007-2015 period. The index (9 huge pages on 3 columns) is also meticulous and extremely useful. Overall this is a high-quality book I constantly go back to whenever I read anything elsewhere on the past of evolutionary history. This book embodies the kind of overall quality that only top glossy paper makes possible. I feel immensely thankful to Columbia Un. Press for having taken the challenge of

publishing this engrossing, beautiful scholarly book, that no mass-market trade publisher could have produced with cheapo paper and cheapo reproductions. Yes, the criticism is justified: Creationism and ID could have been easily dismissed in a few pages in an introduction and/or an appendix instead of continually reappearing here and there unexpectedly throughout the book as flotsam brought back by the waves. This would have cleaned up the bulk of the text of what is after all just rubbish, all those long paragraphs devoted by Prothero to debunking step by step, line by line, the specious and tortured "arguments" of evolution deniers. Prothero takes their pseudo-theory too seriously and gives it too much honor and too much space by pretending to debate it as if it were a valid opponent of evolution. Prothero, to his credit, does value highly his human role as a passionate activist for science and clarity of mind in an American social context where obfuscation and superstition still reign rampant. And this, as much as he values his professional vocation as a passionate researcher in paleontology. Prothero sees it as part of his life mission to neutralize the debilitating effect of moronic creationism and the clouds of dust thrown in the eyes of innocent American kids by the futile ID fantasies. But for us, his readers, primarily interested in the solid facts of evolution, what we first and foremost expect from this book is Prothero's immense, unmatched, knowledge of fossils. We silently applaud him in his ideological polemics against the vestigial ideas of Christianity conceived in remote Antiquity. And we suffer as marginal, even if necessary, digressions to the core of Prothero's story his passionate demolishing of what is, after all, for most of us, pure mythology.

ROO BOOKAROO April 15, 2015

I just finished reading *EVOLUTION: WHAT THE FOSSILS SAY AND WHY IT MATTERS* by Donald R. Prothero, professor of geology at Occidental College and of geobiology at California Institute of Technology. The book is 359 pages long and quite challenging, requiring careful reading. It showed me that my education in zoology, evolution and genetics at the University of Michigan 50 years ago is obsolete. The evidences for evolution come from anatomy, fossils, embryos and the molecular clock (DNA and mitochondrial-DNA). The book is heavily illustrated in black-and-white and in color. It contains a devastating critique of creationism and intelligent design, based upon thousands of new discoveries within recent years. The book as a whole is a tower of excellence. I do have a few minor criticisms. There are a huge number of technical terms not in my dictionary, so the book would be improved by a glossary. Alternatively, one could use specialized dictionaries of zoology and paleontology, or look up definitions on the internet. The book covers zoological evolution only, not botanical evolution. The discussion of cladistics (not in my dictionary) is unclear, so I'll Google cladistics for a more thorough explanation. I'll give some representative quotes from the book to give

an idea of what it's like: "The oldest fossils that are clearly formed by living things are microscopic fossils of cyanobacteria...from 3.5 billion year old rocks. Tiny zircon grains from Australia were recently discovered that seem to have a distinctive chemistry indicating oceans as early as 4.3-4.4 billion years ago...If so, then the Earth's surface cooled down to below 100C (the boiling point of water) in only 250,000-350,000 years after its formation 4.65 billion years ago. There is nearly a billion years of time between when the first oceans form and the first clear fossils are known, plenty of time for life to form (more than once, if necessary)" (Pages 145-147). "There are hundreds of microfossil localities around the world...in rocks dated between 3.5 and 1.75 billion years ago, and they yield plenty of good examples of prokaryotes. The first fossil cells that are large enough to have been eukaryotes do not appear until 1.75 billion years ago, and multicellular life does not appear until 600 million years ago. For almost 2 billion years, or about 60%, of life's history, there was nothing on the planet more complicated than a bacterium...and for almost 3 billion years, or 85% of Earth's history, there was nothing more complicated than single-celled organisms." (Page 162) "A detailed examination of the stratigraphic record of fossils through the late Precambrian and Cambrian shows that life did not explode in the Cambrian, but appeared in a number of steps. Thus the Cambrian explosion took over 80 million years to develop, and was no sudden event, even by geological standards. Thus we have seen that the Cambrian explosion is a myth. It follows a series of logical stages from simple and small to larger and complex and mineralized. First, of course, we have microfossils of cyanobacteria and other eukaryotes going to as far as 3.5 billion years ago and spanning the entire fossil record since that ancient time. In short, the fossil record shows a gradual buildup from single-celled prokaryotes and then eukaryotes to multicellular soft-bodied animals to animals with tiny shells, and finally by the middle Cambrian the full range of large shelled invertebrates. This gradual transformation by logical advances in body size and skeletonization bears no resemblance to an instantaneous Cambrian explosion. All of this information has been known for at least the past few decades...They are published in all the standard geology and paleontology textbooks and have been for decades. But the creationists either don't want to know or cannot understand the implications of these discoveries. Their out-of-context quotations of real scientists...are all from old sources that do not reflect what we have learned from recent discoveries. Even their most recent, including the intelligent design texts, persist in perpetuating this out-of-date picture." (Pages 168-170) "An amazing array of new transitional bird fossils and feathered nonbird dinosaurs have been discovered...that fill in most of the gaps between theropods [carnivorous dinosaurs] and advanced birds, so now we have a wealth of transitional forms, of which Archaeopteryx is just one link. Feathers were apparently a widespread feature among theropod

dinosaurs. Feathers, then, did not evolve for flight but were already present in theropod dinosaurs, presumably for insulation, and were later modified to become flying structures." (Page 263) "In addition to Archaeopteryx, there are now dozens of new transitional birds from the Mesozoic, each of which shows a mosaic of evolutionary changes from more dinosaur-like creatures like Archaeopteryx to forms that are similar to modern birds in many ways." (Page 266) "The transition from the most primitive synapsids all the way to mammals is so smooth that it is rather arbitrary where to break the continuous sequence and begin calling advanced synapsids mammals." (Page 276) "More and more transitional whales are being discovered, so that by now the amazing transformation from land mammals to whale is one of the best examples of evolutionary transitions in the fossils record. There is no excuse for creationist ignorance or denial of these fossils. And the final clinching evidence is the fact that living whales DO have hind legs--they are merely vestiges of the hip bone and thigh bone, usually buried deep in their muscles and not visible on the surface." (Pages 321-322) "A quick look at some of the creationist pamphlets and books shows just how misleading and dishonest their presentations are. There are now dozens of normal, undiseased specimens, and they clearly show that Neanderthals was a distinct species that is NOT modern *Homo sapiens*. [Creationists] managed to get every single example in their attack on hominid fossils COMPLETELY WRONG. 1920 description of... *Australopithecus africanus* was the first good fossil hominid [two-legged primate] that was not a member of the genus *Homo*. Decades of hard work in the field by hundreds of scientists has turned up thousands of hominid fossils...including a few good skeletons and many good skulls that show clearly how humans have evolved over 7 million years...mostly in Africa. We are members of the order Primates [five-digit flexible hands and feet], the group that includes not only ourselves and the great apes but also...monkeys...and lemurs...and many other archaic primates still alive today...We can trace the fossil record of most of these lineages back to the Cretaceous [136 million years] and Paleocene [65 million years] primate Purgatorius." (Pages 334-336) "The oldest specimen that can be truly described as a member of our own family was discovered and described only a few years ago. The best specimen is a nearly complete skull...from rocks about 6-7 million years in age...from Chad...Although the skull is very chimp-like with its small size, small brain, and large brow ridges, it had remarkably human-like features, with a flattened face, reduced canine teeth, enlarged cheek teeth...and an upright posture at the very beginning of human evolution. By 4.2 million years ago, however, the first members of the advanced genus *Australopithecus*, the most diverse member of our family in the Pliocene, are also found...in Kenya ranging from 3.9 to 4.2 million years in age. These creatures were fully bipedal, as shown not only by their bones but also by hominid trackways." (Page 339) "IT TURNS

OUT THAT HUMAN AND CHIMPANZEE DNA IS 97.6% IDENTICAL! This made sense, but the real shock was just how similar our genes are to that of most of the great apes. Molecular biologists pointed out that the genetic similarity between humans and chimps was closer than between any other two species they had studied, such as two closely related species of rats or two kinds of frogs. Since these experiments, the actual sequence of the mitochondrial DNA and the nuclear DNA has been determined for both chimps and humans, and the results are the same." (Page 344) Zoologists have also discovered that Hox genes on DNA can cause sudden, large evolutionary leaps, so not all evolution is gradual.

Evolution is a very simple concept. The word simply means "change over time" and change affects just about every thing in the universe. The earth itself has gone through countless changes in its 4+ billion years. All the plant and animal life on earth has also gone through numerous changes over time. And everyone has heard that old clichÃ©: "nothing is as constant as change." And yet the instant the word "evolution" pops up, a large portion of our population still throws up an endless series of flimsy and in some cases ridiculous defenses that insist that it just isn't--can't be!--so. **EVOLUTION: WHAT THE FOSSILS SAY AND WHY IT'S IMPORTANT** is yet another attempt to clarify this very straightforward concept. Does this book answer all the doubters questions? Does it resolve this seemingly endless debate? No to both of those questions. But it does add a few more planks of reason to this growing edifice of facts about the process of evolution.

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