



Evolution: What the Fossils Say and Why It Matters

Donald R. Prothero

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Over the past twenty years, paleontologists have made tremendous fossil discoveries, including fossils that mark the growth of whales, manatees, and seals from land mammals and the origins of elephants, horses, and rhinos. Today there exists an amazing diversity of fossil humans, suggesting we walked upright long before we acquired large brains, and new evidence from molecules that enable scientists to decipher the tree of life as never before.

The fossil record is now one of the strongest lines of evidence for evolution. In this engaging and richly illustrated book, Donald R. Prothero weaves an entertaining though intellectually rigorous history out of the transitional forms and series that dot the fossil record. Beginning with a brief discussion of the nature of science and the "monkey business of creationism," Prothero tackles subjects ranging from flood geology and rock dating to neo-Darwinism and macroevolution. He covers the ingredients of the primordial soup, the effects of communal living, invertebrate transitions, the development of the backbone, the reign of the dinosaurs, the mammalian explosion, and the leap from chimpanzee to human. Prothero pays particular attention to the recent discovery of "missing links" that complete the fossil timeline and details the debate between biologists over the mechanisms driving the evolutionary process.

Evolution is an absorbing combination of firsthand observation, scientific discovery, and trenchant analysis. With the teaching of evolution still an issue, there couldn't be a better moment for a book clarifying the nature and value of fossil evidence. Widely recognized as a leading expert in his field, Prothero demonstrates that the transformation of life on this planet is far more awe inspiring than the narrow view of extremists.

Evolution: What the Fossils Say and Why It Matters Details

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From Reader Review Evolution: What the Fossils Say and Why It Matters for online ebook

Chris Branch says

I sincerely hope that I never again read or hear an argument against the truth of evolution based on the lack of transitional fossils - or so-called "missing links" - from anyone who hasn't read this book.

Prothero describes **dozens** of transitional fossils here - and to be extremely generous in giving creationists the benefit of the doubt, many of these have been discovered and/or documented in the past 20 to 30 years, so anyone who relies on data older than that will find some gaps. But that is emphatically no longer the case; the entire history of life is covered here, and among the fossils described are those that show transitions between:

- worm-like invertebrates and fish-like vertebrates
- fish and tetrapods
- amphibians and amniotes
- dinosaurs and birds
- reptilian synapsids and mammals
- terrestrial mammals and marine mammals such as seals, sea lions and walruses
- proto-ungulates and horses, artiodactyls, and whales
- elephant-like tethytheres and sirenians
- primates and australopithecines and eventually humans

So this book is certainly worth reading just for chapters 7 through 15, where these transitional forms are covered in depth.

Prothero also spends a lot of time attacking creationists for their dishonesty when it comes to matters of science, which is certainly a valid and worthy endeavor, but this makes for some tedious reading, especially if you're already familiar with the arguments on both sides (or if you're a creationist).

Given this agenda, the author has also included plenty of other material that's a bit peripheral to the central subject of fossils, including the nature of science compared to creationism and intelligent design, a debunking of the absurd concept of "flood geology" (!) and a discussion of mechanisms other than natural selection that also contribute to evolution. The categorization of species is covered in the subjects of systematics and cladistics, and there is a chapter regarding theories on the origin of life.

It would be fantastic if readers who've been taught creationism and are curious about evolution would read this book, but if this is their initial exposure to the subject, I would guess it's unlikely they'll make it through. So, as a brief introduction to evolution and natural selection, I highly recommend *River Out of Eden: A Darwinian View of Life* by Richard Dawkins. For a more concise presentation of the evidence for evolution, I recommend Jerry A. Coyne's *Why Evolution Is True*.

And for those who are looking for the exhaustive history of life on earth, it's covered here in a rather textbook-like way; for a more engagingly written account I would suggest Dawkins' *The Ancestor's Tale: A Pilgrimage to the Dawn of Evolution*.

Adam Smith says

Fascinating read. Very enlightening on the subject.

I mainly bought this book because I thought it would cover some of the more unique factors and discoveries within evolutionary history. While it does contain some interesting facts about evolution (like how whales and snakes still have hips), an portion of the book is spent discussing the ignorance and deceitful tactics of fanatical creationists; which is understandable given the fact that prothero has dedicated his life to the subject and has to face a constant barrage of mindless attacks from people who refuse to do proper research.

It is unfortunate that a text on evolution would need to first deal with the problem of creationist thinking, but after reading about some of the things that have been done in the name of willful ignorance I can understand why the religious fanatics garner such hate and ridicule from anyone with a modicum of knowledge on the subject; luckily the problem does not appear to be as bad outside the confines of the United States.

An excellent text covering a broad overview of the evolution of life on this planet; from single cell to hominid. Well worth reading for those with an interest in the subject. Prothero does an excellent job explaining the scientific workings of evolution, even though some places still come across as a bit dense.

Ross says

This is a very scholarly book, equivalent to a university level text covering an overview of the origin of life on Earth. It has been written as a definitive rebuttal to the assertions of creationists who believe that the bible book of Genesis is literally true. The author has debated Creationists over many decades and this work is also an autobiographical account of his absolute frustration that his opponents simply won't accept facts. The book would serve as a wonderful text book for an Evangelical college on the subject of evolution. Of course, it will never be put to such a use.

For the general reader who is interested in Darwin's "dangerous idea" on the origin of species and the history of life on Earth, this work is a very good source.

I should again emphasize that this means really, really interested as more to the point because of the detailed presentation of this book.

Out of curiosity I just checked the Gallup poll and found that the belief of Americans in "Young Earth Creationism" has now fallen to about 15 percent. Darwin is finally winning.

Read again in 2018. For prospective readers I give this book 4 stars for it's excellent overview of the history of life and 2 stars for the time wasted on fighting creationists, resulting in the average of 3 stars for the overall rating.

Daniel Bastian says

“Evolution is happening all around us. It happens every time a new germ invades your body, a new pest or weed destroys our crops, or a new insecticide-resistant fly or mosquito bites you. Creationists may get some personal comfort from their beliefs, but they cannot change the fact that life is evolving all around us and threatens our survival if we don’t come to terms with that evolution.” (p. 118)

If the most profound truths are destined for the most polarizing receptions, then Darwin's ideas surely clinch the heavyweight title. From an empirical vantage point, the passage of time has been exceptionally kind to the iconic naturalist, even if scrupulously supported science is a poor solvent for cemented dogma. In some parts of the world, the mere mention of evolution can still elicit a range of reactions, from deep-seated animosity to a spluttering defiance waged from behind the ramparts of a keyboard. And yet for others it is an embodiment of the heightened grandeur science can evoke.

One might think something so well established would not so thoroughly dichotomize public attitude, but this mystery is clarified by unboxing the countermovement's religious underpinning. Evolution's conflict with a literal exegesis of Genesis is not an insignificant problem for fundamentalists, who feel roused to stamp out this object of dissonance at every turn. In what has become *de rigeur* for many of these blocs, scientific perspectives are measured against the canons of church teaching rather than the other way around. Adaptation is selected by committee, not by nature. Combine this with man's long-harbored fancies about our place in the cosmos and you have an idea ripe for naysaying.

Charles Darwin himself might have identified with such sentiments early in his career. Like many of his contemporaries, he found little reason to doubt the literal truth of the Bible, having been raised in an Anglican family under the Church of England, the state-established Christian institution in Britain. By all tradition and probability, Darwin seemed destined to pursue a life of piety and vicarage. But his gaze was set on loftier pursuits. At the hale and nimble age of twenty-two, Darwin accepted consignment to the HMS *Beagle* and embarked on the famed Pacific voyage that would forever imprint his thinking and shift his worldview.

His observations during this expedition were difficult to stomach initially. He noticed that animals on outlying oceanic islands like the Galápagos were nothing like those on the nearest mainland, and that the fossils left behind by extinct species shared a stronger resemblance to the local fauna than they did to continental fauna. From these initial whispers was spun a thesis for the ages: life on earth had adapted to the environment in which it found itself, with Nature the arbiter.

So conscious was Darwin of the weighty implications of his newfound understanding that he sat on the concept of natural selection (or "descent with modification," as he preferred to call it) for more than twenty years before taking it public. Even absent the evidence that would best support his theory—the fossil record, still sparse at the time—and the field that would tie it all together—genetics—Darwin's observations and insight were groundbreaking.

More than one hundred and fifty years later, his landmark ideas tend to provoke the same animus as in the 1860s. No amount of corroboration seems sufficient to dissipate its detractors; evolutionary science is still disputed and rejected by the bulk of religious America, and by the global majority based on recent indicators. This is unfortunate, not just because it signals anti-intellectualism, but because biological evolution—our evolution—ranks among the most important discoveries in all of science. Its advent ushered in a far more intricate and, indeed, far less anthropocentric understanding of life over against the unquestioned orthodoxy of distinctly created "kinds."

While there may always be holdouts who drum up controversy in a bid to undermine the science, there is no such controversy within the scientific community. *Evolution: What the Fossils Say and Why It Matters*, from reputable paleontologist of 30 years, Donald Prothero, illuminates both sides of this longstanding narrative. With his expertise in fossils and other inter-applicable disciplines, Prothero enlightens his readers on why the occurrence of evolution is part of the furniture of reality and shoots down the biblically motivated dismissals of creationists who deny this reality.

First Things First

Before establishing the positive case for common descent, Prothero first targets the religious engines which fuel its nonacceptance, allocating considerable space to biblical origins and context. I cannot commend this approach enough. All of the evidence in the world is not enough to sway fortified religious mindsets. The ballast of fundamentalism must first be kicked aside.

The forays into biblical interpretation are admirable and strike at the heart of creationism. Entire sections are devoted to precursory creation myths, such as those of the Sumerians and Babylonians, the Documentary Hypothesis, and debunking “flood geology.” As Prothero tells us, “The Bible is a composite of multiple sources that did not always agree with each other.” (p. 30) It is truly refreshing to see a scientist as capable of dissecting the often thorny issues of religion as of science, even though his treatment here is unlikely to break new ground for those well-versed in biblical studies.

All roads lead back to America as the birthplace of modern creationism—from its evangelical roots in the late 19th century and the many spouts of obstructionist fervor in the courtroom to the appearance of its more recent cognate, intelligent design (ID). While most of these efforts to gain academic traction have collapsed in failure, there is a rich history to be told here of the rhapsodic and fitful yet ongoing quarrel over the legality of teaching creationist perspectives in public school systems around the country.

Prothero recounts in places his own debates with creationists and the predictable tactics they employ to evade the portfolio of evidence unearthed by the scientific community. With devastating effectiveness, Prothero yanks the rug out from creationist and ID peddlers and pinpoints the errors in their tattered objections.

Fossils Tell the Story

In reconstructing the evolutionary history of life, scientists look to the strongest clues available: those written in the earth itself. As one of the most accomplished paleontologists of his generation, Prothero is in rare form with his dizzying knowledge of the fossil record. Unfortunately for scientists like Prothero, the discovery of a fossil is actually an overwhelmingly improbable event due to the unforgiving processes of fossilization and deposition, combined with the fact that few scientists are out there hunting for them. Indeed, a fossil record as robust as what we have today is a story in and of itself. He walks us through example after example of evolutionary sequences, highlighting transitional forms along the way as well as each taxon's overall place in the topiary of life.

Our guided tour commences with the smallest of life on earth, the microbial forms of bacteria and protists whose relatively rapid evolution makes for an impressive array of microfossils. We next work our way up to invertebrates, and onto fish, and then proceed to the nonamniote tetrapods (what the rest of us might call amphibians). Next Prothero discusses the selection pressures giving rise to land-based animals' return to the sea and the reptilian's branching evolutionary tree leading to the dinosaurs and, later, birds. Priority then shifts to the mammals. Horse, rhino, pinniped (seals, sea lions and walruses) and whale evolution are among the most remarkable examples in science of later observation confirming prediction.

The book concludes with a recap of our own origins. Some 6,000 hominid fossils have been located to date, and biologists have made significant progress in piecing together the complete canvas of human evolution. The various collections preserved by museums around the world document our ancestry in near-cinematic form. Upon Prothero's first visit to the natural history museum in Kenya, he reminisces: "A tour through the bomb-proof hominid vault in the Kenya National Museum in Nairobi is a revelation: a whole room full of

fossils that document our evolution, and whose existence the creationists must deny.” (p. 336)

Of all the threads of evidence buttressing Darwin’s original insight, the fossil record qualifies as perhaps the most irrefutable testament to the temporal progression from simpler organisms to more complex organisms. The variety presented here reaches a scale and lucidity few other works can match. While Prothero marshals independent corroboration from other disciplines, including embryology, vestigiality, comparative genomics and biogeography, the punch line of the book is the none too shabby fossil record, which only grows more exhaustive with each passing year.

On a somewhat picky note, I do wish Prothero had mentioned one of the primary objections to fossil science: the reconstruction of a full specimen from a small number of bones. As paleontologists will emphasize, you do not need a complete set of bones to extrapolate with accuracy a full skeleton. For example, the human body is comprised of 206 bones, but many of those are redundant. If the left tibia bone is intact, the right tibia is unnecessary. Once you account for all the duplicate bones, you’re left with around 120 unique fragments. Moreover, certain bones constitute defining features for certain genera, relegating others to a lower priority. This is important because rarely is a full set found in the wild.

Slaying the Slain

If a knock can be made against the book, it is Prothero’s relentless captivation with creationists, especially Duane Gish, whom Prothero has debated multiple times in public. In fact certain portions of the book seem almost entirely addressed to a creationist—a boxing match that never seems to let up. At some point it began to feel a bit repetitive, and could potentially turn off the very readers he’s trying to reach. I get it, though: he’s spent much of his life wrangling with creationists; it’s only inevitable this would manifest on the page.

Closing Thoughts

After the last page had been turned, I couldn’t help but feel once more a sense of awe at the diversity of life that has roamed this planet and the time-tested principles that account for it. I find endlessly perplexing the fundamentalist’s continued preoccupation with ancient creation stories when life’s evolutionary past is ever more breathtaking, more nuanced and more surreal juxtaposed with the prosaic passages introducing the biblical texts. Prothero lays down an airtight case, premised on a voluminous amount of empirical evidence, for the truth of the former and against the fallaciousness of the latter. Part textbook, part creationist’s worst nightmare, *Evolution: What the Fossils Say and Why It Matters* is one of the most accessible resources on the topic I’ve had the pleasure of reading. It answered the most questions, and may well be the go-to reference for debunking pestersome creationists. **Highly recommended.**

Note: This review is republished from my official website. Click through for additional footnotes and imagery.

Sarah says

I think a more appropriate subtitle of this book would have been "Creationists Can't Be Bothered." Having been one and having spent some of that time trying to sort out why everybody thought the way they did, I understand why he kept coming back to that phrase. When you don't understand science and when it doesn't interest you, reading about it piecemeal on the Internet is exhausting. The conclusion I came to out of that exhaustion was just to think, "Gee, there's nothing one side can argue that the other side can't answer" and to

therefore stop thinking about it altogether. If you had asked me point blank if I was a Creationist, I would have said so, but at the same time I don't think I would have denied the fact that we can see evolution happening around us and that the conclusions scientists come to do seem to lead to effective advancements toward human goals in medicine, geology, and physics.

They call this "cognitive dissonance" and I had it in spades. This book, especially the early parts that lay the foundation as to how scientists come to understand the fossils, was really speaking to my young adult self. So many of the experiences he has had as an educator were the same ones I had as the person being educated. I disrupted my college biology class while my high school acquaintances sank in their seats. I told an adjunct professor about the second law of thermodynamics fully expecting him to be stumped and being amazed when he absolutely wasn't.

What's more, even though the church I grew up in didn't really harp on the subject very much, I have a very distinct memory of the very "quote-mining" Prothero is exasperated by. I work in a world class research library, you see. There isn't an article you could cite in any church that I can't get. And I did. And it said the opposite of what the Bible School Teacher said it did.

I cannot remember if I pointed this out to that teacher. I have tried at least once to correct this kind of error, but I got dismissed and felt demoralized by it and may have not wanted to go through it again if it was not this time. I really doubt it would have changed his mind.

The whole thing makes me sad. That man is still around the church, but I'm not. And I don't think there's anybody left with the inclination and the resources to check up on him.

buuuuuuuuuuuuh

Maybe I should stick to talking about the book. Okay.

Lots of pictures. The first part is the best part, the part about fossils sort of bogs you down like the book of Numbers with its lists of incomprehensible names peppered with the occasional bizarre story (reptiles, except for crocodilians, can't breathe and eat at the same time; there used to be this crazy hornless rhino that was bigger than an elephant; fish be walking all the time, bro). He gets docked a star because his tone gets a little (albeit understandably) exasperated quite often. Though, he does a good job making clear that he isn't against religious people in general, just creationists in specific. Religion is great, in his book, so long as you keep it out of the science books.

I got a lot out of it, but I think it's another book that won't be read by the people who need it most. The story of my life.

Thanks Donald Prothero! Despite the depressed tone of this review, I really enjoyed the book! Also, now I know you're not Stephen Prothero who is a different human being altogether, apparently.

The end.

Noreen says

This book covers a lot of ground, only hinting at the incredible detail involved in the study of the fossils. It is

accessible and interesting to the casual reader, and for anyone wishing to focus more deeply on a particular aspect, there is a bibliography at the end of each chapter.

The fact is not that there are no transitional forms, it is that EVERYTHING is a transitional form: life is a tree, a continuum, and the concept of categorizing everything is a holdover from the biblical concept of special creation. DNA research has shown that every living thing is related to every other living thing. The old method of taxonomy is outdated; it's from the "kinds" of animals that God told Noah to save.

Something I think Prothero could have made clearer in Chapter 3 is the explanation of the controversy over the term "punctuated equilibrium." That term was coined by Stephen Jay Gould, who apparently vacillated on his own definition of it. This waffling, unfortunately, has given the creationists much fodder. From my reading of Richard Dawkins, here's how I see it. Just because the fossil record is "punctuated" doesn't mean the process of evolution went in great leaps and bounds. Though the speed of change varies, evolution is always gradual, at least compared to our concept of time. If a certain "speciation" took only hundreds or thousands of years (abrupt when considered in deep geologic time), then "transitional" forms may not have fossilized. As Prothero explained, we are lucky we have a tiny part of one percent of the history of life to examine, because fossilization is so very rare. I put "speciation" and "transitional" in quotes, because those words are human constructs, born of our need to categorize everything and based on biblical concepts. However, as Dawkins has explained in writing regarding the controversy over punk eek, everything is a transitional form. "Species" is just a word we use to categorize currently living organisms. Today's taxonomy doesn't apply to ancient organisms. Evolution is a continuum; there is no bright line between species. In fact, DNA research has made it clear that life is a tree and everything is related to one degree or another. What exists now is simply the tips of the branches of the tree, which continues to grow and branch. People try to categorize ancient organisms into species by comparing them to currently living organisms, and it doesn't work that way. Today's categories will be meaningless a million years from now. I think Prothero's use of the words "speciation" and "transitional" without explaining them that way furthers the confusion. [Note; He did clear up my confusion in the chapter on systematics.]

I found the chapter on systematics (taxonomy), or cladistics, interesting and enlightening. Before the current molecular techniques and newer ideas about embryology and anatomy, classification of fossils involved a great deal of guesswork (and controversy). Cladistics is more scientific, more exact. Strict cladists don't make claims that aren't testable. They don't talk about ancestry or descent, only relationships. They look at shared derived characters to compare organisms. There is still controversy, mostly because of the paucity of the fossil record, but this system of categorization is now widely accepted.

Interesting fact: *Homo habilis* is now known as *Homo rudolfensis* and *Homo erectus* is now *Homo ergaster*. Are the new names cladistic?

In conclusion, I found this book extremely educational. It cleared up many misconceptions I had about fossils. For instance, there is the central idea that Prothero continually reiterates: evolution is a bush, not a ladder. Organisms are no longer claimed as being ancestors or descendants of one another. They are related to each other, with nodes connecting them, but the vast majority of organisms may be branches that went extinct (like the hominids that are related to us but did not survive). As Richard Dawkins wrote in *The Blind Watchmaker*, "But however many ways there may be of being alive, it is certain that there are vastly more ways of being dead, or rather not alive." The common diagram that is still used to illustrate human evolution, showing the line of ape to human, is misleading. To put it another way, we didn't "come from" an ape; we share a common ancestor with the apes. Another idea I had was that those complete, articulated skeletons we see in museums are representative of what is found in the field. Actually, fossilization is a rare occurrence and we are lucky to have what we do. Many animals are identified by a single tooth or a microscopic shard

of bone or shell. The complete record demanded by the creationists is completely unrealistic, yet they use the "gaps in the fossil record" argument to support their claim of a supernatural creator. That is an extraordinary claim requiring extraordinary evidence, for which they have provided no evidence at all, even when their "experts" are given an opportunity to do so in a court of law. (See *Kitzmiller v. Dover*, 400 F. Supp. 2d 707, M.D. Pa. 2005)

I don't remember learning about evolution -- or really much science at all -- in school (it was public school in the sixties in the conservative rural Midwest). This book, along with those by Dawkins, Shermer, et al., have filled the gaps. It's a shame that so much of it is devoted to arguments against the creationists, but that battle is essential because the combination of a poor educational system and the religious right's PR machine have resulted in the U.S. being the wealthiest and yet most ignorant nation on earth, a nation that is rapidly losing its place as a world leader. Science denialism is not harmless -- it is causing real damage to our future.

Rachael says

This isn't a book for the feint of heart. The first half is thorough and convincing, the second half is a bit overwhelming. The second half of *Evolution* is devoted to going over fossil evidence, and it's very detailed and technical. Overall I thought this was a fine book, and a good one if you need a reference book. My only complaint is Prothero's intense interest with creationism, it can get a bit distracting, though in the light of the immensely overwhelming evidence in favor of evolution I suppose I can understand how it would be frustrating to have to deal with those people.

John says

"*Evolution: What the Fossils Say and Why It Matters*" is the best book I have ever read emphasizing the importance of the fossil record as the indisputable "facts" of biological evolution, documenting the history of life on Planet Earth. Its publication is long overdue, and yet, remains quite timely, when major publishers like Simon and Schuster have mistakenly published sterling examples of mendacious intellectual pornography like Michael Behe's "*The Edge of Evolution*". Indeed, Prothero's book ought to be viewed as the one that demolishes forever, Behe's inane assertion that the fossil record is irrelevant, claiming that the "truth" will be found only at the molecular level (More than anything else, that terse comment from Behe merely demonstrates his profound ignorance and understanding of the fossil record. Incidentally, Prothero refers to Behe as an "Intelligent Design creationist"). It also demonstrates the absurdity of creationist claims from the likes of Behe's Discovery Institute colleagues Paul Nelson, Jonathan Wells, and Geoffrey Simmons, among others, that the fossil record does not have "transitional forms". Indeed, as Prothero clearly shows his readers again and again, the history of life on our planet is replete with "transitional forms" documenting the evolutionary transitions from fish to tetrapods, from terrestrial carnivorous dinosaurs to flying birds, from primitive ungulate mammals to whales, and from apes to mankind. He also stresses the relevance of the fossil record to other aspects of evolutionary biology, noting its relevance with respect to molecular - as well as comparative anatomical - data. All of this is told in clear, concise, and persuasive, prose that often reaches the same literary heights attained by Prothero's mentor and friend, the late Stephen Jay Gould; without question this splendid book ought to be regarded as among the finest published last year.

Prothero's book is also a superb guide to the history and - regrettably - ever-present danger posed by Intelligent Design advocates and other creationists. The first three chapters emphasize the profound

intellectual differences between valid mainstream science like contemporary evolutionary biology and pseudoscientific religious nonsense like "scientific" creationism in all of its flavors, especially Intelligent Design. Prothero offers a detailed look at the scientific method in the very first chapter, comparing and contrasting it with creationism (He also provides a superb introductory guide too to the writing of the Judeo-Christian Old Testament.). The second chapter is an in-depth exploration of creationism, tracing its roots in early 20th Century American Fundamentalist Protestant Christianity, and, of course, describing the emergence of Intelligent Design and its zealous promotion by the Discovery Institute, the Seattle, Washington-based "conservative" think tank (However, much to my amazement, he does not emphasize sufficiently, the important work done by philosopher of science Barbara Forrest and biologist Paul Gross in their book "Creationism's Trojan Horse: The Wedge of Intelligent Design" in exposing the Discovery Institute's crypto-Fascist agenda for a future United States. Yet, to his credit, he does acknowledge that agenda by referring to its infamous "Wedge Document" while noting the Discovery Institute's deceitful promotion of Intelligent Design at the expense of valid mainstream science like contemporary evolutionary biology.). Finally, in Chapter Three, Prothero exposes both the intellectual inanity of "Flood Geology" and the popular creationist pastime of "quote mining"; the latter, a practice that's still popular with Discovery Institute Senior Fellows Michael Behe, William Dembski and Jonathan Wells.

The next two chapters comprise an excellent introduction to the history and science of evolutionary biology and the theory and practice of cladistic systematics. In Chapter Four, Prothero discusses the history of evolutionary biology, tracing its intellectual roots from the ancient Greeks to Lamarck, Darwin, and those biologists who became the "architects" of the Modern Synthesis Theory of Evolution (also known as the so-called "Neo-Darwinian Synthesis", since it merged population genetics with paleontology, biogeography, ecology and systematics). He also discusses some of the current controversies in contemporary evolutionary biology, beginning with evolutionary developmental biology, better known as "Evo - Devo", and, ending, of course, with punctuated equilibrium, noting how often it has been twisted and bent out of shape by creationists of all stripes, who have excelled only in "quote mining" from the published scientific and popular publications written by Stephen Jay Gould and Niles Eldredge; the two American invertebrate paleobiologists responsible for "punk eke". In Chapter Five, Prothero offers an especially lucid account of the theory and history of cladistic systematics, emphasizing its importance as a tool for studying both Earth's current biodiversity and its history of life.

In "Part II Evolution? The Fossils Say YES!", Prothero gives us a whirlwind tour of the history of life on Planet Earth, emphasizing major episodes in the history of life on Planet Earth, beginning with the origin of life, and culminating with the emergence of mankind. In Chapter Six, Prothero offers clear, persuasive evidence for the relative ease in creating life from inert organic compounds, brushing aside creationist arguments to the contrary. He debunks the outdated notion of a "Cambrian Explosion" - which remains popular with creationists, including Intelligent Design advocates - in Chapter 7, observing that the fossil record points to instead, a "Cambrian Slow Fuse", involving the gradual diversification of hard-part skeletonized fauna over the span of eighty million years, from the Late Precambrian through early Ordovician. He discusses the emergence of tetrapods from limbless fish in Chapter 10, the rise of early amniotes (which includes the reptiles, birds and mammals) in Chapter 11, and the evolution of flight in avian dinosaurs in Chapter 12, demonstrating the existence of countless "transitional forms". Further chapters are devoted to the origin of whales (Chapter 14) and humans (Chapter 15), and thus, offer a terse, but still thorough, glimpse, at the history of life on this planet. Prothero's coverage is so superb, that I am surprised by his all too brief references to mass extinctions, especially when their very existence ought to raise ample questions about an Intelligent Designer and his ability to "design" life that is extinction resistant.

In the final chapter of his book (Chapter 16), Prothero makes a truly compelling argument explaining why creationism is a clear and present danger, not only to American education, but indeed, the very survival of

the United States too. He quotes from an extended excerpt from the Los Angeles Times, describing creationist Ken Ham's indoctrination of young school children against evolution, conjuring up - at least for me - an image of Adolf Hitler's infamous Nuremberg Nazi Party rallies. He blames the advent of creationism since the late 1950s for fostering scientific illiteracy among Americans, and noting that this threatens our future economic success as we compete with other, better educated, countries like those in Europe and East Asia in a global economy increasingly dominated by science and technology. He also argues persuasively that denial of evolution is harmful to our health and well being, graphically illustrating this point by reminding us of the unsuccessful 1984 baboon to human heart transplant by a creationist Loma Linda University surgeon. Prothero's dire warning is a message I have read before, especially from Niles Eldredge, but here, Prothero's remarks are most compelling, and ones that ought to be heeded by all (Not surprisingly, Prothero compares and contrasts current denial of evolution with that of global warming, and finds obvious parallels with both.).

(Reposted from my Amazon review)

Rob Smith says

In the past ten to fifteen years there's been a renaissance in science writing. This is partly fueled by the controversy of intelligent design to be inserted into textbooks and curriculum in public schools. This lovely little book by Donald Prothero joins the constellation of evolution defenses that has formed in recent years, and is actually one of it's brightest stars. Whether the information inside is familiar or fresh, this is a book that nearly everyone can read.

The main thrust of the book is fossils. For anyone who's watched a creationist debate, the fossil record is among the most abused and misunderstood pieces of evidence in science today. Prothero's book is divided into two parts. The first part examines the basic tenants of evolution and how it was received by the world around it. The second part is a stellar demolishing of creationist tracts, via the method of going over the fossil evidence in great detail. Prothero's second part covers everything from biogenesis, to fish, to mammals. It is, by far, one of the most exhaustive catalogues of fossil data and why it upholds evolution I have ever read.

Prothero also holds special contempt for creationists. He will quote an attack against evolution and than promptly demolish it. Duane Gish, whom Prothero debated some years ago, is quoted quite a bit. At times this book can outclass the infamous Dawkins

The book is not just a screed against creationism, but a love letter to evolution and it's intellectual history. Prothero writes and cites every biologist from Darwin, to Mayr, to the late great Stephen Jay Gould. He clearly knows his stuff. Included within are also a high number of pictures and diagrams of various fossils and evolutionary processes, much more than the typical pop-evolution book!

Overall, this is one of the finest science books I have read, and is an especially fine defense of evolution. I would recommend this one over anything Richard Dawkins wrote.

Book says

Evolution: What the Fossils Say and Why it Matters by Donald R. Prothero

"Evolution: What the Fossils Say and Why it Matters" is an outstanding book that focuses on the fossil record as strong evidence for evolution. It covers the science of evolution with great expertise and eloquence. The book is basically broken out into two main parts. The first part focuses on the science or progression of evolution while the second part gets into the more technical and fossil case studies. Dr. Prothero's scientific background is unquestioned and is an accomplished science writer evidenced by the number of books and papers under his belt. He tackles many fascinating topics of evolution with proficiency and annihilates the so-called evolution-creationism "controversy". This is a reference quality book on evolution and is a significant scientific contribution. This 408-page book is broken out into two main parts: Part I. Evolution and the Fossil Record, and Part II. Evolution? The Fossils Say YES.

Positives:

1. Reference quality book.
2. Extensively researched by an expert in the field.
3. Great accessible science writing.
4. The always fascinating topic of evolution.
5. Great use of converging sciences to solidify points.
6. Excellent use of charts and diagrams.
7. Great defense of science. Explains what science is all about.
8. Evolution is a scientific fact. "But even if Darwin's mechanism, the theory of natural selection, were to be rejected by scientists, it would not change the fact that life has evolved".
9. One of the main goals of this book is to debunk creationism and it succeeds by providing overwhelming evidence. One of the great strengths of this book. Bravo!
10. A who's who of creationists and their weak positions exposed.
11. Creation myth debunked!
12. A historical look at creationism and evolution. Great stuff.
13. The author does a wonderful job of explaining what the threats to science are.
14. A fascinating look at geology, "The geologists who first discovered the fact that fossils change through time, or faunal succession, were actually devoutly religious men who were not trying to prove evolution (an idea that would not be published for 50 or 70 years after they discovered faunal succession)".
15. A close examination of the "great flood". Interesting.
16. Understanding punctuated equilibrium, mosaic evolution...
17. The genius of Charles Darwin and his legacy.
18. Some fascinating and eye-opening facts...I will not spoil them for you.
19. The importance of regulatory genes.
20. Thought-provoking quotes, "Yet amidst all this turmoil no biologist has been lead to doubt the fact that evolution occurred; we are debating how it happened".
21. How converging science like genetics solidify evolution.
22. The impact of Hox genes.
23. Systematics one of the least understood by the general public. Cladistics...
24. Human evolution, awe-inspiring. The fossils, the evidence...
25. Debunking the distortions of the fossil record that the creationists promote.
26. Living up to the title, what the fossils say.
27. Microfossils and why they are ideal for evolutionary studies.
28. One of the great strengths of this marvelous book: a look at a number of captivating cases of transitional forms. I can't stress that enough. Awesome!
29. Many great evolutionary breakthroughs covered in this book. With plenty of examples.
30. Great fossil discoveries.

31. The author does a wonderful job of helping the reader ground the timelines involved with evolution. The combination of lucid narratives and illustrations is an effective teaching tool.
32. What teeth tell us about our ancestors.
33. How close are human and chimpanzee DNA. Find out.
34. The author closes out the book with a persuasive plea in defense of science.
35. Links worked great!
36. An extensive and I mean extensive bibliography.

Negatives:

1. Creationists don't need to believe evolution but if they care about their beliefs corresponding to reality must certainly learn to accept it. This book will rattle dogmatic believers.
2. I will disagree with the author that supernatural hypotheses cannot be tested in a scientific manner. Some can be...take the efficacy of prayers as an example. Can prayers help amputees grow a new limb?? I do however, respect the author's stance.
3. Science is moving at a fast pace so some new findings in particular in the genetics field has altered some things from this book. For instance, there are some new findings that show that Neanderthals in fact did mate with humans. The book was published in late 2007, so some minor differences are bound to happen.

In summary, I thoroughly enjoyed this book. I've read a number of books on evolution as my further suggestions will attest, and this book has become one of my favorites. It's great science writing with conviction and passion. Dr. Prothero cares about the state of science and in particular the so-called scientific controversy and relentlessly goes after creationists who attempt to undermine science and in particular evolution. The book is thorough, comprehensive and quite enlightening. It is reference quality and I really appreciate how the author lets the reader know the areas in which creationists misrepresent or flat out lie about scientific facts. One of the greatest strengths of this book is the number of cases in which the author provides fossil evidence for transitional forms. The author also uses converging scientific knowledge such as genetics to solidify his arguments. An absolute intellectual treat!

Further suggestions: "Written in Stone" by Brian Switek, "Why Evolution Is True" by Jerry A. Coyne, "Why Evolution Works (and Creationism, Fails) by Matt Young, "The 10,000 Year Explosion" by Gregory Cochran and Henry Harpending, "The Red Queen" by Matt Ridley, "The Making of the Fittest" by Sean B. Carroll, "The Greatest Show On Earth" by Richard Dawkins, "Your Inner Fish" by Neil Shubin, "Relics of Eden" by Daniel J. Fairbanks, "Why Darwin Matters" by Michael Shermer, "Only a Theory" by Kenneth R. Miller, and "Life Ascending: The Ten Great Inventions of Evolution" by Nick Lane, "Evolution: The Triumph of an Idea, by Carl Zimmer, "Before the Dawn: Recovering the Lost History of Our Ancestors" by Nicholas Wade, and "What Evolution Is" by Ernst Mayr.

Barry says

So there's the tetrapod clade, then the amniote clade, which includes mammals, THEN comes the reptilia. So we're not descended from reptiles. I'm having an identity crisis.

Anne says

This is an outstanding book. Donald Prothero has put together an extremely comprehensive account of the fossil record as it stands today. There are chapters on the origin of life; prokaryote development; microfossils; the evolution of the backbone and the first vertebrates; the transition from fish to tetrapods; from primitive tetrapods to amniotes; the evolution of dinosaurs and from avian dinosaurs to birds; from primitive synapsids to mammals; and the evolution of humans.

Each chapter lists the many transitional fossils in each group – over the last couple of decades, the fossil record has increased substantially to provide excellent transitional forms for many groups and species – as well as corroborating evidence from molecular biology. Some species have such a complete transitional fossil record – the whale for example – that they merit sections of the book all to themselves.

But there is much more than that in this book. The first part of the book deals with the nature of science and the importance of the scientific method. He explains how fossilisation occurs, and how rocks are dated. He outlines the evolution of evolutionary biology itself, from before Darwin up to the latest uses of the cladistic model of evolutionary heritage and DNA analysis.

Prothero also gives an account of the history of the creationist movement in America, giving a damning appraisal of the pseudo-science of “flood geology” and “intelligent design”, and clearly demonstrating exactly where and why creationists distort, lie about, or just ignore, evidence for evolution. He pulls no punches in his portrayal of them, nor in his obvious disgust for their intentions to disrupt science education. I cannot recommend this book highly enough – it is extremely well written, and full of fascinating and meticulously researched facts. It should be required reading for all.

Steve Van Slyke says

It's my own fault that I did not read the book description or the other reviews here closer. I didn't get the impression from the book description that so much of it would be devoted to countering the fallacious arguments of the creationist-ID crowd. Not expecting that, and not one needing to be convinced, I was a little annoyed at all the time and ink spent describing and shooting down the creationist positions. For those who need a little more convincing, or who regularly debate creationists, those parts of the book would be quite valuable. It is for these reasons that I gave the book four rather than five stars.

Nevertheless, it does a good job of describing most of the evolutionary pathways from simple bacteria to various megafauna including dinosaurs, birds, whales, and humans. My only other regret that once he takes the reader on to land with the “amphibians,” that he forgets plants and insects, but I understand that author's have to make choices because of marketing constraints. His frequent references to systematics and cladistics made me want to read a book specifically on that topic.

So, again, if you are looking for a book on evolution that specifically takes on the creationist and Intelligent Design community, you could do no better than to start here.

NOTE TO KINDLE READERS: GoodReads does not at the time of this writing show the availability of the Kindle edition, which is what I read. If I had to do it again I would buy the hardback. There are many cladograms and other illustrations, including color plates. Some these "zoomed" well enough to appreciate while others did not and required the use of a magnifying glass. Also, the Kindle version was expensive, close to \$15.

Alison says

Despite Prothero's somewhat agitated style (the list of things that annoy varies from the incorrect use of the word fish to creationist distortions of science) this is possibly my favourite of the evolution primers around at the moment. Prothero discusses comprehensively the various mechanisms currently thought to contribute to evolution, and the varied areas of scholarship, from molecular biology to paleontology, which contribute to the field. He has a much more expansive view of evolution than Dawkins, whose books lead the field, and as such is able to efficiently explain how rapid evolutionary jumps are likely to occur, and how our genes facilitate rapid changes in form, downplaying the gradualism that Darwin, and now Dawkins, emphasise. In fact, his history of evolutionary science is fascinating, delimiting roles for many scientists of the time, and making it clearer that it was less the radical idea of one man, and more the culminating point of contemporary understanding.

The first part of the book covers off these topics, in between launching tirades against the creationists, and taking a detailed approach to debunking their main claims. As someone who does not live in a nation where creationism is a common worldview, it can seem a little ridiculous to dedicate the best part of a chapter to explaining why the genesis story of Noah's Ark could not have created the fossil record, but unfortunately the constant undermining of science teaching in the US by such beliefs necessitates such intellectual exercises.

The second part of the book is narrow in focus, delimiting the fossil record from the origins of life to the development of homo sapiens. It is excellently done, if a little dry in places. Prothero doesn't pretend this is the sum of evolutionary science - it is a paleontology book concerned with the fossil record, without detailed accounts of molecular and DNA studies, but he refers to them where they influence the findings of paleontologists. It is thorough, and for those like me who like to understand the big picture, simply invaluable reading. It is easily the text I would recommend to anyone with the basics of natural selection looking for a better understanding of how evolution has shaped our world. It does focus on the animal life development, plants seem conspicuously missing from the later chapters. In this, as in other things, you can see the influence of the creationists, and Prothero's determination to counter their arguments, and hence concentrate on areas most commonly raised by them.

The book is particularly valuable for being relatively recent, and able to incorporate recent discoveries - the sense of how much more we understand every year provides a mild thrill for those so inclined. :)

I couldn't help wishing some of the tirades against creationism had been cut in order to allow for a fuller explanation of some areas of development - the evolution of reproduction, for example. And Prothero's focus on how the record shows the evolution of forms very occasionally seems to overwhelm an understanding of why such forms might have developed (frilly necked dinosaurs, for example). Thankfully, Prothero's excellent referencing system, and helpful list of further reading from each chapter should keep me going for a while.

Jo Green says

This book presents facts against creationist arguments. The author presents early on that religion and science are not incompatible for many Christians or scientists, he just explains the arguments that creationists use and has rebuttals. He also gives information on how science has been leaving the classroom due to a direct attack by a relatively small group of people and how that group of evolution deniers has grown as a result. It is full of fossil history, where fossils are stored, and how a museum of actual fossils is in danger in Africa

due to fundamentalist beliefs there. Basically, don't destroy evidence and availability of real science if it threatens your belief. If you don't like the museum and its contents, don't go. It is never that simple though if a creationists belief is challenged. Good book, I didn't need convincing, but the information is good.
