The Evolution Ringmaster

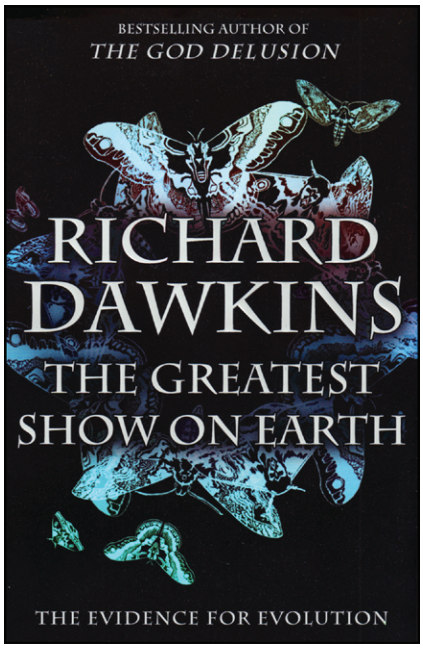
The Greatest Show on Earth: The Evidence for Evolution
Richard Dawkins
New York, NY, USA: Simon and Schuster (2009).
470 pp. $30.00

In 1871, P.T. Barnum launched the "Great Traveling Museum, Menagerie, Caravan, and Hippodrome," a year later adding the moniker "The Greatest Show on Earth." Ever the showman, Barnum was renowned for promoting hoaxes, the most celebrated of which was the *Feejee Mermaid*, a mummified specimen boasting the head and torso of a monkey and the rear end of a fish. Such a ridiculous creature, what Richard Dawkins would refer to as a "fishkey," half fish and half monkey, is precisely what many creationists clamor for. "If monkeys descended from fish," they say, "then show me an intermediate form!"

In his latest book, *The Greatest Show on Earth*, Dawkins points out the absurdity of this expectation. First, modern species are not descended from other modern species. Rather, they share a common ancestor some time in the past. Second, there is no reason to think that this ancestor would be perfectly intermediate in form between its descendant species. With a flair for analogy and unique explanatory abilities, Dawkins confronts such creationist myths one by one. He is an entertainer but, unlike Barnum, he sticks to the facts.

Although Dawkins carefully dismantles the underpinnings of creationist thinking, he is in fact uncharacteristically restrained. This is not the unrelenting attack on religion that made his previous book, *The God Delusion*, controversial. Instead, inspired by the bicentennial of Darwin's birth, Dawkins harnesses the wonders of the natural world to lay out the evidence for evolution. For Dawkins, the marvels of biological diversity—from the origami-like folding of developing embryos to the seaweed-grazing marine iguanas of the Galapagos Islands—both ask and answer evolutionary questions. In so doing, Dawkins covers vast territory with crystal-clear scientific thinking and wonderful prose, the Dawkins hallmark.

The book starts semantically: what is a theory? Although not the sexiest of entrées, this single word "theory" belies a central confusion about evolution, and so it must be done. In the 1980 presidential campaign, Ronald Reagan, when questioned about his views on evolution, responded "Well, it's a theory…it is a scientific theory only…" This lack of awareness (or political tap-dancing) highlights a key dichotomy in the usage of the term: the general public uses theory to mean



speculation or conjecture, whereas scientists define it as a hypothesis confirmed by observation or experiment and accounting for the known facts.

Unlike many of his previous books, which assume the fact of evolution, here Dawkins compiles, piece by piece, the evidence for it. Dawkins follows Darwin in starting with the analogy of our own species shaping varieties of crops, breeds of dogs, and economically important traits of cattle. Next, Dawkins leads us to more natural "agents of selective breeding," like pollinators selecting plants or females selecting showy male traits. Finally, Dawkins reasons that we do not need to invoke a choosing agent at all, but rather "the choice can be made automatically" by surviving to reproduce or failing to reproduce. This, Dawkins recognizes, is the triumph of Darwin's genius: the elimination of a teleological view of the natural world.

In the 150 years since the publication of *On the Origin of Species*, the evidence has continued to mount. In 1859, the fossil record was still poorly described, but just 2 years after Darwin's publication, the first clear transitional fossil was discovered, a complete specimen of 150-million-year-old *Archaeopteryx*, representing an intermediate between birds and dinosaurs. Since then, the fossil record has yielded many examples of key transitions in the origin of major taxa: tetrapods, mammals, and whales being three textbook examples. Similarly, the fossil record of humans has proven extraordinarily rich. None were known during Darwin's life, although he correctly predicted that they would be most abundant in Africa. Here again we have transitional forms. Even in the few weeks since the publication of Dawkins' book, a trove of new hominid fossils has been described. Although Dawkins argues that fossils are like thousands of "spy cameras" that just provide bonus information to the already airtight case for evolution, he treats the fossil record with rigor because it is a favorite target of creationist misinformation.

In addition to fossil organisms, evidence for evolution also can be found in what can be thought of as "fossil parts"—vestigial organs. Whales retain remnants of a pelvic girdle as a testament to their land-dwelling ancestry, and humans an appendix from their herbivorous ancestors. In addition, because evolution has no foresight, we are also riddled with major design flaws. Dawkins vividly illustrates this point by personal experience: the day after Darwin's 200th birthday, Dawkins describes donning orange coveralls and stark white boots to join a team of anatomists dissecting a giraffe, recently deceased, from a nearby zoo. The focus was, naturally, part of the giraffe's neck anatomy. Dawkins observed his colleagues painstakingly dissect out the recurrent laryngeal nerve, and they were

probably the first people to do so since Richard Owen (Darwin's most prominent foe) in 1837. This is a marvel of bad design. The nerve, which links the larynx to the brain, takes a detour of almost 15 feet through the thorax. Why? Because evolution is not a simple matter of optimal engineering; rather, natural selection modifies or builds on what has come before. The laryngeal nerve descended from the brachial arches of our fish-like ancestors and as such is constrained by the position of the aorta, also ultimately derived from the brachial arch. As Dawkins notes, similar evolutionary imperfections abound.

Dawkins reminds us that evolutionary biologists are like "detectives who come late to the scene of a crime," and, although we were not able to witness the crime itself, the evidence we can gather, such as fossils, vestiges, and DNA, is often much more reliable than any eyewitness account. He does, though, stray from this analogy to present cases of rapid evolution either in the wild or in the lab in which we can witness evolutionary change in real time. One need only extrapolate this over thousands or millions of years to understand how larger changes can accumulate. In fact, Dawkins devotes a whole chapter to dating the geological record, recognizing that the time dimension is a key component of our understanding of evolution.

My sole quibble with the book is that Dawkins gives rather short shrift to the latest genomic data, some showing the precise molecular details of how, what Darwin referred to as, "endless forms most beautiful" evolved. We now know the genetic switches that control basic body plans. We know mutations responsible for variation in wild populations of butterflies, fish, and mammals. Dawkins steers clear, perhaps mindful that the book is already 470 pages long and quickly could become an unwieldy encyclopedia were he to foray into molecular territory. I think, however, this is an unfortunate oversight because it gives the impression that we have simply been filling in the gaps left by Darwin—with, for example, further exploration of the fossil record or description of developing embryos—rather than moving ahead into areas that Darwin could not have even imagined. And the most remarkable fact of all? That Darwin's theory holds up when spoken in the language of DNA.

Why, one may wonder, does this book need to be written at all? And, Dawkins, I should note, is not alone in having the impulse to make the case for evolution: Jerry Coyne's explicitly titled *Why Evolution is True* appeared earlier this year. Polls suggest that 40% of Americans are tried and true anti-evolution creationists, and the numbers, Dawkins claims, are not much better in Britain or the rest of Europe. In principle, this book is for them. Yet, they do not appear to be Dawkins' target as he makes little attempt to draw in his opponents.

But those who do read Dawkins—perhaps those who are undecided or uncertain or who accept evolution but are unsure how to argue their case—will be awed by the majesty of nature, wonderfully entertained, and brilliantly informed. Even well-trained biologists will come away with a new (or renewed) appreciation of both the power of natural selection and the extraordinary biological diversity it has generated.

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