The Evidence for Evolution
by Alan R Rogers
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reviewed by Warren D Allmon

For at least the past 25 years, many educators and others have been arguing that one of the problems with modern science teaching is that it simply has too much specific content, and that it should focus more on “how to think” and less on mind-numbing lists of details. Evolution education's own take on this is that just providing additional information does not appear to significantly improve evolutionary knowledge or acceptance. True though this may be, it is also unarguable (although not very well documented) that the public's generally low level of knowledge of basic biology and geology is a significant obstacle to increasing acceptance of evolution. As Alan Rogers writes in this fresh and splendid little book, “The more familiar one is with the facts of nature, the more convincing is the case for evolution” and the less one knows, the easier it is to be critical (p 100).

Rogers correctly notes that, because whether evolution happens is no longer an active scientific question, there is “a bias in the way scientists teach courses and write textbooks. We tend to emphasize what we find interesting and to gloss over the rest. For this reason, students learn a lot about the mechanisms of evolution but only a little about the evidence that evolution really happens … Perhaps,” he says in passing, “this contributes to the fact that most Americans view evolution with skepticism and suspicion.” Rogers's book therefore reverses this “traditional emphasis,” focusing “on the evidence that evolution happens, while saying as little as possible about how it happens” (p 3–4).

Rogers's approach also differs from other recent summaries of the “evidence for evolution” (such as Prothero 2007, Coyne 2009) in asking and answering a set of questions: “Do species change? Do they split into new species? Does evolution make big changes? Can evolution account for adaptation?” And, notably, he focuses on “evidence that Darwin did not have” to make the important point that “The case for evolution is stronger today than it has ever been” (p 4).

Rogers answers each of these questions in a clear, accessible tone. He is very direct in his criticisms of creationist views, but he is also respectful. Almost half the book is devoted to addressing the first two questions, by stepping through them sequentially the way an honest skeptic might (what are the experimental demonstrations of selection reducing the rate at which populations can exchange genes? can selection reduce this rate to zero? only in the lab or also in nature?). Here, and throughout the book, he focuses on a small number of elegant experimental and observational studies that provide conclusive answers, but then quickly points out that there is much more where those came from.
As convincing as such “real-time” studies are, however, the greatest volume of evidence for evolution has always been more indirect (that is, patterns in the characters of organisms), and it is here—in what Rogers calls “Traces of common descent in living organisms”—that non-scientific skepticism is probably greatest. By far the best feature of this book, therefore, is its focus on precisely why such indirect evidence actually favors evolution over its alternatives. The answer is hardly novel, but it is strangely missing (or at least dramatically deemphasized) in virtually all presentations of the topic: the most abundant evidence for evolution is that the characters of organisms are not scattered randomly, but rather are arranged in such a pattern that implies a hierarchical, branching tree. Such “[p]hylogenetic pattern is everywhere in nature,” he says. “It makes sense only if all living things evolved from a single ancestor” (p 31). This is the simplest possible version of “tree thinking” (although Rogers doesn’t use that term), which has been discussed as an important element of evolution education (for example, Meisel 2010).

Rogers uses the seemingly arcane example of transposons in whales as his primary data for making this argument. In four species of whales (bottlenose dolphin, narwhal, sperm whale, and humpback), a total of 16 different transposons are distributed in “blocks”. One such block of two transposons occurs in all four species. The next block of three transposons occurs in all species except the humpback. “These species must share a common ancestor not shared with the humpback. In other words, they form a separate branch of the tree. ... The different transposons tell a consistent story and indicate that whales share a long history of changing and splitting that began with a single ancestor” (p 27–28). “If the species had been independently created, there would be no reason to expect the [transposons] to be arranged in a pattern that implies a phylogenetic tree.” Rogers generated “shuffled” datasets by randomly reordering the occurrence of all of the 16 transposons and found, “In 100 000 tries, [the computer] didn’t find a single shuffled data set that would fit onto a tree—any tree. Thus, the perfect phylogenetic pattern ... is extremely unlikely to arise by chance” (p 28, emphasis in original).

As Rogers notes several times, a creationist might argue that such “phylogenetic” patterns are caused by the observed features being “simply the best way to do the job and were thus selected for this job by the creator”, while an evolutionist would argue that these similarities are evidence of common ancestry. How then, Rogers asks, can we tell which explanation is correct? “If the evolutionists are correct, then we should also see traces of common descent at finer scales. Closely related species should have closely related [similarities], and distant relatives should have [similarities] that are less similar ...”, and these patterns are overlain by “another sort of historical record ... a nested pattern of similarities ...” (p 43–44).

In his conclusion, Rogers writes, “Without evolution, biology is a huge mass of unconnected facts. Evolution is a lens that makes those facts jump sharply into focus. The real power of evolution to convince lies in the huge mass of facts that it manages to so simply explain ...” (p 100). Evolution educators clearly need to present more than just these “facts”, but evolution education, just as clearly, cannot succeed without them.

**References**


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