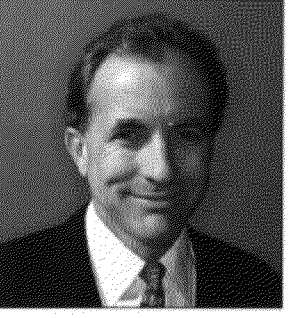

The Fossil Fallacy

Creationists' demand for fossils that represent "missing links" reveals a deep misunderstanding of science

By MICHAEL SHERMER

Nineteenth-century English social scientist Herbert Spencer made this prescient observation: "Those who cavalierly reject the Theory of Evolution, as not adequately supported by facts, seem quite to forget that their own theory is supported by no facts at all." Well over a century later nothing has changed. When I debate creationists, they present not one fact in favor of creation and instead demand "just one transitional fossil" that proves evolution. When I do offer evidence (for example, *Ambulocetus natans*, a transitional fossil between ancient land mammals and modern whales), they respond that there are now *two gaps* in the fossil record.

This is a clever debate retort, but it reveals a profound error that I call the Fossil Fallacy: the belief that a "single fossil"—one bit of data—constitutes proof of a multifarious process or historical sequence. In fact, proof is derived through a convergence of evidence from numerous lines of inquiry—multiple, independent inductions, all of which point to an unmistakable conclusion.

We know evolution happened because of a convergence of evidence.

We know evolution happened not because of transitional fossils such as *A. natans* but because of the convergence of evidence from such diverse fields as geology, paleontology, biogeography, comparative anatomy and physiology, molecular biology, genetics, and many more. No single discovery from any of these fields denotes proof of evolution, but together they reveal that life evolved in a certain sequence by a particular process.

One of the finest compilations of evolutionary data and theory since Charles Darwin's *On the Origin of Species* is Richard Dawkins's magnum opus, *The Ancestor's Tale: A Pilgrimage to the Dawn of Evolution* (Houghton Mifflin, 2004)—688 pages of convergent science recounted with literary elegance. Dawkins traces numerous transitional fossils (what he calls "concestors," the last common ancestor shared by a set of species) from *Homo sapiens* back four billion years to the origin of heredity and the emergence of evolution. No single concestor proves that evolution happened, but together they reveal a majestic story of process over time.

Consider the tale of the dog. With so many breeds of dogs popular for so many thousands of years, one would think there would be an abundance of transitional fossils providing paleontologists with copious data from which to reconstruct their evolutionary ancestry. In fact, according to Jennifer A. Leonard, an evolutionary biologist then at the Smithsonian Institution's National Museum of Natural History, "the fossil record from wolves to dogs is pretty sparse." Then how do we know whence dogs evolved? In the November 22, 2002, *Science,* Leonard and her colleagues report that mitochondrial DNA (mtDNA) data from early dog remains "strongly support the hypothesis that ancient American and Eurasian domestic dogs share a common origin from Old World gray wolves."

In the same issue, molecular biologist Peter Savolainen of the Royal Institute of Technology in Stockholm and his colleagues note that even though the fossil record is problematic, their study of mtDNA sequence variation among 654 domestic dogs from around the world "points to an origin of the domestic dog in East Asia" about 15,000 years before the present from a single gene pool of wolves.

Finally, anthropologist Brian Hare of Harvard University and his colleagues describe in this same issue the results of a study showing that domestic dogs are more skillful than wolves at using human signals to indicate the location of hidden food. Yet "dogs and wolves do not perform differently in a nonsocial memory task, ruling out the possibility that dogs outperform wolves in all human-guided tasks," they write. Therefore, "dogs' social-communicative skills with humans were acquired during the process of domestication."

No single fossil proves that dogs came from wolves, but archaeological, morphological, genetic and behavioral "fossils" converge to reveal the concestor of all dogs to be the East Asian wolf. The tale of human evolution is divulged in a similar manner (although here we do have an abundance of fossils), as it is for all concestors in the history of life. We know evolution happened because innumerable bits of data from myriad fields of science conjoin to paint a rich portrait of life's pilgrimage.

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