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*The Ancestor's Tale: A Pilgrimage to the Dawn of Evolution* . Richard Dawkins. xiv + 673 pp. Houghton Mifflin, 2004. \$28.

Popular science writing is, for the most part, undertaken by two different, if sometimes intersecting, classes of author: the intelligent general writer, often a journalist who has a deep interest in a particular scientific subject; and the versatile scientist who can place easy hands on a keyboard. Some writers in the former group, such as Richard Rhodes, interweave personality and topic to produce a compelling narrative. Others, such as Roger Lewin, write so clearly and vividly that the essential features of their subject stand out in bold relief, giving readers entrée to an often-forbidding scientific domain. Scientists who attempt the genre may display those same virtues, and the very best write with an authority that commands the attention not only of a literate public but of their colleagues as well. In their popular writing, these latter can even shift scientific discourse and bring forward new theories, or at least new perspectives.

During the last 30 years, biology has been served by several scientists who have succeeded in altering the terrain of their discipline not just through technical articles and books but also through the medium of popular science writing. Two of the very best have been the late Stephen Jay Gould and Richard Dawkins. Gould was the more prolific, although Dawkins is hardly a slouch, having published eight books, including *The Selfish Gene*, *The Blind Watchmaker* and now *The Ancestor's Tale: A Pilgrimage to the Dawn of Life*.

Gould's last book, *The Structure of Evolutionary Theory*, ran to some 1,400 pages, into which he crammed most of the major ideas and historical perspectives he had cultivated during his career. Although that book might seem to have slipped the boundaries of popular science, at \$39.95 it was priced to garner a large audience--a buyer could almost resell it for scrap paper and recover its cost. It displays many of the virtues of his other popular pieces and some of the vices of his later work, such as verbosity carried aloft on an inflated ego.

*The Ancestor's Tale*, at half the length of *The Structure of Evolutionary Theory*, still has considerable heft. Dawkins's book, though, displays a properly proportioned sense of its author's accomplishments. Yet it does have the feeling of an academic's large portmanteau, one quickly stuffed with odd books, papers and mismatched socks, rather cumbersome for lighter travel. In order to assess the good, bad and indifferent in the volume, I would like to examine more generally the several features of popular science writing that it exhibits.

The most obvious criterion for something being labeled a work of popular science is authorial intention. Does the writer wish to reach a general audience, even if he or she is a scientist hoping also to entice colleagues? Intention is not an infallible mark, however. In *Newton's Principia for the Common Reader*, for example, Subrahmanyan Chandrasekhar uses sophisticated contemporary mathematics to explore Newton's own demonstrations of theorems; the book would challenge the most adept mathematical physicist and leave the common reader gasping for breath. (The publisher could hardly have had exalted hopes: Although the work is less than half as long as Gould's book, it is priced more than four times as high.)

Dawkins does invite an intelligent but untrained reader, whom he graciously attunes to a medley of topics regarding evolutionary biology. He adapts the narrative device of Chaucer's *Canterbury Tales* to frame a regressive journey through our evolutionary past. Starting with modern humans, he draws the reader back in time through a succession of species ever more remotely related to us. And for those species he contrives tales of evolutionary import that are supposed to be something like the diverting stories told by Chaucer's pilgrims during their travel. But Dawkins quickly abandons any pretense that his creatures actually narrate the tales he assigns to them--after trying for one sentence to have the star-nosed mole say something to the duck-billed platypus, he decides that "it won't do ... I'll ... revert to my practice of telling the tale itself in my own words."

Dawkins begins the journey with a chapter that descriptively passes through archaic humans (including Neanderthals) to *Homo erectus*, *Homo habilis* and the australopithecines, relating something of their history and our way of understanding that history. He then moves to the first instance of a "rendezvous" with "the common ancestor"--in this case, the ancestor humans share with the chimpanzees, our nearest living relatives. Thereafter, Dawkins recedes to the second rendezvous, where the human and chimp lines merge with that of the gorilla. There he recounts "The Gorilla's Tale," the story of the discovery of that shy but massive creature in the 19th century. Dawkins then successively regresses first to the ancestor that humans, chimps and gorillas share with the orangutans, then to the ancestor those four species share with the gibbons, and so on. Each rendezvous point takes the reader back through long stretches of geological time, repeatedly seeking the common ancestor--or "concestor," in Dawkins's confection--of a steadily growing group of "pilgrims" ever more remote from human beings. These fellow travelers include marsupials, amphibians, sea squirts, sponges, plants and eubacteria. The journey ends at the metaphorical Canterbury--the first breath of life, the first kind of replicating molecule.

The Chaucerian framing device, which takes the reader back through some 40 rendezvous points and more than 50 tales, has a friendly intention. Yet it forces Dawkins to assign to creatures some very odd and only very loosely connected stories--the cauliflower's tale, for instance, is about scaling relations of body size to brain size and metabolic rates. The tale is plain and easily digested, but a weary traveler at rendezvous 36 might crave something more enticing. The concestors we meet along

the way take on an ever more ecto-plasmic existence, finally becoming barely imagined creatures that have left little trace in the historical record or in Dawkins's book.

A second criterion of good science writing is intelligibility. The Ancestor's Tale fulfills it admirably. Dawkins writes clearly, keeping jargon to a minimum, and the book is replete with helpful illustrations. He is usually careful about explaining the specialized concepts he does introduce, presupposing only a modest amount of knowledge.

However, clarity must be considered at two levels. Gould was a master of the larger units--the paragraph, the article and the book (at least the earlier books). But his sentences, especially in later years, suffered from pathological growth. They slithered this way and that, twisting and turning back on themselves and then continuing on in a different direction. They lacked editorial pruning or even the appearance of having been given a second thought. Dawkins writes in a much more controlled and forceful way. His sentences bear his thoughts economically and sturdily. And the tales of his creatures are individually interesting and clear. But the cumulative effect of quite diverse topics that are only very loosely associated builds, if not to a decided confusion, at least to a mild irritation and a certain disorientation.

For instance, at rendezvous 10 we find the mouse's tale, describing the operation of the genome, and the beaver's tale, which happily summarizes Dawkins's early book *The Extended Phenotype*. When the reader reaches rendezvous 16, where the mammals and mammal-like reptiles meet the sauropsids (which include the dinosaurs and their living descendants, the birds), four tales are spun out: the Galapagos finch's tale, the peacock's tale, the dodo's tale and the elephant bird's tale. These deal, respectively, with contemporary research on morphological divergence; sexual selection from Darwin and Alfred Russel Wallace to Dawkins's memes; the history of the dodo and wing loss; and finally, the breakup 150 million years ago of Gondwana (the conglomeration of several now-separated continents and other landmasses). The overall logic of when a tale gets told and to what species it is assigned is hardly apparent. At times you know that Dawkins just needed some damned creature--even a cauliflower--to hang a tale upon.

Another mark of popular science writing is a level of intimacy with the reader. Professional books and articles usually bleed out the personal, replacing it with layer upon layer of passively rendered sentences and impersonal constructions. The first edition of Darwin's *Origin of Species* has the first-person pronoun sprinkled through almost every paragraph: "I think we are driven to conclude," "I am strongly inclined to suspect," "I may add," and so forth. By the sixth edition, however, those "I"s have been driven out by Darwin's growing sense of what objective science should look like. Gould is always present in his essays and books, overbearingly so in his later work. Dawkins's "I" makes an appearance in virtually every tale in this book, without, however, producing any irritation or feeling of intrusion--even when, for example, in the midst of a discussion on the biogeography of New World monkeys, he drops in a short disquisition on the probability of nuclear disaster, given the limited extent of our president's intelligence.

These personal asides and observations give his book a comfortable, inviting feeling and a quite individual cast.

Popular science books usually have a range that exceeds the specialized research of the scientist writer. Dawkins is quick to indicate his borrowing of ideas and theories from other professionals. On several of the tales he lists his research assistant Yan Wong as joint author. Dawkins's explicit references to other authors to whom he owes a debt have the added function of identifying some of the major contributors to contemporary evolutionary theory.

Most popular science books, at least those written by scientists, are built on fairly prominent sociopolitical and metaphysical foundations. Gould's sociopolitical views wore the guise of Marxism in a J. Press work shirt. He disdained the idea that individuals were born with genetic chains that held them in thrall to predetermined slots in life. Brain and consequent behavior, he believed, revealed a flexibility that belied any of the sorts of determinism supposed by evolutionary psychologists. Moreover, evolutionary development, as Gould conceived it, was radically contingent; what was done could, at any geological moment, be undone. Thus interpretations that supposed a progressive evolution of creatures over long periods could only be artifacts of misapplied statistics or conservative political assumptions. Although Gould rejected determinism from below, he did allow that larger forces from above--for example, selection at the species level--might shape the course of evolution, producing a gentle sway of the atoms of life.

Dawkins's sociopolitical beliefs are fairly evident, as he takes well-aimed shots at the current U.S. administration. In these attitudes he seems to differ little from Gould or the majority of liberal-minded academics, being perhaps only a bit more expressive than most. At a deeper level, however, his metaphysical views are quite distinct from Gould's and also from those of a large segment of the biological community. In his disturbing book *The Selfish Gene*, Dawkins portrays biological individuals as being merely vehicles driven from below by genes fixed on their own perpetuation. Human beings are not merely chained to their genomes, they are hollow men whose slightest feelings, passing notions and stumbling actions are cranked out by evolutionary machinery put in place long ago by natural selection. Dawkins, both in that book and in this one, certainly recognizes that phenotypes are not simply manufactured out of individual genes alone; rather, epistatic and environmental interactions must be part of the causal matrix producing manifest structures and behaviors. In *The Ancestor's Tale*, the genetic cogs and wheels, although they are not the focus of attention, propel many discussions on such topics as the way to determine phylogenetic relatedness and speciation events.

Most good popular science books and articles have a provocative, if not a polemical, character. They don't just convey information about scientific subjects, they argue a point of view. They urge the adoption of the author's sociopolitical or metaphysical positions and bring the science to support these deeper attitudes. Dawkins has never been shy about making such arguments: They often lie close to the surface of his writing. In this book, the very framework of a religious pilgrimage allows him to suggest that Darwinism offers a more reliable set of beliefs, better supported by evidence, than

the ones the Canterburians were honoring. Along the way, he occasionally makes that suggestion more explicit. But the most provocative feature of his book comes in the last chapter. There the opposition is not the Biblical literalist or even the postmodern equivalent, the Intelligent Designer; it is the shadow of Stephen Jay Gould.

Gould liked to affirm the contingency of evolutionary development by proposing that if the tape of evolutionary history were replayed, the outcome would be quite different. The image is oxymoronic--surely if the same tape were replayed, the same outcome would be reproduced. Yet one gets his drift: History is contingent, and even the semblance of progress would likely disappear the second time around.

Dawkins reaches a different conclusion, although not with startling or sterling argument. He points out that constant physical constraints on evolutionary development--gravitation, light, change of seasons, resources and the like--narrow the possibilities of organic evolution considerably. Moreover, the history of evolution shows patterns of reinvention, of convergence: The eye has evolved independently some 40 to 60 times in evolutionary history. This fact suggests that if the same physical environment recurred, roughly the same sort of biological outcome could be expected. (And of course if it were exactly the same physical environment, then unless quantum effects played a role, you would expect exactly the same biological outcome.) Further, that outcome would have, according to Dawkins, progressive features similar to those characterizing the actual history of life. The gradual improvement in design to deal with environmental problems, as constructed by natural selection, is, he believes, virtually the definition of progress--at least of one clear kind. Dawkins, however, does not probe the concept of progress much beyond that. Neither Gould nor Dawkins seems to recognize that simply asking whether evolution has been progressive is an ill-formed question. One must first ask, Progressive according to what criterion? If size is to be the criterion, one might say that generally progress was made up to 65 million years ago, and then there was a dramatic falling off, with a gradual rise again to the modern period. Nature does not provide a criterion; that has to be a human choice.

Dawkins has many fascinating and instructive tales to tell, tales that individually mark him a superb writer of popular science. Yet great diversity, although it is the fuel for evolutionary history itself, can be something of a liability in the description of that history.