

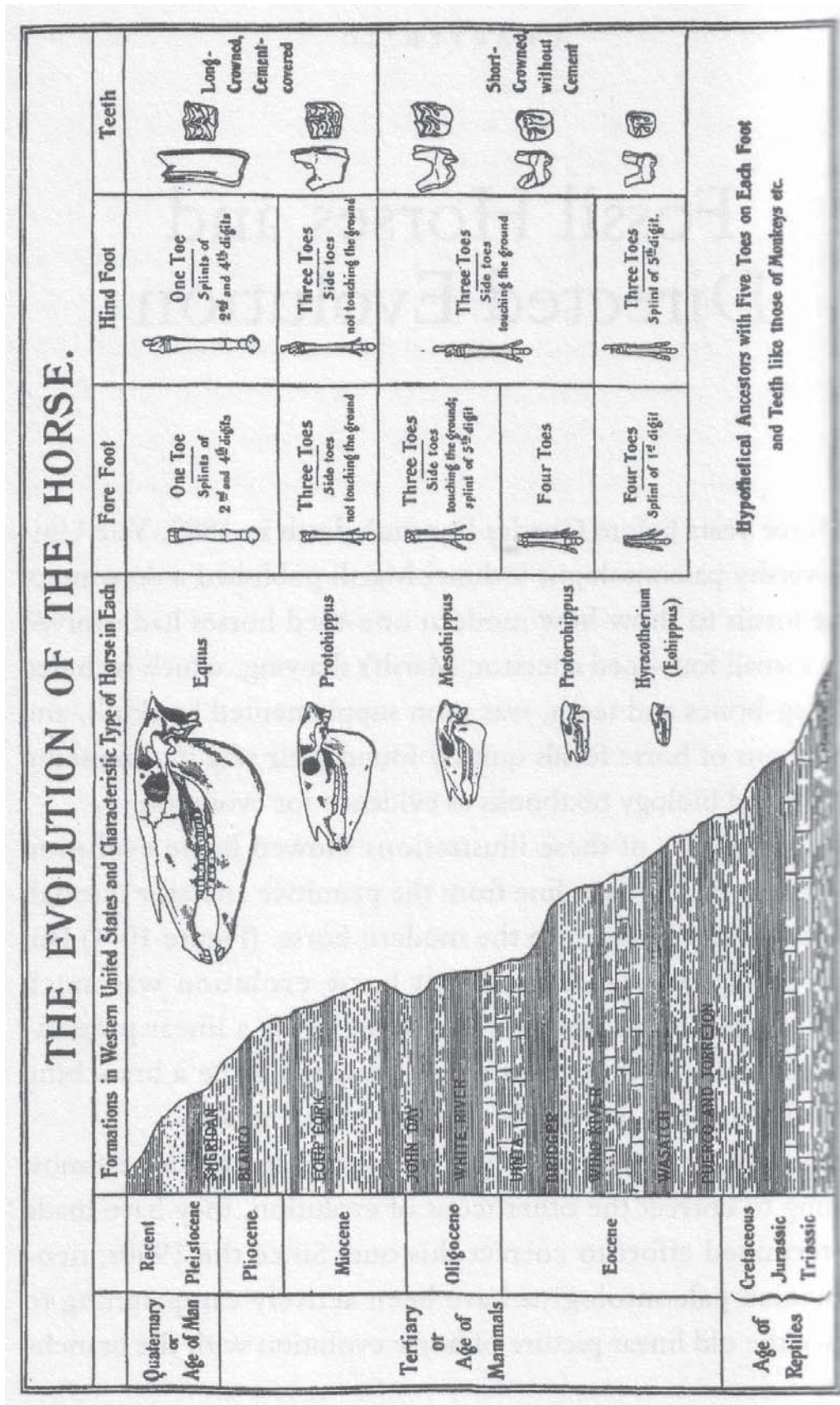
## CHAPTER 10

# Fossil Horses and Directed Evolution

Three years before Charles Darwin's death in 1882, Yale University paleontologist Othniel Marsh published a drawing of horse fossils to show how modern one-toed horses had evolved from a small four-toed ancestor. Marsh's drawing, which included only leg-bones and teeth, was soon supplemented by skulls, and illustrations of horse fossils quickly found their way into museum exhibits and biology textbooks as evidence for evolution.

Early versions of these illustrations showed horse evolution proceeding in a straight line from the primitive ancestor through a series of intermediates to the modern horse. (Figure 10-1) But paleontologists soon learned that horse evolution was much more complicated than this. Instead of being a linear progression from one form to another, it appeared to be a branching with most of its branches ending in extinction.

Although advocates of Darwinian evolution have done almost nothing to correct the other icons of evolution, they have made a determined effort to correct this one. Since the 1950s, neo-Darwinian paleontologists have been actively campaigning to replace the old linear picture of horse evolution with the branching tree.



**FIGURE 10-1** The old Icon of horse evolution.

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Drawings such as this one (created in 1902) used to be common in museum exhibits and biology textbooks, and can still be found in some places today. The two oldest members of the series, Hyracotherium and Protorohippus, had four toes on their front feet; the next two members, Mesohippus and Protohippus, each had three; and Equus, the modern horse, has one.

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The reason for their campaign, however, is more interesting than the horse icon itself. People used to regard the old icon as evidence that evolution was directed, either supernaturally or by internal vital forces. Neo-Darwinists now ridicule directed evolution as a myth, and cite the new branching-tree arrangement of horse fossils as evidence that evolution is undirected.

But the doctrine of undirected evolution is philosophical, not empirical. It preceded all evidence for Darwin's theory, and it goes far beyond the evidence we now have. Like several other Darwinian claims we've seen, it is a concept masquerading as a neutral description of nature.

*Fossil horses and orthogenesis*

Most evolutionists who were Darwin's contemporaries believed that evolution was directed. Some regarded human beings as the divinely pre-ordained goal of the evolutionary process, while others saw evolutionary trends as directed by forces inherent in organisms themselves. Those forces might be vital principles, or simply built-in constraints that channeled evolution in particular directions. The view that evolution was directed by internal forces or constraints became known as "orthogenesis (from the Greek words for "straight" and "origin").

Orthogenesis was especially popular among paleontologists, because there are many trends in the fossil record that it seemed to explain. The most famous of these was the horse progression. In 1950 German paleontologist Otto Schindewolf wrote that "excellent examples of orthogenetic courses of events are provided by the progressive reduction of digits," and this process "is best and most completely known in the evolution leading to the modern horse." Schindewolf attributed orthogenesis to mechanisms inherent in the organism, rather than a supernaturally ordained goal. "It is not the conceptual final point but the concrete starting point," he explained, "that determines and brings about the orientation of evolution. Such a view can be based on actual, causative mechanisms."

But the causative mechanisms to which Schindewolf referred were never found. Meanwhile, neo-Darwinists were claiming they could explain evolution in terms of natural selection acting on random genetic mutations. Although the neo-Darwinian mechanism had not been shown to produce anything like horse evolution, it was at least clearly defined. In 1949 American paleontologist George Gaylord Simpson (one of the architects of neo-Darwinism) wrote: "Adaptation has a known mechanism: natural selection acting on the genetics of populations...It is not quite completely understood as yet, but its reality is established and its adequacy is highly probable." Thus "we have a choice between a concrete factor with a known mechanism and the vagueness of inherent tendencies, vital urges, or cosmic goals, without known mechanism."

So orthogenesis lacked a mechanism. It also seemed to become less plausible when new evidence led to a revised picture of horse evolution.

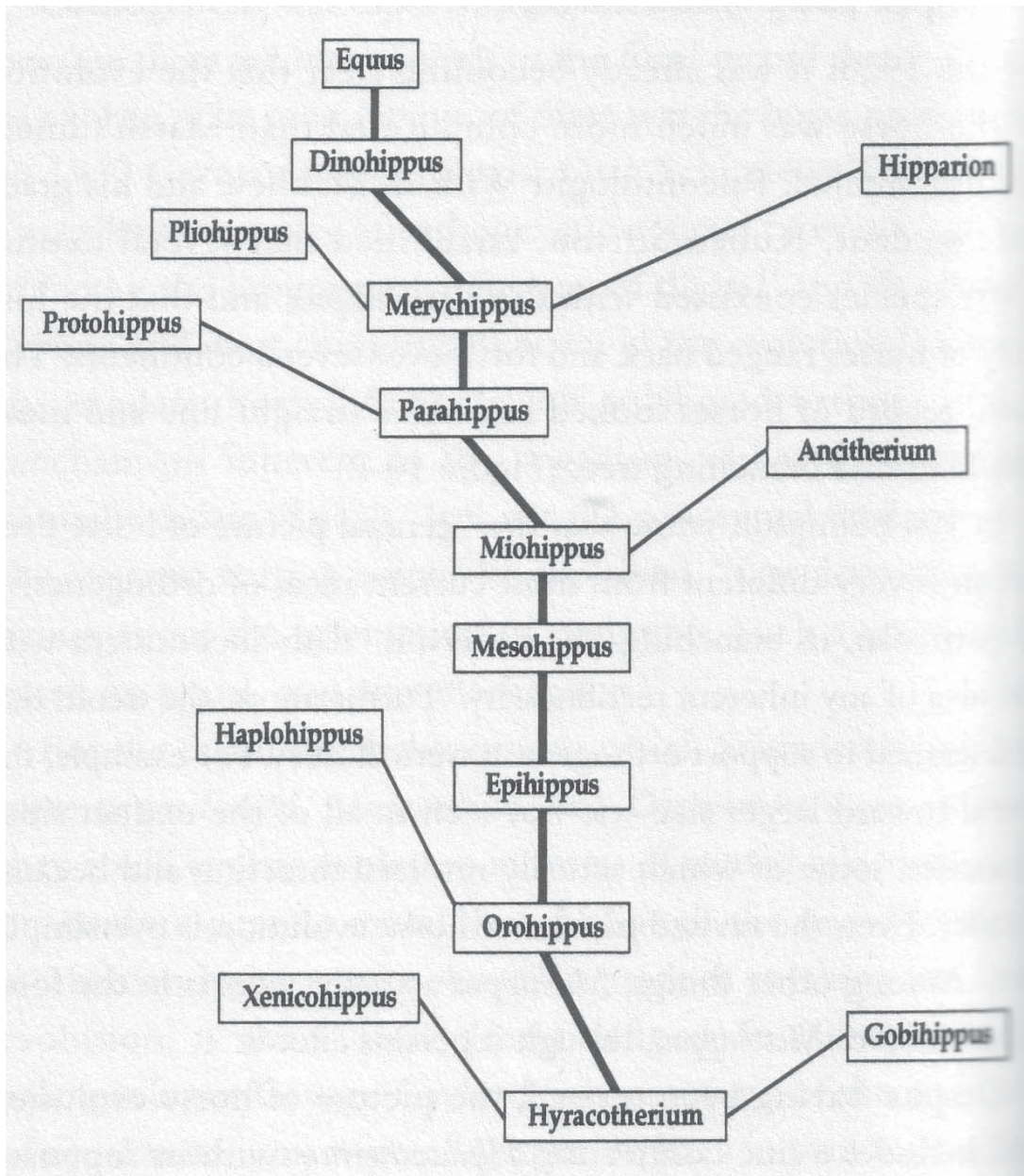


### *Revising the picture of horse evolution*

By the 1920s it was already becoming clear that the evolution of the horse was much more complicated than Marsh's linear picture implied. Paleontologist William Matthew and his graduate student, Ruben Stirton, established that several extinct horse species coexisted with the *Protohippus*, and that the history of horses ranged back and forth over several continents. The fossil record of horses looked less like a straight line and more like Darwin's branching tree. (Figure 10-2)

In 1944 Simpson wrote that the "general picture of horse evolution is very different from most current ideas of orthogenesis." In particular, its branching-tree pattern is "flatly inconsistent with the idea of any inherent rectilinearity." Furthermore, the trends that had seemed to support orthogenesis were illusory. For example, the trend toward larger size was not seen in all of the extinct side-branches, some of which actually reversed direction and became smaller. Even the revised picture of horse evolution is oversimplified. Among other things, *Miohippus* actually appears in the fossil record before *Mesohippus*, though it persists after it.

Despite having been revised, the picture of horse evolution still includes a line connecting *Hyracotherium* with its supposed descendants, all the way up to the modern horse. Ironically, this very Darwinian line of ancestor-descendant relationships still presents a problem for neo-Darwinists like Simpson, because it is «consistent with directed evolution as the linear series in the old icon. The mere existence of extinct side-branches doesn't rule out the possibility that the evolution of modern horses was directed. A cattle drive has a planned destination, even though some steers might stray from the herd along the way. Or, to use another analogy, the branching pattern of arteries and veins in



**FIGURE 10-2 The new icon of horse evolution.**

Two of the fossils shown in the old version, *Hyracotherium* and *Mesohippus*, are still considered to be in the line leading to modern horses, but *Protorohippus* has been dropped, and *Protohippus* is regarded as an extinct side-branch. Only a few of the many other extinct side-branches are shown here. Note that although the new pattern is not linear, it still shows a continuous lineage connecting *Hyracotherium* with the modern horse (heavy line).

the human body has some randomness to it, but our very lives depend on the fact that the overall pattern is predetermined.

This doesn't prove that directed evolution is true, but only that a branching-tree pattern in the fossil record doesn't refute it. A straight line and a branching tree are equally consistent (or inconsistent) with the existence (or non-existence) of either a predetermined goal or an inherent directive mechanism. In other words, even if we knew for sure what the pattern was, that alone would not be sufficient to establish whether or not horse evolution was directed.

*What does the evidence really show?*

Although the fossil pattern, by itself, does not refute directed evolution, it does seem to refute orthogenesis—if orthogenesis is taken to imply a straight line with no branches. But in the process of criticizing orthogenesis, Simpson made it clear that there was more at stake than straight-line evolution.

One thing at stake was the theory of inner forces or constraints. A mechanism was needed, and neo-Darwinists succeeded in persuading most biologists that theirs was the best—if not the only—candidate. But Simpson was criticizing even more than straight-line evolution and internal forces or constraints. By tacking "cosmic goals" onto the theory he was attacking, Simpson tried to strike a blow against the idea that evolution tends to follow some sort of pre-established plan.

If the whole of evolution were really the product of natural election acting on random mutations, as neo-Darwinists claim, perhaps it would be legitimate to conclude that evolution is undirected in this cosmic sense. If peppered moths and Darwin's finches are our best evidence for natural selection, however, and

the four-winged fruit fly is our best example of a morphological mutation, then neo-Darwinists are very far from proving their case. They don't have anywhere near enough evidence.

But the rejection of goal-directed evolution was around long before the fossil record of horses was revised, and long before neo-Darwinists proposed random genetic mutations and natural selection as the mechanism of evolutionary change. In fact, it was around before Othniel Marsh drew his picture of straight-line horse evolution in the 1880s.

### *Undirected evolution from Darwin to Dawkins*

In Charles Darwin's view, the process of evolution by natural selection excluded designed results. He wrote: "There seems to be no more design in the variability of organic beings, and in the action of natural selection, than in the course which the wind blows." Darwin did not exclude design entirely, since the laws of nature—including the law of natural selection—might have been supernaturally designed. But he believed that survival of the fittest, acting on random variations, was inherently undirected, and thus could not produce designed results. He wrote that he was "inclined to look at everything as resulting from designed laws, with the details, whether good or bad, left to the working out of chance."

Darwin's view that evolution was undirected was not inferred from biological evidence. Natural selection had not yet been directly observed, and the nature and origin of variations was unknown. According to historian of science Neal Gillespie, Darwin excluded directed evolution and designed results because he wanted to place science on a foundation of materialistic philosophy. Since Darwin's view was primarily a philosophical



doctrine rather than an empirical inference, its success depended less on marshalling evidence than on winning a war of ideas.

Simpsons rejection of directed evolution, like Darwin's, was a philosophical move rather than a scientific one. As Simpson put it, he favored the view that evolution "is dependent only on the physical possibilities of the situation and on the interplay of organism and environment, the usual materialist hypothesis." And he didn't limit himself to horses. Although the evidence for human evolution was (and still is) much scantier than that for horses, Simpson extrapolated his materialistic conclusion to our own species. "Man," he declared, "is the result of a purposeless and natural process that did not have him in mind."

Simpson wrote in the 1940s and 1950s, before Watson and Crick's discovery of the structure of DNA led to our current understanding of mutations as molecular accidents. By 1970 it seemed to many biologists that DNA mutations are the ultimate source of Darwin's random variations, and this seemed to confirm that evolution was undirected. When Jacques Monod announced in 1970 that "the mechanism of Darwinism is at last securely founded," he also declared: "And man has to understand that he is a mere accident."

Yet when Monod said this, the only beneficial DNA mutations known to him were biochemical. There was no evidence in 1970 that DNA mutations—random or not—could provide raw materials for morphological evolution. In other words, Monod—like Darwin and Simpson—was going far beyond the evidence in claiming that human beings are "a mere accident." Once again, the claim was philosophical rather than empirical.

This tendency to promote materialistic philosophy in the guise of biological science has continued. Oxford zoologist Richard Dawkins, as dogmatic a Darwinist as one might expect

to find, is an outspoken apostle of what he calls "the blind watchmaker."

### *The blind watchmaker*

Richard Dawkins's views on design in living things and direction in evolution are expressed most clearly in his 1986 book, *The Blind Watchmaker*. The book got its name from an argument made famous in the early nineteenth century by William Paley. "In crossing a heath," Paley wrote in 1802, "suppose I pitched my foot against a stone, and were asked how the stone came to be there." Paley answered that for all he knew, the stone might have been there forever. "But suppose I had found a watch upon the ground," Paley continued. Like any reasonable person, he would say that the watch had been made by a watchmaker.

For Paley, living things were like watches in their complexity and adaptiveness, so he argued that they must be designed. For Charles Darwin and Richard Dawkins, however, living things only *appear* to be designed. In fact, Dawkins defines biology as "the study of complicated things that give the appearance of having been designed for a purpose."

How does Dawkins know that design in living things is only apparent? Because, he says, natural selection explains all the adaptive features of living things, and natural selection is undirected. "Natural selection, the blind, unconscious, automatic process which Darwin discovered, and which we now know is the explanation for the existence and apparently purposeful form of all life, has no purpose in mind.... it is the *blind* watchmaker."

Although the subtitle of Dawkins's book is "Why the evidence of evolution reveals a world without design," it turns out that he actually excludes design on philosophical grounds. As he

writes in his preface: "I want to persuade the reader, not just that the Darwinian world-view happens to be true, but that it is the only known theory that could, in principle, solve the mystery of our existence." And he repeats this claim in his concluding chapter: "Darwinism is the only known theory that is in principle *capable* of explaining certain aspects of life." (emphases in the original)

But claiming that a theory is true "in principle" is the hallmark of a philosophical argument, not a scientific inference. The latter requires evidence, and as Dawkins himself admits, evidence is unnecessary to prove the truth of Darwinism.

If Dawkins were making a scientific inference, he would have to have better evidence than computer simulations (the main "evidence" he provides in his book). He would need real evidence from living things. Yet, as we have seen throughout the preceding chapters, the real evidence for Darwin's theory is surprisingly thin. It appears to be overwhelming only because it is greatly exaggerated and sometimes blatantly misrepresented by certain proponents of Darwinian evolution. If there is anything about living things that is mere appearance, it is the alleged "evidence" that natural selection explains the existence and form of all life.

So Dawkins's exclusion of design and purpose is philosophical, not empirical. This is obvious not only from the insufficiency of the evidence, but also from the "in principle" form of his argument. It is also clear from the motivation that apparently underlies it. As Dawkins states early in his book, "Darwin made it possible to be an intellectually fulfilled atheist."

Now, Professor Dawkins has a right to profess atheism. He even has a right to make it intellectually fulfilling. But atheism is not science.

*Teaching materialistic philosophy in the guise of science*

There is nothing wrong with having philosophical views. Everyone does, whether they admit it or not. In public education, however, there is a reasonable expectation that philosophy be clearly identified as such, and not disguised as science. Certainly no philosophical view of human nature should be taught as though it were on a par with Newtonian physics or Mendelian genetics. Yet that is exactly what American public schools are doing in biology classrooms.

As we have seen, the doctrine that evolution was undirected, and consequently that human existence is a mere accident, is rooted in materialistic philosophy rather than empirical science. The doctrine existed long before the meager evidence now cited to justify it. Since the doctrine is very influential in our culture, it is a good idea to teach students about it—but as philosophy, not science.

Yet Miller and Levine's high school textbook, *Biology*, teaches students that as they learn about "the nature of life" they must "keep this concept in mind: *Evolution is random and undirected*." (emphasis in the original) College students using *Life: The Science of Biology*, by Purves, Orians, Heller and Sadava, read that the Darwinian world view "means accepting not only the processes of evolution, but also the view that... evolutionary change is not directed toward a final goal or state."

Campbell, Reece and Mitchell's *Biology* treats students to an interview with Richard Dawkins, who tells them: "Natural selection is a bewilderingly simple idea. And yet what it explains is the whole of life, the diversity of life, the complexity of life, the apparent design of life," including human beings, "who are fundamentally not exceptional because we came from the same



evolutionary source as every other species. It is natural selection of selfish genes that has given us our bodies and our brains." But our existence was not planned, because natural selection is the blind watchmaker, "totally blind to the future."

Students who have moved beyond introductory biology to study evolution in greater detail might find themselves reading Douglas Futuyma's textbook, *Evolutionary Biology*. According to Futuyma, Darwin's "theory of random, purposeless variations acted on by blind, purposeless natural selection provided a revolutionary new answer to almost all questions that begin with 'Why?'" The "profound, and deeply unsettling, implication of this purely mechanical, material explanation for the existence and characteristics of diverse organisms is that *we need not invoke, nor can we find any evidence for, any design, goal, or purpose anywhere in the natural world, except in human behavior.*" (emphasis in original) Futuyma goes on to explain that "it was Darwin's theory of evolution, followed by Marx's materialistic (even if inadequate or wrong) theory of history and society and Freud's attribution of human behavior to influences over which we have little control, that provided a crucial plank to the platform of mechanism and materialism" that has since been "the stage of most Western thought."

Clearly, biology students are being taught materialistic philosophy in the guise of empirical science. Whatever one may think of materialistic philosophy, there is no doubt that it is being imposed on the evidence rather than inferred from it. And this in the real significance of neo-Darwinian efforts to revise the picture of horse evolution. Although there are scientific issues involved, what really matters is the myth.