

Part One:

A HISTORY OF

EVOLUTION

*Friends & Foes: A Scientific Idea is Born and
Explored by all Disciplines*

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Chapter 1

Early Evolutionists in the Debate: The Birth of the Idea

Overview

In this chapter we will explore how an argument of vertebrates vs. invertebrates in 1830s France, 29 years before the publication of *The Origins of Species*, began the Evolution Wars that continue today and remain hotly debated by 21st century academics, religious believers and political leaders. This chapter primarily discusses the life and work of four scientists who not only started the debates, but also set the stage for the wars to continue—Erasmus Darwin, Jean Baptiste de Lamarck, George Cuvier, and Etienne Geoffroy Saint-Hilaire.

Whereas later debates focus heavily on religion vs. science, these early scientists were exploring, debating and disagreeing on evolution with both sides having strong religious beliefs. Early evolutionists like Erasmus Darwin were neither agnostics nor atheists. They tended to be deists, that is, to believe in God as a supreme being who created the physical universe, but who doesn't intervene in its operation. Their God works through unbroken law and there is no need of miracles. Evolution, for them, therefore supports rather than detracts from the belief in God.

Because theorists in the early Evolution Wars did not necessarily see evolution in conflict with their religion, the early debates did not focus on religion vs. science, but on three aspects of evolution itself: There is the very *fact* of evolution: the slow, natural development of all organisms, living and dead, from simple, shared forms, perhaps ultimately from inorganic materials. There is the *path* of evolution: what direction did evolution take; are the birds for instance, descended from the dinosaurs? Then there is the *mechanism* or *cause* of evolution: what drives the process of change?

Charles Darwin's grandfather, late-eighteenth-century English physician Erasmus Darwin was an early evolutionist. What really drove him, rather than any empirical facts, was The Social Doctrine of Progress, the belief that through our unaided (by God) effort we can improve science, technology, and life generally, as evidenced by the Industrial Revolution.

The late-eighteenth-century and early-nineteenth-century botanist and zoologist, French minor aristocrat Jean Baptiste de Lamarck, was the first to write a systematic account of evolution. Like Erasmus Darwin, he too was a deist who believed in progress (hence his success, despite his noble status, during the Revolution). He laid on this the belief that acquired characteristics (like the long neck of the giraffe) can be inherited through parts that respond to use and disuse. This mechanism, known as “Lamarckism,” fell out of favor as the modern theory of evolution began to take hold.

The great, early-nineteenth-century French comparative anatomist Georges Cuvier was skeptical about the progress theory. He was a practicing Christian (a Protestant) who disliked the deistic notion of God. Further, he had empirical evidence against evolution, citing the unchanged, mummified animals Napoleon’s scientists had brought back from Egypt. But his main objection to evolution was that he could not see that tightly designed, well-functioning organisms that he explored as an anatomist could gradually change from one form to another. To him, this meant that a midpoint organism would be literally neither fish nor fowl and hence could not exist and reproduce.

Cuvier and his one-time friend, another early-nineteenth-century French comparative anatomist, Etienne Geoffroy Saint-Hilaire, clashed over the possibility that there might be connections or significant similarities between vertebrates and invertebrates. To accept these connections also meant accepting the very *fact* of evolution mentioned earlier. This famous clash of two titan personalities in the 19th century European scientific community is the first battle in the Evolution Wars that we will explore.

The Role of the Scientific Community

The work of the following scientists is discussed in this chapter. Short, biographical essays of these individuals appear in **Biographies** on page 607.

Erasmus Darwin (1731–1802)

Jean Baptiste de Lamarck (1744–1829)

Georges Cuvier (1769–1832)

Etienne Geoffroy Saint-Hilaire (1772–1830)

Setting the Stage

It was 1830 and Georges Cuvier was angry. And when Cuvier, the most powerful scientist in France, was angry, he was really livid. Pompous too. And very dangerous. He knew more than anyone else, and he set the standards and judged the results (Coleman 1964). You crossed him at your peril. For thirty years now he had been listening to this stupid, unfounded, dangerous nonsense from his fellow scientists. First there had been Jean Baptiste de Lamarck, and now when finally Lamarck had died and peace was in the offering, Etienne Geoffroy Saint Hillare—an old friend and a man who should have known much better—had taken up the cudgels and was promulgating the same detritus of the intellectual world, pseudoscience if ever there was such a thing. Action had to be taken. No longer could this be a civilized debate between savants of the same stature and learning. Things had to go public (Appel 1987).

No better forum could be found than the chief learned scientific society of France, the Academie des Sciences, of which both Cuvier and Geoffroy were members, and where indeed Cuvier was a Permanent Secretary, one of the chief positions of power and authority. Yet as so often happens when things explode after many years of provocation, the ostensive topic of debate was very minor and arcane. In October 1829, two unknown naturalists, Pierre-Stanislas Meyranx and a Monsieur Laurencet—a man so obscure that no one today knows his first name!—had submitted a memoir to the Academie on the subject of molluscs, a well-known group of marine invertebrates, that is, animals without backbones. They argued that there are significant similarities between the molluscs—they took the cuttlefish as a typical example—and the vertebrates, that is, animals with backbones. At least they argued—for nothing in this world is simple and straightforward—that if you bend a vertebrate backward in a bow, so that its head is virtually sticking up its butt, then you can see similarities. Geoffroy (as a member of the Academie) was asked to make a report on their claim, and his response came in very positively. Rubbing salt into open sores, he quoted (without identifying either source or author) an old paper of Cuvier's that denied forcefully that there could be any similarities between vertebrates and invertebrates. Now, claimed Geoffroy, we see that this kind of zoology is outdated and unneeded.

Incandescent with rage—so much so that the unfortunate authors of the memoir wrote earnestly to Cuvier, denying that their work had any implications whatsoever or that they intended in any way to contradict “the admirable work that you have written and that we regard as the best guide in this matter” (Appel 1987, 147)—Cuvier held forth before the Academie, with charts and tables showing that similarities are absent and that only the truly deluded could think otherwise. At which point, realizing that the best form of defense is attack and that Cuvier had forgotten far more about the invertebrates than he could ever learn, Geoffroy switched topics, arguing now that real similarities across species could best be discerned within the vertebrates (rather than across the verte-

brate/invertebrate line). Now his point of argument was focused on the bones in the ears of humans and cats, which although different in size, shape, and number were (according to Geoffroy) essentially similar. Again Cuvier responded, and again his arguments were mixed with scorn and derision. Define your terms, he thundered at Geoffroy. “If our colleague had made a clear and precise response to my requests, that would be a fine point of departure for our discussion.” Unfortunately, all he does is introduce one airy-fairy philosophical construction after another. All words and no substance. “It is to say the same thing in other terms, and in much more vague, much more obscure terms” (p. 150).

And so the debate went back and forth, with Geoffroy bobbing and weaving, always changing ground. Chasing him round the ring was Cuvier, flailing away, every now and then landing a good hard punch but never able to strike his opponent on the chin and end the contest. Finally, the fight petered out, with the contestants threatening their opponents with long series of justificatory memoirs. But not before the audience had had a wonderfully good time. Including the aged poet Johann Wolfgang von Goethe, who exclaimed to a friend, “The volcano has come to an eruption, everything is in flames”—an event that he saw as being “of the highest importance for science” (Appel 1987, 1).

But, even accounting for poetic license, could this really be so? An event “of the highest importance for science”? Are we truly talking about the same things: the similarities between a cuttlefish and a vertebrate bent backward until it resembled nothing so much as a participant in a prerevolutionary Cuban sex show? The bones in the ears of humans and of cats? Who cares? Or rather, since some obviously did care, why should we care? To answer these questions, we must go back a hundred years and start our story: then we shall see why it was that two distinguished French scientists did hammer it out in the spring of 1830, to the joy of onlookers then and of historians ever since.

Essay

Defining Evolution

We must not fall into the same trap that Cuvier accused Geoffroy of falling into. We must be careful to define our terms. At least, we must be careful to define one particular term. I realize that at this point you will probably start to groan and fear that I have forgotten already what I said at the end of the Prologue about my duty to be interesting and informative. You will find that I am a professional philosopher, and you will remember that someone once told you that the trouble with philosophers is that they are obsessed with language. They get hold of an important problem, start defining and redefining the pertinent terms, turning them upside down and inside out, and then they end up by announcing triumphantly that there was no genuine problem to begin with!



Georges Cuvier

I cannot deny that there is some truth to this. But terms and language are important, and unless one does take care one can waste an awful lot of time. I expect many of us have gotten into heated arguments about the existence of God, only to find at the end that we are arguing completely at cross purposes. The atheist is denying a God who looks a little bit like Santa Claus in a bed sheet, sitting on a cloud surrounded by angels with wings. The Christian is asserting a God who is the ground of our being or some such thing. The Christian would be appalled to learn that he or she is supposedly defending the odd entity that the atheist is denying. The atheist has never really thought seriously about the being that the Christian is affirming.

So, without further apology, let me turn to the term that is going to be at the heart of this book: *evolution*. And let me tell you that, traditionally, there are three things to which the term *evolution* applies (Ruse 1984). First, there is what we might call the very *fact* of evolution. By this is meant the idea that all organisms—you and I, cats and dogs, cabbages and kings, living and dead—are the end result of a long process of development, from forms vastly different. Usually it is thought that the original forms were very simple and today's forms are rather complex—some of them at least—and that everybody and everything is related in some form through descent. We shall see, however, that there are variations on this. Usually it is also thought that if you go back far enough then you pass from

Chronology

1543	<i>De Revolutionibus Orbium Coelestium</i> (<i>On the Revolutions of the Celestial Spheres</i>) by Nicholas Copernicus	1838	Charles Darwin discovers natural selection
1660	Francesco Redi shows that the maggots of flies are generated only in putrefying meat exposed to air	1844	<i>Vestiges of the Natural History of Creation</i> by Robert Chambers (published anonymously)
1687	<i>Philosophiae Naturalis Principia Mathematica</i> by Isaac Newton	1850	<i>In Memoriam</i> by Alfred Tennyson
1749	First volume of <i>Histoire naturelle, générale et particulière</i> by Georges Louis Leclerc (Comte de Buffon)	1856	Neanderthal remains discovered
1735	<i>Systema Naturae</i> by Carolus Linnaeus	1858	Alfred Russel Wallace sends essay on natural selection to Charles Darwin
1789–1799	French Revolution	1859	<i>On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life</i> by Charles Darwin
1794–1796	<i>Zoonomia</i> by Erasmus Darwin	1860	Bishop Samuel Wilberforce and Thomas Henry Huxley clash at the British Association for the Advancement of Science
1798	<i>An Essay on the Principle of Population</i> by Thomas Robert Malthus	1861–1865	American Civil War
1802	<i>Natural Theology; or, Evidences of the Existence and Attributes of the Deity</i> by Archdeacon William Paley	1862	Louis Pasteur crushes idea of spontaneous generation
1809	<i>Philosophie zoologique</i> by Jean Baptiste de Lamarck	1863	<i>Evidence as to Man's Place in Nature</i> by Thomas Henry Huxley
1809	Birth of Charles Darwin	1869	Founding of American Museum of Natural History
1815	Napoleon defeated at battle of Waterloo	1871	<i>The Descent of Man</i> by Charles Darwin
1817	<i>Le règne animal distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée</i> by Georges Cuvier	1876	Thomas Henry Huxley announces fossil history of horse <i>Darwiniana</i> by Asa Gray
1830	Georges Cuvier and Geoffroy Saint Hilaire clash at French Academie des Sciences	1879	<i>Principles of Ethics</i> by Herbert Spencer
1830–1833	<i>Principles of Geology</i> by Charles Lyell	1881	Opening of British Museum (Natural History)
1831–1836	Voyage of <i>H.M.S. Beagle</i>	1882	Death of Charles Darwin
1835	Charles Darwin visits Galápagos Archipelago	1900	Mendel's laws rediscovered Albert Einstein discovers relativity theory
1837	Queen Victoria comes to the throne Charles Darwin becomes an evolutionist	1901	<i>Mutual Aid</i> by Prince Petr Kropotkin Death of Queen Victoria
		1908	Hardy-Weinberg law

Glossary

ABIOGENESIS: the natural development of life from nonliving materials (traditionally applied to the spontaneous generation of life from inorganic, never-living material).

ADAPTATION: any characteristic that aids its possessor to survive and reproduce.

ADAPTATIONISM: the belief that all organic characters are indeed adaptive.

ADAPTIVE LANDSCAPE: a metaphor introduced by Sewall Wright claiming that the fitness of organisms can be mapped as if on a hilly terrain.

AGNOSTICISM: the belief that one cannot know whether or not God exists.

ALLELE: any one of a number of forms of a gene that can occupy the same place (locus) on a chromosome.

ALLOMETRY: the study of the relative growth of some parts of an organism in comparison with other parts or the whole.

ALTRUISM: help given by one organism to another, at some biological cost, for the donor's long-term reproductive advantage.

AMINO ACID: the major complex organic molecules that serve as the building blocks of proteins.

ARACHNID: an arthropod (an invertebrate with segmented body, jointed limbs, and an external skeleton) with eight legs; includes spiders and scorpions.

ARCHAEOPTERYX: an ancient bird with many reptilian features (a missing link).

ARCHETYPE: the basic building plan of a group of animals such as vertebrates.

ARMS RACE (BIOLOGICAL): members of two lines competing against each other and developing evermore sophisticated adaptations.

ASTROLOGY: the system claiming that our destinies are controlled by the configurations of the heavens.

ATHEISM: the belief that God does not exist.

AUSTRALOPITHECUS: a genus that gave rise immediately to our genus, *Homo*, consisting of animals intermediate between apelike forms and humans.

AUTOCATALYTIC: becoming ever more powerful thanks to positive feedback mechanisms.

BALANCE HYPOTHESIS: the belief that natural selection holds many different alleles or genes in a balance or equilibrium within a population.

BALANCED SUPERIOR HETEROZYGOTE FITNESS: the claim that natural selection keeps different alleles in balance or equilibrium within a population, because the heterozygote is fitter than either homozygote.

BAUPLAN: an archetype.

BIOGENESIS: the natural development of life from living materials (as in normal generation).

BIOGENETIC LAW: the claim that ontogeny, individual development, recapitulates phylogeny, the evolution of the group.