

## The Wars Over Evolution

By Richard C. Lewontin

The Evolution—Creation Struggle

by Michael Ruse

Harvard University Press, 327 pp., \$25.95

Not By Genes Alone: How Culture Transformed Human Evolution

by Peter J. Richerson and Robert Boyd

University of Chicago Press, 332 pp. \$30.00

### 1.

The development of evolutionary biology has induced two opposite reactions, both of which threaten its legitimacy as a natural scientific explanation. One, based on religious convictions, rejects the science of evolution in a fit of hostility, attempting to destroy it by challenging its sufficiency as the mechanism that explains the history of life in general and of the material nature of human beings in particular. One demand of those who hold such views is that their competing theories be taught in the schools.

The other reaction, from academics in search of a universal theory of human society and history, embraces Darwinism in a fit of enthusiasm, threatening its status as a natural science by forcing its explanatory scheme to account not simply for the shape of brains but for the shape of ideas. *The Evolution—Creation Struggle* is concerned with the first challenge, *Not By Genes Alone* with the second.

It is no surprise that Cardinal Christoph Schönborn has recently chosen the Op-Ed page of *The New York Times* to enunciate the doctrine on evolution of the new Benedictine papacy.<sup>1</sup> Political and cultural struggle over the origin of life and of the human species in particular has been a characteristically American phenomenon for a century, providing Europeans (the French in particular) with yet another example of *la folie des Anglo-Saxons*. In his essay, Cardinal Schönborn accepts that human and other organisms have a common ancestry and, by implication, that the species on earth today have evolved over a long period from other species no longer extant. That is, he accepts the historical fact that life has evolved. He distinguishes this acceptable fact of evolution from what he characterizes as the unacceptable “neo-Darwinian” theory that, in the words of the official 1992 Catechism of the Catholic Church of which he was an editor, evolution is “reducible to pure chance and necessity.” He rejects, as he must, the Newtonian notion of first cause, that at the beginning God only created a material mechanism with a few basic molecular laws and that the rest of history has simply been the consequence of this mechanism.

In the evolutionary process, he writes, there must have been “an internal finality,” the Divine plan. He calls attention to the fact that John Paul II, who endorsed the science of evolution in his 1996 address to the Pontifical Academy of Sciences, nevertheless insisted in his other writings that there must also be such a principle of finality and direction built into the material process. Such internal finality and direction cannot be omitted from the minimal Christian position. For if evolution is only the consequence of random mutations, none of which needs to have occurred, and if the subsequent fate of those mutations is subject only to the relative ability of their carriers to reproduce and to survive catastrophes of the environment that eliminate species and make room for new ones, then rational beings capable of moral choices might never have come

<sup>1</sup>“Finding Design in Nature,” *The New York Times*, July 7, 2005.

into existence. But without such beings the concept of Redemption is unintelligible. Christianity demands, at the very least, the inevitable emergence of creatures capable of sin. Without a history of human sin, there is no Christ.

Everything else is up for grabs. Neither the Vatican nor much of quite conventional Protestant theology demands that one take the story in Genesis 1 literally. Even William Jennings Bryan, famous as the prosecutor in the Scopes trial in 1925, when called as a witness for the defense, confessed that he did not much care whether God took six days or six hundred million years to create the world. Moreover, even the minimalist Christian position does not require the abandonment of the neo-Darwinian view of the mechanism of evolution. It is quite possible to argue, as some of my believing religious colleagues do, that God set the stage for evolution by natural selection of undirected mutations, but that He reserved the ancestral line destined to become human for special preservation and guidance.

What, then, is the source of the repeated episodes of active political and social agitation against the assertions of evolutionary science? One apparent answer is that it is the expected product of fundamentalist belief, which rejects the easy compromises of liberal exegesis and insists that every word in Genesis means exactly what it says. Days are days, not eons. But there's the rub. A literal reading of Genesis tells us that it took God only three days to make the physical universe as it now exists, yet nuclear physics and astrophysics claim a very old stellar system and provide the instruments for the dating of bits and pieces of the earth and of fossils spanning hundreds of millions of years. So why aren't Kansas schools under extreme pressure to change the curriculum in physical science courses? Why should physicists be allowed to propagate, unopposed, their godless accounts of the evolution of the physical universe? Something more is at stake than a disagreement over the literal truth of biblical metaphors.

One way to understand the particular vulnerability of the science of biological evolution to religious attack is to blame it on the biologists. That is the message of Michael Ruse's *The Evolution—Creation Struggle*. Ruse, a well-known philosopher of science, is not a creationist and is careful to align himself with the Darwinian explanation of the origin and evolution of species. He identifies his position on the existence of a higher power as "somewhere between deist . . . and agnosticism." That is, he is committed to giving natural explanations of natural phenomena as a methodological principle, but he is not absolutely sure that every aspect of the world is, in fact, nothing but the interactions of matter according to natural laws.

His chief quarrel is not with evolutionary biology as a technical scientific discipline, or even with its claim that the evolution of species has been a purely material process, but rather with what he calls "evolutionism," a commitment to a principle of universal long-term progress in the biological, social, cultural, and political worlds. He identifies evolutionism as a form of religion and portrays the conflict between creationism and evolutionism as a fight between two religious doctrines, a struggle between premillennialism, the doctrine that earthly perfection will only be achieved after, and as a consequence, of the Second Coming, and postmillennialism, the view that Christ will return, if at all, only after earthly paradise has been achieved. Ruse sees evolutionary biology as having been permeated by the idea of progress and so, as a rhetorical device, identifies it as "postmillennial," but without any commitment to the Second Coming.

Ruse is certainly correct that notions of progress have recurred repeatedly in evolutionary biology, especially in the nineteenth century. However, it is not the ideology of progress that has characterized evolutionary theory, not even at its nineteenth-century origins. Rather it was change, ceaseless change, that was the ideological leitmotif of a revolutionary era. Ninety years before Darwin's *On the Origin of Species*, Denis Diderot had his dreaming philosopher d'Alembert ask,

Who knows what races of animals preceded ours? Who knows what races of animals will succeed ours? Everything changes, everything passes, only the totality remains.<sup>2</sup>

Nine years before the appearance of the *Origin*, Tennyson's *In Memoriam* echoed Diderot. Is nature, while making individual death inevitable, at least careful of the type?

*So careful of the type? But no.  
From scarped cliff and quarried stone  
She cries, "A thousand types are gone:  
I care for nothing, all shall go."*

Herbert Spencer in his *Progress: Its Law and Cause* (1857) argued for change as a general phenomenon, as a "beneficent necessity," citing historical transformation in music, poetry, society, government, and language. But even Spencer defined progress in a way that accorded with contemporary changes in social and economic relations:

Leaving out of sight concomitants and beneficial consequences, let us ask what progress is in itself.

From the earliest traceable cosmical changes down to the latest results of civilization, we shall find that the transformation of the homogeneous into the heterogeneous is that in which progress consists.

What could have seemed more obvious to the mid-nineteenth-century observer than the transformation of a relatively "homogeneous" society, characterized by the "simple" agrarian life with the rural village its center, into one marked by the booming, buzzing "heterogeneous" confusion of life in industrial Manchester and London?

Darwin himself avoided implications of general progress or of directionality. It should be noted that his great work is unideologically titled *On the Origin of Species*, not *On Evolution*, and the word "evolution" nowhere appears in the first edition of that work, which thus neatly avoids, by intent or not, any implication of an unfolding of a progressive program. Equally revealing is the title of his work on human evolution, a field in which its more recent practitioners find notions of progress and directionality all too tempting. Darwin's title is *The Descent of Man*.<sup>3</sup> The theory of evolution was not a product of a commitment to progress but a reaction to a consciousness of the instability of the social structures that characterized the bourgeois revolutions and the radical changes in them. The Founding Fathers did not promise us all eventual happiness, but only the freedom to run in pursuit of it.

Despite Darwin's caution, notions of progress and directionality have indeed reappeared from time to time in evolutionary theory, especially in discussions of human physical and cultural change. However, the modern empirical science of evolutionary biology and the mathematical apparatus that has been developed to make a coherent account of changes that result from the underlying biological processes of inheritance and natural selection do not make use of a priori ideas of progress. It is true, as Ruse points out, that two of the originators of the mathematical formulation of evolutionary dynamics were ideologically committed to some form of meliorism, if not perfection. Ronald Fisher in England was an advocate of eugenics, and both he and Sewall Wright in America formulated the principle of natural selection as a process of increasing, from generation to generation, the average fitness of members of a breeding population. Yet these formulations make no predictions about a general progress of species.

<sup>2</sup>"Qui sait les races d'animaux qui nous ont précédé? Qui sait les races d'animaux qui succéderont aux nôtres? Tout change, tout passe, il n'y a que le tout qui reste." *Le Rêve de d'Alembert*.

<sup>3</sup>As compared to the book of an eminent anthropologist of the last generation, Earnest A. Hooten, *Up from the Ape* (Macmillan, 1946).

This may seem odd, since the process of natural selection is supposed to make organisms more fit for their environment. So why does evolution not result in a general increase of the fitness of life to the external world? Wouldn't that be progress? The reason that there is no general progress is that the environments in which particular species live are themselves changing and, relative to the organisms, are usually getting worse. So most of natural selection is concerned with keeping up. Certainly quite new kinds of making a living have been occasionally exploited in evolution, but every species eventually becomes extinct (99.9 percent already have) and no way of making a living will be around forever.<sup>4</sup> Judging from the fossil record a typical mammalian species lasts roughly ten million years, so we might expect to last another nine million unless, as a consequence of our immense ability to manipulate the physical world, we either extinguish ourselves a good deal sooner or invent some extraordinary way to significantly postpone the inevitable.

One of the most-cited results in evolutionary biology is the study by the University of Chicago biologist Leigh Van Valen of the longevity of Tennyson's "types." Van Valen reasoned that if there is a general increase in the fitness of organisms then the length of time between the first appearance of a kind of organism in the fossil record and its eventual extinction should increase over the long run of geological time. But that is not what has happened. He found that the average length of time from origin to extinction of an invertebrate, as measured in the fossil record, has not changed over evolutionary time. We have no evidence that this is not true for species in general. So despite natural selection, things are not getting any better over the long run. Van Valen called this phenomenon the evolutionary "Red Queen," after the character in *Through the Looking Glass* who found it necessary to run constantly just to keep up with a world that was constantly moving beneath her. Unfortunately, in real life, the Queen inevitably will tire, stumble, and be swept away.

If we accept that evolutionary biology is not, in fact, committed to progress, then we cannot accept Ruse's central contention that

in both evolution and creation we have rival religious responses to a crisis of faith—rival stories of origins, rival judgements about the meaning of human life, rival sets of moral dictates and, above all, rival eschatologies [i.e., premillenarian vs. postmillenarian].

Flowing from his view that scientific evolutionary biology can be turned into a kind of religion, Ruse is worried that the commitment to using only natural phenomena in the attempt to explain the history and variety of organisms is a "slippery slope" down which evolutionists may glide from the firm surface of hard-minded methodology, of which Ruse approves, into the slough of unreflective metaphysical naturalism. We demand that our scientific work be framed with reference only to material mechanisms that can, at least in principle, be observed in nature because any other method would lead us into a hopeless morass of uncheckable speculation that would be the end of science. But we should not, in Ruse's view, confuse that rule of conduct with a revelation of how the world really works. Maybe God is lurking out there somewhere but He doesn't leave any residue in our test tube, so we will be tempted to assume He doesn't exist.

This is a philosopher's worry that does not, as far as I can tell, correspond to the way people really acquire their views of reality. Some may have had mountaintop conversions at some point in their lives, while others experience a crisis of faith as they mature. Theodosius Dobzhansky, the leading empirical evolutionary geneticist of the

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<sup>4</sup>Indeed, life on earth is about half over. It has been around for about two billion years and from our knowledge of the changes that occur in stars, the sun will become a "red giant" destroying the earth and other planets in another two billion years or so.

twentieth century, who spent most of his life staring down a microscope at chromosomes, vacillated between deism, gnosticism, and membership in the Russian Orthodox Church. He could not understand how anyone on his or her deathbed could remain an unrepentant materialist. I, his student and scientific epigone, ingested my unwavering atheism and a priori materialism along with the spinach at the parental dinner table.

## 2.

The present struggle over evolution is often seen by defenders of Darwinism as a culture war in which creationism is a part of a general right-wing ideology that justifies an authoritarian, traditionalist society, protecting “traditional values” against assaults from social revolutionaries intent on overturning long-held moral values. It is certainly true that creationism is far more popular in the rural South, the Midwest, and the Southwest among supporters of the present Republican administration than among urban Northern Democrats. But the evolution/creation struggle has a complex history. Before World War II the science of evolution was virtually absent from school curricula everywhere in America, although explicit creationism was characteristic largely of the rural South and West. Then the atomic bomb and, later, an immense increase in the public funding of science as a response to the alarm raised by Sputnik resulted in a revolution in teaching science. With support from the National Science Foundation, evolution became a regular part of biology textbooks and science instruction in the public schools and remains so in most places.

In response, among those who had never lost their traditional fundamentalism, an active creationist reaction began, slowly accelerating to its present prominence. According to a series of polls taken over the last twenty-five years, about 50 percent of Americans believe that “God created man pretty much in his present form at one time within the last 10,000 years.”<sup>5</sup> There have been repeated recent attempts in Minnesota, New Mexico, Ohio, Pennsylvania, Arkansas, and Kansas to make the study of challenges to evolutionary biology part of the mandated public school science curriculum. These have so far not succeeded, but Kansas seems on the verge of passing a statewide requirement that a new variant of the Creation myth, “intelligent design,” be part of the discussion of evolution in public secondary schools. Intelligent design (ID) has itself been intelligently designed to circumvent legal challenges to the teaching of biblical creationism, challenges based on the constitutional requirement of a separation of church and state.

God, the Bible, and religion in general are not mentioned in the doctrine of ID. Rather, it is claimed that an objective examination of the facts of life makes it clear that organisms are too complex to have arisen by a process of the accumulation of naturally selected chance mutations and so must have been purposefully created by an unspecified intelligent designer. An alien from outer space? But the theory of ID is a transparent subterfuge. The problem is that if the living world is too complex to have arisen without an intelligent designer, then where did the intelligent designer come from? After all, she must have been as complex as the things she designed. If not, then we have evolution! Otherwise we must postulate an intelligent designer who designed the intelligent designer who . . . , back to the original one who must have been around forever. And who might that be? Like the ancient Hebrews the ID designers fear to pronounce Her name lest they be destroyed, but Her initials are clearly YWH.

The political identification of creationism with conservative politics is recent. Before World War II, rural populism in the Southwest and Midwest, motivated by resentment against politically and socially powerful Northern urban elites, included both

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<sup>5</sup>Otis Dudley Duncan and Claudia Geist, “The Creationists: How Many, Who, and Where?” *Reports of the National Center for Science Education*, Vol. 24, No. 5 (September–October 2004), pp. 26–33.

creationism and socialism. In the election of 1912, the poorest rural counties of Texas and Oklahoma and Arkansas gave more votes to Eugene Debs than did the urban populations of Chicago and New York. At the same time the best-selling weekly in America was the *Appeal to Reason*, a socialist periodical published in Girard, Kansas. So, what's the matter with Kansas these days? The shift of American populism from the left to the right is part of the history of the disappearance of the American left as a serious political force.

We see then that Christian fundamentalists have been historically inconstant in their political preferences; and their demand for a public recognition of the literal truth of Genesis has not, at least so far, included agitation against the teachings of physical science. So the campaign against evolutionary biology must be neither an integral part of the politics of the right nor the consequence of a devotion in principle to a literal reading of the Bible. How then are we to explain the continued strength of the campaign against evolution? We can do no better than to listen to the Reverend Ron Carlson, a popular preacher, lecturer, and author. He presents to his audience two stories and asks them repeatedly whether it matters which one is true. In the secular story,

you are the descendant of a tiny cell of primordial protoplasm washed up on an empty beach three and a half billion years ago. You are a mere grab-bag of atomic particles, a conglomeration of genetic substance. You exist on a tiny planet in a minute solar system . . . in an empty corner of a meaningless universe. You came from nothing and are going nowhere.

By contrast, the Christian view is that

you are the special creation of a good and all-powerful God. You are the climax of His creation. . . . Not only is your kind unique, but you are unique among your kind. . . . Your Creator loves you so much and so intensely desires your companionship and affection that . . . He gave the life of His only Son that you might spend eternity with Him.<sup>6</sup>

What is at issue here is whether the experience of one's family, social, and working life, with its share of angst, pain, fatigue, and failure, can provide meaning in the absence of a belief in an ordained higher purpose. The continued appeal of a story of a divine creation of human life is that it provides, for those for whom the ordinary experience of living does not, a seductive relief from what Eric Fromm called the Anxiety of Meaninglessness. The rest is commentary.

### 3.

At the same time that religious forces have been attempting to destroy evolutionary biology by denying its truth, a movement within academia has been attempting to make Darwinism a universal model for an understanding of history and social dynamics. This movement has two roots in the traditions of intellectual life. In their intellectual formation, natural scientists have held up before them a model of scientific work that places a powerful value on general applicability and on inclusiveness. "Great" scientists are those who, like Newton, make laws that apply universally, while lesser ones spend their lives dissecting particular phenomena. If Darwinism is to satisfy the demand for generality then it must explain not only the evolution of the physical structure of the organism but of its individual and social behavior.

At the same time natural science has increasingly provided a source of academic legitimacy for inquiry that had previously been seen as a merely impressionistic endeavor. Surely there must be laws of history rather than just a narrative of one damned thing

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<sup>6</sup>Ron Carlson and Ed Decker, *Fast Facts on False Teachings* (Harvest House, 2003).

after another. Of course there is a long tradition of attempts to find laws of history. In his *Muqaddimah*, the fourteenth-century historian Ibn Khaldun formulated quantitative laws of “universal” (i.e., Arab) history and five hundred years later Hegel lamented that the problem for the historian was not to write history but to find a general theoretical frame on which the facts can be hung. More recently the study of history and social structures has often become “social science,” with an apparatus of sample surveys and statistics. The searches for the general in the biological sciences and for legitimacy in explaining human social phenomena have converged in the creation of Darwinian models of human nature, of culture, and of history.

The first attempts at generalization, epitomized by E.O. Wilson’s *Sociobiology: the Modern Synthesis*, were simple extensions of evolutionary theory within biology to non-physical characters. A universal human nature was described, including such properties as religiosity, aggression, entrepreneurship, and conformity. Genes for these traits were postulated, and adaptive stories were invented to explain why they were established by natural selection. The credibility of these models was eventually undermined by the lack of evidence of genetic determination of such traits and by the slipperiness of attempts at trying to define the “universal” characteristics of human nature. So when I once pointed out to a sociobiologist that sane and rational human beings were willing to go to prison rather than engage in armed struggle, he replied that their resistance to the state was a form of aggression. One need not be an orthodox follower of Karl Popper to see that a theory that allows things to appear in the form of their apparent opposites when convenient is not of much value.

Naive sociobiology then gave way to evolutionary psychology, which avoids the danger of making predictions that are too specific and concerns itself with the evolution of underlying behavioral mechanisms of sexual attraction, fear of life-threatening circumstances, group cohesiveness, rationality, and so on. Such explanations, however, do not do the work that historians and sociologists require. For example, evolutionary psychology explains why babies emit piercing howls and wails when they are hungry or uncomfortable. They are helpless, and unless they can distract their parents from other concerns they will not be sure they will be fed or rescued from pain. Natural selection will then favor howling babies, since quiet ones may be malnourished or suffer injuries and so are less likely to survive.

Of course the screams of a baby can be counterproductive since parents have been known, in their frustration, to take drastic measures to quiet crying babies, even to the point of killing them. These are to be seen as pathological exceptions, however, when we take account of natural selection in favor of maternal love, since parents who injure their children will have fewer surviving offspring. While entirely plausible, such a theory does nothing to explain historical and social differences in child-rearing practices. As recently as the middle of the last century the administration of a swat on the buttocks or a rather energetic shaking was an entirely acceptable form of discipline for a recalcitrant child, but such behavior now is grounds for criminal charges of child abuse.

Evolutionary psychology also explains why all spoken languages must have certain phonemic properties in order that hearers can distinguish one word from another. The ability to distinguish similar spoken sounds is clearly of survival value. A confusion between “That animal always calls when cornered” and “That animal always kills when cornered” can lead to injury or death. What evolutionary psychology does not tell us, however, is why some people use clicks, some use rising and falling tones, why the kings of England finally came around to speaking English at home instead of French, or how the use of the periphrastic “do,” as in the replacement of phrases like “I go not” by “I do not go,” grew in the sixteenth and seventeenth centuries. Evolutionary psychology is not a theory applicable to historical change and cultural variation.

As a result, biological models of cultural change and diversity have been replaced by

pseudobiological models, using the structure of Darwinian explanation metaphorically rather than literally. Darwinism is a population-based theory consisting of three claims. First, there is variation in some characteristics among individuals in a population. Second, that variation is heritable. That is, offspring tend to resemble their biological parents more than they do unrelated individuals. In modern Darwinism the mechanism of that inheritance is information about development that is contained in the genes that are passed from parent to offspring. Third, there are different survival and reproduction rates among individuals carrying different variants of a characteristic, depending on the environment inhabited by the carriers. That is the principle of natural selection. The consequence of differential reproduction of individuals with different inherited variants is that the population becomes richer over generations in some forms and poorer in others. The population evolves.

A classic case is the evolution of mimicry in butterflies. Some butterflies taste bad to their potential bird predators and the birds quickly learn from a few revolting trials to recognize them by their wing coloration and to avoid trying to eat them. Other species of butterflies that taste good have evolved wing patterns that make them look like the nasty-tasting species, and so are also avoided by their potential predators. This evolution was possible because butterfly wing patterns are genetically variable from individual to individual. In the past, an individual butterfly that tasted good and whose wings somewhat resembled those of the uneatable species would sometimes fool a bird and be spared from predation. The offspring of this survivor would on average resemble it. Some would be lucky enough to have combinations of genes from its two parents that resulted in its looking even more like the nasty species and their lives would be even more likely to be spared. The final result of these repeated generations of selection in favor of the mimics would be the evolution of an essentially perfect mimic.

Metaphorical Darwinian models of cultural and historical behavior do not contain genes, but contain cultural variants that arise like gene mutations and that are somehow differentially propagated over time in human minds and institutions, resulting in cultural evolution. The first, rather simple formulation of such a model in 1982 by Richard Dawkins<sup>7</sup> contains elementary particles of culture, *memes*, playing the role of genes, which are propagated to greater or lesser degrees because they are more or less appealing to people. The memes might be ways of pronouncing the letter *r*, or whether the color associated with death is white or black, or whether one prefers Luther to the Pope. In this model human beings are the carriers of the cultural particles, the physical propagators of these particles through communication, and they provide the environment that determines which memes are successful.

There have been a number of more or less complex variants on this original elementary metaphor for genetic evolution and it is generally agreed that the most nuanced and sophisticated version is contained in the work of Robert Boyd and Peter Richerson, and laid out in considerable detail in *Not By Genes Alone*. The title is meant to suggest that cultural evolution is not simply like, but is part of, the entirety of human evolutionary change. The authors begin by asserting, quite correctly, that culture is part of human biology partly because evolved neural structures that underlie psychological states must have some influence on what people believe and perceive and partly because the culture creates an environment in which future physical evolution by natural selection takes place. We could not have our present automotive culture without a certain minimum of depth perception. Moreover, since automobile accidents are the leading peacetime cause of death, by far, among people of reproductive age in technologically advanced countries (about one death per one hundred persons in this age group per generation in the United States), genes that favor short reaction time to perceived danger

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<sup>7</sup>Richard Dawkins, *The Extended Phenotype: The Gene as the Unit of Selection* (Freeman, 1982).



must be increasing in our population, slowly but inexorably.

Richerson and Boyd reject the simplistic model of gene-like “memes,” but they are rather vague, as they must be, on how to recognize culture or its structure. They are aware that one aspect of culture will change in reaction to and in concert with other aspects of culture, that there is a complex network of causal dependency among parts of culture. Changes in technology, occupation, education, political attitudes, division of household labor and parental responsibility, leisure activities, and styles of speech and dress are connected as both causes and effects within and between generations.

The invention and spread of computers are the direct cause of major changes in patterns of education and leisure as books are replaced by on-line databases and computer games. They are the agents of the creation of new occupations and new methods of work, of changes in vocabulary and in volume and speed of interchange between individuals as well as the possibility that one person can communicate with large populations without the intervention and control of public media. They create the ability to purchase immediately a vast array of goods and services and to have access to a vast quantity of stored information.

All of these changes in turn feed back onto the development of further computer hardware and software, developments that amplify the effects already seen and create new forms of production, commerce, communication, and education. The difficulty that this complexity presents for making models of cultural change and diversification is that it has no clear structure. That structure has to be invented.

**I**n Richerson and Boyd’s formulation, cultural elements, ideas, tastes, languages, and attitudes are properties of individual human carriers who acquire them by a great variety of processes including conscious and unconscious imitation of others, direct teaching by parents, learning in formal educational settings, or by exposure to various forms of communication. Changes in frequency of cultural variants among specific populations occur by two basic mechanisms. First, there are biases in the transmission of cultural elements, some elements being more popular or easier to learn or simply more frequent among those from whom we acquire our culture. That might explain the spread of, for example, hard rock. Second, in a purely Darwinian mode, the carriers of some cultural variants may survive better or have more children. All other things being equal, the religious beliefs of those who oppose contraception on principle ought to be spreading like wildfire. The differential rate of reproduction and the biases in transmission are, of course, dependent on environment, but Boyd and Richerson recognize that the human environment is itself largely a consequence of culture so that cultural change is both the cause and effect of further evolution.

This model has some shortcomings. One is that much of one’s culture is not acquired from other persons. When I walk down the street in Florence I do not have to hear anyone speak or read any sign to know that I am not anywhere in America. Buildings look strange, streets look strange, things have a strange smell, people carry their bodies in an unfamiliar way. I become conscious of a culture different from my own, a culture that I acquired throughout my development simply by walking down the street and being bombarded by sense impressions. Another is that no model of cultural evolution of which I am aware takes account of power. The people of Bavaria are predominantly Catholic while Westphalians are Protestant, not because somehow Lutheranism was more appealing to northerners but because at Augsburg in 1555 the warring German princes and the Holy Roman Emperor made peace using the rule of *cuius regio, eius religio*, which allowed rulers to enforce their own religion in their own dominions and to expel those who were recalcitrant.

The most important question is why we should use a Darwinian model at all for history and culture. The population model of variation, inheritance, and different rates of reproduction has been specifically designed to explain a particular set of natural phe-

nomena that have a well-known empirical and mechanistic base. Even Darwin, who had no idea of genes or of the rules of inheritance, knew that organisms were reproduced only by other organisms, that offspring resembled their parents more in concrete physical characteristics than they resembled individuals not related to them, and that more organisms were reproduced than could survive to reproductive age. That was no guarantee that his model for evolution would have to be entirely correct because it might have turned out that there was significant inheritance of acquired characters.

Cultural evolutionists have no set of phenomena of comparable concreteness. They can't even reach an agreement on how to define and describe their objects of interest. The arguments offered by Boyd and Richerson for adopting a Darwinian model of cultural change are all epistemological: they serve an intellectual interest but cannot be said to accord better with the phenomena that they are meant to explain. They say of their arguments, for example, that "they provide islands of conceptual clarity in the midst of otherwise mind-numbing complexity and diversity"; that "they are productive of further work"; that they are "economical" of human intellectual labor; and that they will "increase the chance that we will detect useful generalizations in spite of the complexity and diversity of human behavior."

That a theoretical formulation is desirable because it makes it easier and more efficient to write more articles and books giving simple explanations for phenomena that are complex and diverse seems a strange justification for work that claims to be scientific. It confuses "understanding" in the weak sense of making coherent and comprehensible statements about the real world with "understanding" that means making correct statements about nature. It makes the investigation of material nature into an intellectual game, disarming us in our struggle to maintain science against mysticism. We would be much more likely to reach a correct theory of cultural change if the attempt to understand the history of human institutions on the cheap, by making analogies with organic evolution, were abandoned. What we need instead is the much more difficult effort to construct a theory of historical causation that flows directly from the phenomena to be explained. That the grand historical theorists of the past tried and failed to do this does not foreclose further efforts. After all, Darwin was preceded by eminent failures and even he did not get it all right.