

certainly a “must have” book for anyone interested in the ongoing debates over evolution and creationism or the relations between science and religion. I believe that any reader, on either side of the debate, will join me in thanking the editor for his superb job in bringing these materials together.

KEITH M. PARSONS  
*Dept. of Philosophy*  
*University of Houston, Clear Lake*  
*Houston, TX 77058*

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**Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution** by Kenneth R. Miller. New York: HarperCollins, 1999. xiii + 338 pp. \$25.00 (cloth), ISBN 0-060-175-931; \$14.00 (paper), ISBN 0-06093-049-7.

Kenneth R. Miller is a cell biologist at Brown University, co-author of widely used high school and college biology textbooks, author of articles in diverse scientific journals and magazines, and my own choice as the most effective defender of evolution in the tricky business of debating creationists. He is also a devout Roman Catholic. This book is his attempt to explain these dual commitments to his students and to others who might be inclined to judge them as incompatible.

Miller's book is one of two main texts, along with one written by myself, in my college course on Science and Religion. I chose his book for four reasons. First, it is a breezy, engaging, often personalized, yet lucid read. Second, biological evolution is the chief scientific stumbling block for many students. Miller does an excellent job of explaining why the basic claims of evolution are not controversial within the scientific community, and why that community finds no merit in various creationist challenges to evolution. (I believe that

modern physics has done more than biology to challenge conventional thinking, but its claims are less accessible to a layman's understanding and therefore less worrisome to the public.) Third, Miller properly takes some of the chief popularizers of science to task for claiming scientific warrant for their own philosophical extrapolations. Fourth, in describing how he reconciles science with his Christian commitment to notions of God and human free will, Miller does in fact speak for many modern theologians. (Nothing in the book is specifically limited to Roman Catholicism.) This is a useful counterfoil to my own book, which does ask the question of whether a truly integrated, self-consistent worldview is even possible.

Chapter 1 describes Darwin's *Origin of Species*, particularly his concept of how "the combination of random variation and natural selection automatically selects the organisms that do best in a particular environment. . . ." Miller describes historical and present-day reactions favoring and opposing "Darwin's dangerous idea." He attributes them to evolution displacing "the Creator from His central position as the primary explanation for every aspect of the living world."

Chapter 2 responds to the creationist argument that real science is limited to controlled experiments in the laboratory and that it cannot deal with the past. Miller refutes this claim with the example of forensic science. Then, in some detail, he describes the discovery of the element helium—on the sun, well before its identification on Earth. He explains why the assumptions of "scientific materialism" work in science and why "miracles" do not. To illustrate dating and analysis of sediments by their contents, he cites detached "pop tops" from beverage cans, abundant in garbage only from 1962 to 1975. An overview of the early history of geology includes William Smith's discovery of faunal succession, Georges Cuvier's description of mass extinctions, and Geoffroy Saint-Hilaire's speculations about possible ancestor-descendant relationships. The appearance and persistence of major groups of organisms is charted over the 4500-million-year geological time scale. Various instances of fossils convincingly transitional between major groups are cited (with further elaboration in Chapters 4 and 9). Biogeographic arguments (which are among the most difficult for creationists to explain away) are represented, among others, by Darwin's find in South America of the armadillo relative, the giant *Glyptodon*, and (in Miller's Chapter 4) by Darwin's observation that the Cape Verde Islands and the Galapagos Islands are similar, yet contain diverse species apparently derived from those on their neighboring continents, Africa and South America, respectively. Speciation is illustrated with data from the fossil record of diatoms and of hominids. Ring species illustrate speciation in progress. Miller uses evolution of HIV and of drug resistant bacteria to refute the creationist argument that mutations are always detrimental to the organisms in which they occur. The deliberate production of designer proteins illustrates the creative power of the trio of mutation, recombination, and natural selection. In Chapter 4, Miller describes how a bacterial enzyme that exists and functions only under anaerobic conditions was changed, in thirteen days, to one highly resistant to oxygen

damage. Miller rejects the claim that evolution is “just a theory.” Rather it is a fact that life has changed over time, and the theory of evolution “seeks to explain the detailed mechanism behind that change.”

Chapters 3, 4, and 5 present much more evidence for evolution, but in the context of refuting currently significant varieties of creationism. Since there can be no definitive disproof of religious claims, Miller focuses on the theological implications of scientific evidence as such evidence is interpreted by diverse creationists. The titles of these three chapters invoke those implications.

Chapter 3, “God the Charlatan,” aims at the young-earth creationism of Henry M. Morris and his Institute of Creation Research, which insists that the universe is no more than 10,000 years old and that most of the fossil record was produced by the Genesis flood. Miller, in considerable detail, describes evidence that Earth is about 4.5 billion years old. The universe is about three times that old. When humans observe a supernova millions of light years away, that event happened long before Morris’s earliest possible date for creation of the universe. God, according to Morris, created the world with the appearance of age. In this case, God must have created evidence of an event that never happened.

Chapter 4, “God the Magician,” aims at creationists like Phillip Johnson, the Berkeley law professor who avoids Morris’s biblical literalism and the more bizarre claims it generates. Lawyer that he is, Johnson’s “wedge” strategy is to limit himself to raising doubts about evolution and about the scientific community that accepts it. He hopes to split open the existing scientific consensus. Thus he seizes on the concept of “punctuated equilibrium” which notes the geologically “sudden” appearance of new forms and their subsequent stability over prolonged periods of time. Miller notes that Darwin himself allowed variations in rate of change, and that processes that are geologically “sudden” may still be stretched out over tens of thousands of years and be no different in kind than changes that occur even more gradually. Johnson sees different species as separate creations. Miller cites the fossil record of elephants, with just two species surviving today, but a family tree with twenty-two species just within the last six million years and many more extending back more than 50 million years. “This designer has been busy! And what a stickler for repetitive work!” “The senseless signs of history,” such as mammalian embryos having a yolk sac but no yolk, if attributed to a designer, would raise questions about his competence. So would the observation that new species typically survive only a few million years. Most anti-evolutionists accept “microevolution” (adaptation within a species) but challenge “macroevolution” (speciation and development of higher taxonomic categories). Miller cites various studies that indicate that evolutionary theory nicely accounts for both. Chapter 4 concludes with a contrast between science and the law as distinct systems of thought with different goals, and with a summation of what the fossil record says about its designer—assuming each species was separately designed.

Chapter 5, “God the Mechanic,” is Miller’s response to Michael Behe, chief exponent of “irreducible complexity.” In his book, *Darwin’s Black Box*, Behe

argues that many cellular mechanisms are so complex that they could not possibly have arisen by natural mechanisms and that, therefore, they must be attributed to an “intelligent designer.” This is the old “argument from design.” Behe says a mechanism is irreducibly complex if, when one component is removed, the mechanism no longer functions. That is, function depends on various components, and natural selection could not have produced those components separately before they began to function together. In rebuttal, Miller invokes the detailed fossil record that shows how two of the three little bones of the mammalian middle ear evolved from components of reptilian jawbones. He takes on Behe’s example of the eukaryotic cilium and shows that simpler versions of it do exist and function. He cites studies that show how various multi-part biochemical mechanisms, including the ubiquitous and fundamental Krebs cycle, came into being by evolutionary processes. He shows how Behe’s example of the cascade of factors involved in blood clotting in vertebrates must be understood as having evolved from requisitioning of proteins with other functions and from a series of gene duplication mutations. He shows, too, that the animal kingdom exhibits diverse mechanisms of blood clotting involving various degrees of complexity. Behe accepts more parts of the standard evolutionary story than most creationists, and Miller finds Behe’s claims about the timing of events involving intelligent design strangely incoherent with other concepts that he does accept.

Miller does not analyze the arguments of William Dembski, trained in information theory and author of several books that claim that instances of “specified complexity” demonstrate action by an intelligent designer. However, several physicists and information theorists have identified serious flaws in Dembski’s arguments. Dembski and Behe are both Senior Fellows of the Discovery Institute, which has adopted Phillip Johnson’s wedge strategy, and which is the chief force behind current efforts to get “intelligent design” adopted as an alternative to evolution in public schools.

Chapter 6 of Miller’s book, “The Gods of Disbelief,” attributes the continuing hostility to evolution by many people to “a well-founded belief that the concept of evolution is used routinely . . . to justify and advance a philosophical worldview that they regard as hostile and even alien to their lives and values.” Miller discusses well-known writers such as Stephen Jay Gould, Richard Dawkins, Daniel Dennett, Edward O. Wilson, and Richard Lewontin who, in one way or another, see the world as having (quoting Dawkins) “no design, no purpose, no evil and no good, nothing but blind, pitiless indifference.” Biologist William Provine denies the reality of free will, a concept usually seen as the basis of responsible behavior. My own belief is that these authors extrapolate from the methodological naturalism of science to construct their own worldview. That worldview is as reasonable as any, and its authors are as free as anyone to advocate it. However, they do a disservice to science when they fail to distinguish between the well-supported conclusions of science and the uncertainty of their own private metaphysical extrapolations. The latter are not

logically necessary, and to imply that they exacerbate the alienation that Miller describes.

Miller's last three chapters are devoted to showing how he reconciles science with what he considers to be the essentials of Christianity. In Chapter 7, "Beyond Materialism," Miller defines "absolute materialism" as "a view that control and predictability and ultimate explanation are possible." He seems to equate it (erroneously?) to the rigid cause-and-effect thinking of hard determinism. Miller describes the emergence of quantum mechanics and its conclusion that some phenomena at the subatomic level are inherently unpredictable. He describes Erwin Schroedinger's prediction, borne out by the subsequent description of DNA, that basic molecules of life can amplify quantum indeterminacy into indeterminacy of outcomes in the macroscopic world. Though many theists are repelled by the notion that we and the world are the result of chance events, Miller finds in it "a key feature of the mind of God" and the basis of human free will. The alternative, according to Miller, is "a universe of clockwork mechanisms that would also rule out active intervention by any supreme deity." In contrast to deism, Miller's God is involved with people in the present, which is understood to be governed by physics and chemistry. Creationists, including advocates of intelligent design, unwittingly align themselves with deists when they claim and focus on supernatural acts in the past.

Chapter 8, "The Road Back Home," summarizes what Miller sees as the core beliefs of Judaism, Christianity, and Islam, including the primacy of an eternal, personal God who created the universe, that He has revealed himself to us, and that "we are the intentional creations of God, creatures with physical bodies but immortal, spiritual souls . . . with free will. . . ." Miller certainly does not speak for all members of these faiths, and he recognizes that such beliefs are articles of faith and not of convincing demonstration. His project is to show that such beliefs are compatible with a naturalistic, evolutionary understanding of the world. He discusses evidence for the Big Bang and alternative interpretations of the "anthropic principle," but quickly returns to the role of chance in biology, in human history, and in our personal lives. God is not a "cosmic tyrant, a grand puppeteer pulling every string at once." "Chance is not only consistent with the idea of God, it is the only way a truly independent physical reality can exist." In light of the many chance events in evolution, it might have turned out very differently. But, "given evolution's ability to adapt, to innovate, to test, and to experiment, sooner or later it would have given the Creator exactly what He was looking for—a creature who, like us, could know Him and love Him, . . . a creature who would eventually discover the extraordinary process of evolution that filled His earth with so much life." Miller's God is capable of miracles, including the virgin birth of Christ, but takes care "not to intervene pointlessly" and is "wise enough to act in ways that preserve our own freedom." In scientifically undetectable ways, God could influence quantum events, work through the "butterfly effect" of chaos theory, and especially "influence the thoughts and actions of individual human beings." Miller also responds to

objections that evolution took too long or that it is too cruel to have been a mechanism used or allowed by God. At chapter end, he uses the two creation accounts in Genesis 1 and 2 to make the point that “*any* reading of that book requires interpretation and judgment.”

In Chapter 9, “Finding Darwin’s God,” Miller notes that new discoveries are constantly filling in gaps previously used as evidence for divine action, to the detriment of religion. “What science cannot do is assign meaning or purpose to the world it explores.” When meaning is claimed by theists or atheists, it comes from outside science. If the world is claimed to be purposeless, that judgment, too, comes from outside science. Once again, Miller attributes much of the hostility to evolution to atheists who cite biological discoveries in support of their extra-scientific philosophical pronouncements. To illustrate, he cites interpretations of studies on infanticide in primates and in humans. Regarding the latter, one study showed that a child’s stepfather is almost 60 times more likely to kill him than his biological father. Miller argues that such murder rates are very low, that most stepfathers are kind and loving parents, and that biological fathers have “an incredibly strong instinct against harming their own offspring.” Biology cannot tell us what is moral. That human passions are rooted in survival mechanisms does not contradict the reality of grace. Miller objects to attempts by Edward O. Wilson and Steven Pinker to use evolutionary arguments to explain the popularity of religious belief. The same arguments can be turned against their proponents. Miller, noting Darwin’s own ambivalence regarding worldview questions, says his own view of God is represented by the famous last sentence of the *Origin*. But it should be clear by now that Miller’s Christianity, which sees science as the way to understand nature, involves much more.

Christianity, in most formulations, emphasizes the sinfulness of humans and God’s sacrifice of His son to redeem sinners. The concept of sin arises from the notion of free will, which Miller and many others believe to be made plausible, or at least possible, by quantum indeterminacy. But quantum indeterminacy, as I understand it, leads to the same old cause-and-effect thinking, but with statistical variability added, so that predictions cannot be precise and the future cannot be seen as rigidly determined. This seems to me to be irrelevant to free will, which I see as something entirely different. The notion of free will is based on the human experience of making choices, coupled with the need to hold ourselves and others responsible for the choices we make. But our experience of choosing may only be our awareness of moving from not knowing to knowing what we will think or do. Our thoughts, or their neural precursors, obviously influence our choices. But can we really control the thoughts we think? Since our distant ancestors acquired the capacity to consider options through reason, they thereby also acquired the ability to rationalize. The demand for responsible behavior is a refusal to accept exonerating excuses. However, it may also be worthwhile to ask why we or others behave as we do. Even without convincing answers, this line of questioning inexorably leads to elimination of personal responsibility. If there is merit both in asking why a person behaved as he did, to better

understand human behavior, and in refusing to ask why, as a means of holding him accountable for that behavior, we may be invoking two mutually contradictory systems of thought. If so, a coherent, self-consistent worldview may not even be possible.

KARL D. FEZER  
*Concord College*  
*Athens, West Virginia*

### **An Evolving Dialogue: Theological and Scientific Perspectives on Evolution**

edited by James B. Miller. Harrisburg, PA: Trinity Press International, 2001. xi + 532 pp. \$40 (paper). ISBN 1-56338-349-7.

Religiously motivated attacks on “evolution”, “Darwinism”, or “neo-Darwinism” continue. As one battle ends, another begins. This volume provides a useful sample of the most current controversy in which the attack is waged under the banner of “intelligent-design theory”. At the same time the volume suffers from some of the common drawbacks of edited volumes, and it was quite inadequately proof-read (for instance “enthroned” and “faired” better). Some typos are best explained as resulting from unsupervised automated scanning, for example mc2 for mc<sup>2</sup>.

This review will focus on the most interesting or well done chapters.

Francisco Ayala (chapter 2) gives a splendid introduction to current views about evolution within biology. Charles R. Marshall in chapter 4 describes how molecular biology has confirmed the utility of evolutionary theory. “Levels of Selection: An Alternative to Individualism in Biology and Human Sciences”, by David Sloan Wilson, is a masterful discussion of the application of natural selection to the idea of group interest and group selection; Wilson shows that the ideas are subtle enough to be much misunderstood even by competent peers.

Chapters 7 to 11, collected under the heading “The History of Life”, are less satisfying, with much abstraction and some repetition. The chief message is that strictly random processes suffice to explain the presence of such complex beings as humans.

Ernst Mayr gives an authoritative explanation of the concept of “species” (chapter 12). Then Ayala explicates, again splendidly, “Chance and Necessity”, showing how something can and does occur all the time against huge apparent odds, for example things whose probabilities are as small as  $4 \times 10^{-16}$  happen continually in the evolution of characteristics of bacteria, since billions of bacteria can grow in a matter of hours. John Durant, in “A Critical-Historical Perspective on the Argument About Evolution and Creation” (chapter 14), points out that Darwinism has no necessary religious implications. Ronald Numbers summarizes the history of the creationist movement (chapter 15), but does not extend it to the present intelligent-design group.

Chapters 17 through 22 are heavily theological. John F. Haught in chapter 18,