

Darwin's Gift to Science and Religion

by Francisco J. Ayala

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This year, 2009, marks the one hundred fiftieth anniversary of the publication of Charles Darwin's book *The Origin of Species*. It is also the bicentennial of Darwin's birth. In early March of this year, a conference titled "Biological Evolution: Facts and Theories," co-organized by the Pontifical Gregorian University, the University of Notre Dame (Indiana), and the Vatican's Pontifical Council for Culture and funded in part by the John Templeton Foundation, was held in Rome. Its purpose was to probe the relationship between faith and science as it relates to evolution. One of the speakers at the conference was Francisco J. Ayala, a professor of biology and philosophy at the University of California, Irvine. Ayala is a prominent American evolutionary biologist and the author of *Darwin's Gift*.

The message that Ayala delivered at the Rome conference, and the main thesis of his book, is this: a belief in evolution does not conflict with Christianity. Rather, Ayala argues, Darwin's theory of natural selection has "gifted" religion by providing a solution to the age-old problem of how evil can exist in a universe that was created by a God who is both beneficent and omnipotent. In other words, according to Ayala, Darwinian evolution solves the "theodicy" problem. Moreover, as every biologist knows, Darwin's theory is a gift to science as well because it explains the unity of life, which has arisen on earth in all of its diversity from a common ancestor through the process of natural selection acting on heritable variation within populations over eons of time. Much of the book is concerned with unpacking this thesis.

The book contains ten chapters, as well as a notes section and an index. Chapter 1, the introduction, gives an overview of the book. Chapter 2, "Intelligent Design: The Original Version," presents William Paley's original argument, contained in his book *Natural Theology*, for the existence of God based on the design of organisms and the structures within them. Ayala presents Paley's famous analogy of the watch and the watchmaker: a person traveling along a woodland path, upon finding a watch lying on the ground, would come to the reasonable conclusion that the watch could not have arisen by chance but instead must have been designed. Likewise, when one encounters the organized complexity of living organisms, Paley argues, one will reasonably conclude that it is the handiwork of God.

A similar argument is used today by proponents of what is known as intelligent design (ID). Consider, for instance, biochemist Michael Behe's argument for the existence of an intelligent designer based on what he perceives to be the *irreducible complexity* of biological structures and systems such as the vertebrate eye, the bacterial flagellum, and the immune system. According to this argument, since each of the individual parts of the structure or system (e.g., the vertebrate eye) depends intricately on the presence of the others within the whole, then all of the parts must have arisen together, as one integrated unit, not piecemeal.

Ayala marvels at Paley's extensive knowledge of biology, but believes that Paley's (and others') argument for design falters when it encounters the "imperfections, defects, pain,

and cruelty of organisms” (21). He asks how the existence of such “deficiencies” in nature could be consistent with an omnipotent and omniscient designer. “Paley cannot have it both ways,” he writes (22). He cannot both believe in an all-knowing and all-powerful God and also believe that nature, with all its imperfections, was designed by the same God. Later in the book, in chapter 8, Ayala returns to this discussion. He gives examples of the apparent cruelty of nature—predators that eat their prey alive, females of certain species of insects that eat their mates—and writes, “The God of love and mercy could not have planned all this” (159).

In chapter 3 (“Darwin’s Revolution: Design Without Designer”), Ayala describes Darwin’s theory of natural selection, explaining that “Darwin’s greatest accomplishment was to show that the complex organization and functionality of living beings can be explained as a result of a natural process—natural selection—without any need to resort to a Creator or other external agent” (42). In other words, Darwin provided a natural explanation for the design seen within organisms. Ayala emphasizes that Darwin did not use the term “evolution,” but instead used such phrases as “common descent with modification.” The term he did use, and the concept he did claim—enthusiastically—was natural selection.

Ayala also compares and contrasts Darwin’s theory of natural selection with the apparently similar ideas of Alfred Russel Wallace, who was Darwin’s contemporary. He states that while Wallace thought that evolution was progressive, Darwin did not necessarily think it was. On the contrary, Ayala writes, “Darwin . . . did not accept that evolution would necessarily represent progress or advancement, nor did he believe that evolution would always result in morphological change over time.” This is a very penetrating observation by Ayala, one that seems to place him in the company of the late Stephen Jay Gould (whom Ayala does not cite despite the similarity of some of his ideas to Gould’s, e.g., the idea that science and religion represent nonoverlapping realms of knowledge).

It is gratifying to see Ayala accurately portray Darwin as believing that evolution is not necessarily progressive, especially given the temptation of some theologians to read “progress” into biological evolution, arguing that it provides evidence that the universe is headed toward future fulfillment in God. (This may be true, but does evolution provide evidence for it?) Finally, it was the notion that evolution is progressive, expressed in the belief that races will improve through selective breeding, which contributed to social Darwinism and eugenics. It is good to recognize that these social phenomena are not extensions of Darwin’s original idea. They are misrepresentations of it.

In chapter 4, “Natural Selection,” Ayala further explains how natural selection works. Here, he hews close to the neo-Darwinian paradigm of evolution, or what is known as the modern synthesis. It was the synthesis of Gregor Mendel’s discoveries of the segregation and independent assortment of heritable traits with the discovery of genes on chromosomes as the units of inheritance that provided a much-needed mechanism for the generation of heritable variation, something that Darwin’s original theory lacked. In this chapter, Ayala describes the ins and outs of evolution by natural selection according to the neo-Darwinian paradigm, but he also brings in other, newer, explanations for generating novelty. He mentions the Baldwin effect in which adaptive responses to the environment can become genetically fixed, and the concept of “reaction norms” in which the environment can call forth one of a range of phenotypes from a single genotype. He discusses adaptive radiation, describing how the variable distribution of organisms throughout the earth reveals evolution’s “opportunism.” He presents the unique flora and fauna of the Hawaiian Islands as an example of this. He makes the subtle but important point that natural selection itself is not a random process: “The traits that organisms acquire in their evolutionary histories are not fortuitous, but rather determined by their functional utility to the organisms” (77). He stresses that although the generation of traits on which natural selection works is

random, natural selection, which sifts and sorts those traits, is not.

Chapter 5, “Arguing for Evolution,” cites the evidence for evolution from several sources, including the fossil record and embryology. Ayala cites “embryonic rudiments,” such as the tail of four-week-old human embryos, as proof that intelligent design cannot be true: “Why would some structure be designed to form during early development if it will disappear before birth?” (91). In chapter 6, “Human Evolution,” Ayala outlines what we know about human evolution, starting with the oldest hominids, which lived six to seven million years ago, and moving to *Australopithecus* (three to four million years ago), *Homo erectus* (1.8 million years ago) and, finally, our species, modern humans, or *Homo sapiens*. He discusses *Homo neanderthalensis*, which appeared in Europe around two hundred thousand years ago and disappeared less than thirty thousand years ago. Once thought to be ancestral to modern humans, paleontologists now know that Neanderthals and modern humans, who appeared in Africa around one hundred fifty thousand years ago, co-existed for tens of thousands of years. On the topic of ethnicity and race, Ayala makes the interesting observation that the vast majority (85 percent) of the genetic diversity present in the entire human population on earth is also present within a single village. This is because the dispersal of humans around the globe from Africa is a relatively recent event in evolutionary terms, beginning only about one hundred thousand years ago. Moreover, it turns out that the stereotypical traits that explain the differences among the various “races” are based on very few genes. Thus, we humans are much more alike than we are different. What has uncovered this profound fact is the analysis of genomes in an evolutionary context.

In chapter 7, “Molecular Biology,” Ayala explains how molecular phylogenetics, made possible by the sequencing of the genes and genomes of organisms, supports the conclusion that all life on earth arose from a common ancestor, that all life has a common origin.

In the next two chapters, titled “Follies and Fatal Flaws” (chapter 8) and “Beyond Biology” (chapter 9), Ayala takes on the proponents of ID. First, he counters the notion that evolution is “only” a theory. ID proponents often say this in order to convince school boards that ID should be taught alongside evolution in the science classroom. But, Ayala writes, “that evolution has occurred is, in ordinary language, a fact.” He disagrees with the assertion made by ID proponents that a failure of evolutionary theory to explain a natural phenomenon means that the alternative explanation provided by ID therefore must be correct. He calls this the “two-explanations fallacy,” saying that ID must be able to stand on its own, not gain its credibility from the failure of a rival explanation. The fact that it cannot—that there is no body of scientific literature on which it is based—proves that it is not true science. This is essentially what Judge John E. Jones said in 2005 in *Kitzmiller v. Dover Area School District*: “ID is not science and cannot be adjudged a valid, accepted scientific theory.” Further, he wrote that “the disclaimer [that the school district wanted to provide students in the classroom] . . . presents students with a religious alternative masquerading as a scientific theory.” (171). Ayala states that ID cannot be science because it does not put forth any hypotheses of its own that can be tested empirically.

Emphasizing that science and religion are separate but equally valid ways of finding truth, Ayala argues in chapter 9 that science does not deny the existence of religious values, meaning, or truth. He disagrees with some scientists and philosophers (e.g., Douglas Futuyma, Richard Dawkins, and William Provine) who assert that to believe in evolution is to believe that life is inherently devoid of meaning and purpose. He writes that “there is a monumental contradiction in these assertions” because, while it is true that science cannot prove that there *is* meaning and purpose in life, it is also equally true that science cannot *deny* such meaning and purpose (174). Citing Catholic biologist Kenneth Miller and Catholic theologian John Haught, he notes that there are many who see no essential conflict between Christianity and

a belief in evolution. Such theistic evolutionists believe that God could create the world through a mechanism in which creatures adapt to environmental change over time, i.e., a world in which they evolve.

If the first nine chapters of the book bring up important but tried-and-true arguments about science and religion, chapter 10, “Postscript for the Cognoscenti,” makes a uniquely scholarly contribution to our understanding of Darwin’s thought process as a scientist. Ayala first states that there is a common misperception that science is “inductive,” i.e., that science moves forward by gathering facts and constructing general laws from those facts. First proposed by Francis Bacon and John Stuart Mill, the “inductive canon” asserts that an inductive manner of proceeding allows scientists to reach conclusions objectively, without any preconceived notions of how things are. However, as Ayala argues, this is not really how science proceeds. The way it really proceeds, he says, is that scientific hypotheses—“creations of the mind”—are proposed, and then these hypotheses are rigorously subjected to “critical examination and empirical testing” (188). Darwin, Ayala argues, publicly claimed to proceed by the inductivist canon of Bacon and Mill but, in fact, he did science as any brilliant scientist would: by letting his hypothesis (in this case, of natural selection) guide his observations, all the while testing it mercilessly. Ayala notes that it may have been Darwin’s public reluctance to reveal the hypothesis (natural selection) behind his work that caused him to delay, for more than twenty years, the publication of *The Origin of Species*. It was only after Alfred Russel Wallace wrote Darwin a letter in which he revealed that he had discovered a similar explanation for evolution based on natural selection that Darwin was spurred into action. In common scientific parlance, Darwin was afraid of being “scooped!”

In conclusion, returning to the topic of the Rome conference mentioned at the beginning, what was particularly encouraging about the conference was that it was very broad in considering possible mechanisms of evolutionary change. Ayala presented the standard neo-Darwinian view that evolution proceeds

very gradually through natural selection acting on genetic mutations generated randomly. But others, notably biologists Lynn Margulis, Scott Gilbert, and Stuart Newman, presented other mechanisms (besides genetic mutation) for how heritable variation can arise. Margulis discussed symbiogenesis, the generation of new life forms through the ancient symbiotic association of ancestral organisms; Gilbert talked about mechanisms for the generation of anatomical diversity through changes in development (e.g., through heterochrony, due to changes in the timing or duration of the expression of developmental genes); and Newman showed how “developmental patterning modules” present in ancient unicellular organisms could have acquired novel functions simply by undergoing a change in scale and context that accompanied the rise of multicellularity around five hundred fifty million years ago. This, Newman argued, could have generated the animal body plans and organ structures that exist today. The fact that these scientists were given a voice demonstrates that the Vatican is truly interested in knowing about the latest developments in evolutionary biology as it contemplates issues at the intersection of science and religion; it is not bound by a strict neo-Darwinian paradigm of evolution, as are so many biologists, unfortunately. It is also noteworthy that the Vatican did not invite ID proponents to participate in the conference. The reason, according to Rev. Marc Leclerc, director of the conference and a professor of philosophy of nature at the Pontifical Gregorian University, was that ID was not appropriate because “it’s not a scientific perspective, nor a theological or philosophical one.”¹ This certainly is a conclusion with which Francisco Ayala, author of *Darwin’s Gift* and speaker at the conference, would wholeheartedly agree.

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¹“Evolution at the Vatican,” *Templeton Report*, April 1, 2009, http://templeton.org/templeton_report/20090401/.