

Seeing and Believing

The never-ending attempt to reconcile science and religion, and why it is doomed to fail.

Jerry A. Coyne, *The New Republic* Published: Wednesday, February 04, 2009

Saving Darwin: How to be a Christian and Believe in Evolution

By Karl W. Giberson

(HarperOne, 248 pp., \$24.95)

Only A Theory: Evolution and the Battle for America's Soul

By Kenneth R. Miller

(Viking, 244 pp., \$25.95)

I.

Charles Darwin was born on February 12, 1809--the same day as Abraham Lincoln--and published his magnum opus, *On the Origin of Species*, fifty years later. Every half century, then, a Darwin Year comes around: an occasion to honor his theory of evolution by natural selection, which is surely the most important concept in biology, and perhaps the most revolutionary scientific idea in history. 2009 is such a year, and we biologists are preparing to fan out across the land, giving talks and attending a multitude of DarwinFests. The melancholy part is that we will be speaking more to other scientists than to the American public. For in this country, Darwin is a man of low repute. The ideas that made Darwin's theory so revolutionary are precisely the ones that repel much of religious America, for they imply that, far from having a divinely scripted role in the drama of life, our species is the accidental and contingent result of a purely natural process.

And so the culture wars continue between science and religion. On one side we have a scientific establishment and a court system determined to let children learn evolution rather than religious mythology, and on the other side the many Americans who passionately resist those efforts. It is a depressing fact that while 74 percent of Americans believe that angels exist, only 25 percent accept that we evolved from apelike ancestors. Just one in eight of us think that evolution should be taught in the biology classroom without including a creationist alternative. Among thirty-four Western countries surveyed for the acceptance of evolution, the United States ranked a dismal thirty-third, just above Turkey. Throughout our country, school boards are trying to water down the teaching of evolution or sneak creationism in beside it. And the opponents of Darwinism are not limited to snake-handlers from the Bible Belt; they include some people you know. As Karl Giberson notes in *Saving Darwin*, "Most people in America have a neighbor who thinks the Earth is ten thousand years old."

The cultural polarization of America has been aggravated by attacks on religion from the "new atheists," writers such as Richard Dawkins and Daniel Dennett, who are die-hard Darwinists. Outraged religious leaders, associating evolutionary biology with atheism, counterattacked. This

schism has distressed liberal theologians and religious scientists, who have renewed their efforts to reconcile religion and science. The "science" is nearly always evolutionary biology, which is far more controversial than any area of chemistry or physics. Francis Collins, director of the Human Genome Project, wrote *The Language of God: A Scientist Presents Evidence for Belief*; the philosopher Michael Ruse produced *Can a Darwinian Be a Christian?* (his answer is yes); and there are high-profile books by theologians such as John Haught and John Polkinghorne. The Templeton Foundation gives sizeable grants to projects for reconciling science and religion, and awards a yearly prize of two million dollars to a philosopher or scientist whose work highlights the "spiritual dimension of scientific progress." The National Academy of Sciences, America's most prestigious scientific body, issued a pamphlet assuring us that we can have our faith and Darwin, too:

Science and religion address separate aspects of human experience. Many scientists have written eloquently about how their scientific studies of biological evolution have enhanced rather than lessened their religious faith. And many religious people and denominations accept the scientific evidence for evolution.

Would that it were that easy! True, there are religious scientists and Darwinian churchgoers. But this does not mean that faith and science are compatible, except in the trivial sense that both attitudes can be simultaneously embraced by a single human mind. (It is like saying that marriage and adultery are compatible because some married people are adulterers.) It is also true that some of the tensions disappear when the literal reading of the Bible is renounced, as it is by all but the most primitive of JudeoChristian sensibilities. But tension remains. The real question is whether there is a *philosophical* incompatibility between religion and science. Does the empirical nature of science contradict the revelatory nature of faith? Are the gaps between them so great that the two institutions must be considered essentially antagonistic? The incessant stream of books dealing with this question suggests that the answer is not straightforward.

The easiest way to harmonize science and religion is simply to re-define one so that it includes the other. We may claim, for example, that "God" is simply the name we give to the order and harmony of the universe, the laws of physics and chemistry, the beauty of nature, and so on. This is the naturalistic pantheism of Spinoza. Its most famous advocate was Einstein, often (and wrongly) described as believing in a personal God:

The most beautiful emotion we can experience is the mysterious. It is the fundamental emotion that stands at the cradle of all true art and science. He to whom this emotion is a stranger, who can no longer wonder and stand rapt in awe, is as good as dead, a snuffed-out candle. To sense that behind anything that can be experienced there is something that our minds cannot grasp, whose beauty and sublimity reaches us only indirectly: this is religiousness. In this sense, and in this sense only, I am a devoutly religious man.

But the big problem with this "reconciliation," in which science does not marry religion so much as digest it, is that it leaves out God completely--or at least the God of the monotheistic faiths, who has an interest in the universe. And this is unacceptable to most religious people. Look at

the numbers: 90 percent of Americans believe in a personal God who interacts with the world, 79 percent believe in miracles, 75 percent in heaven, and 72 percent in the divinity of Jesus. In his first popular book, *Finding Darwin's God*, Kenneth Miller attacked pantheism because it "dilutes religion to the point of meaninglessness." He was right.

A meaningful effort to reconcile science and faith must start by recognizing them as they are actually understood and practiced by human beings. You cannot re-define science so that it includes the supernatural, as Kansas's board of education did in 2005. Nor can you take "religion" to be the philosophy of liberal theologians, which, frowning on a personal God, is often just a hairsbreadth away from pantheism. After all, the goal is not to turn the faithful into liberal theologians, but to show them a way to align their actual beliefs with scientific truths. Theologians sometimes suggest a reconciliation by means of naturalistic deism, the idea that the creation of the universe--and perhaps the laws of physics--was the direct handiwork of a deity who then left things alone as they unfolded, never interfering in nature or history again. For the faithful, this has been even more problematic than pantheism: it not only denies miracles, virgin births, answered prayers, and the entire cosmological apparatus of Christianity, Judaism, Islam, Hinduism, and much of Buddhism, but also raises the question of where God came from in the first place.

No, a proper solution must harmonize science with theism: the concept of a transcendent and eternal god who nonetheless engages the world directly and pays special attention to the real object of divine creation, *Homo sapiens*. And so we have Karl Giberson and Kenneth Miller, theistic scientists and engaging writers, both demolishing what they see as a false reconciliation--the theory of intelligent design--and offering their own solutions. Giberson is a professor of physics at Eastern Nazarene College, a Christian school, and has written three books on the tension between science and religion. He is the former editor of *Science and Spirit*, a magazine published by the Templeton Foundation. (*Saving Darwin* was also financed by Templeton.) Kenneth Miller, a cell biologist at Brown University, is one of the most ardent and articulate defenders of evolution against creationism. He is also an observant Catholic. Miller's new book, *Only a Theory*, is an update of *Finding Darwin's God*. Both books offer not only a withering critique of intelligent design, but also a search for God in the evolutionary process.

Together, *Saving Darwin* and *Only a Theory* provide an edifying summary of the tenets and the flaws of modern creationism, the former dealing mainly with its history and the latter with its specious claims. If these books stopped there, they would raise a valuable alarm about the dangers facing American science and culture. But in the end their sincere but tortuous efforts to find the hand of God in evolution lead them to solutions that are barely distinguishable from the creationism that they deplore.

II.

As recounted by Giberson, the history of creationism in America has itself been an evolutionary process guided by a form of natural selection. After each successive form of creationism has been struck down by the courts for violating the First Amendment, a modified form of the

doctrine has appeared, missing some religious content and more heavily disguised in scientific garb. Over time, the movement has shifted from straight Biblical creationism to "scientific creationism," in which the very facts of science were said to support religious stories such as the Genesis creation and Noah's Ark, and then morphed into intelligent design, or ID, a theory completely stripped of its Biblical patina. None of this has fooled the courts. In 2005, a federal judge in Harrisburg, Pennsylvania rebuffed an attempt to introduce ID into the classroom, characterizing the enterprise as disguised creationism and branding its advocates liars. (Miller was an important witness for the prosecution, supporting the rejection of ID.) But of course this has not settled matters. Creationists have returned with appeals to our sense of fair play, urging schools to "teach the controversy"--and never mind that the controversy about evolution is not scientific, but social and political.

What is surprising in all this is how close many creationists have come to Darwinism. Important advocates of ID such as Michael Behe, a professor at Lehigh University (and a witness for the defense in the Harrisburg case), accept that the earth is billions of years old, that evolution has occurred--some of it caused by natural selection--and that many species share common ancestors. In Behe's view, God's role in the development of life could merely have been as the Maker of Mutations, tweaking DNA sequences when necessary to fuel the appearance of new mutations and species. In effect, Behe has bought all but the tail of the Darwinian hog.

Yet other forms of creationism remain. Many IDers are also "young-earth creationists," taking a Biblically based stand that the earth is about six thousand years old. (The evangelist Ken Ham's \$27 million Creation Museum in Kentucky depicts a *Triceratops* wearing a saddle!) Others believe that the distribution of animals on our planet is explained by Noah's Ark. Still others claim that while some species evolved, many others were created by God. Understandably, creationists prefer to hide these differences, deceptively implying that they are philosophically united.

But regardless of their views, all creationists share four traits. First, they devoutly believe in God. No surprise there, except to those who think that ID has a secular basis. Second, they claim that God miraculously intervened in the development of life, either creating every species from scratch or intruding from time to time in an otherwise Darwinian process. Third, they agree that one of these interventions was the creation of humans, who could not have evolved from apelike ancestors. This, of course, reflects the Judeo-Christian view that humans were created in God's image. Fourth, they all adhere to a particular argument called "irreducible complexity." This is the idea that some species, or some features of some species, are too complex to have evolved in a Darwinian manner, and must therefore have been designed by God. Blood clotting in vertebrates, for example, is a complex sequence of enzyme reactions, involving twenty proteins that interact to produce the final clot. If any were missing, the blood would not clot. How could something this sophisticated have blindly evolved?

Easily, says Miller. In a devastating dismantling of ID, he takes the "scientific" claims of ID seriously and follows them to their illogical conclusion. In clear and lively prose, Miller shows that complex biochemical pathways are cobbled together from primitive precursor proteins that once had other functions but were co-opted for new uses. And ID turns out to be simply a "god of the gaps" argument--the view that if we do not yet comprehend a phenomenon completely, we

must throw up our hands, stop our research, and praise the Lord. For scientists, that is a prescription for the end of science, for perpetual ignorance.

Miller brilliantly exposes ID for what it is: a farrago of theological assertions and discredited scientific claims designed to inveigle a religious view of life into the biology classroom. IDers have no defined program of scientific research. Although they spend huge sums of money on public relations, they have not produced a single scientifically refereed paper supporting the empirical claims of their "theory." Miller correctly concludes that "the hypothesis of design is compatible with any conceivable data, makes no new testable predictions, and suggests no new avenues for research." One of Miller's keenest insights is that ID involves not just design but also supernatural creation. After all, the designer has to do more than just envision new creatures; he must also place them on Earth. And if that is not creationism (a label that IDers loudly reject), I do not know what is.

For Giberson, ID is not just bad science (or more strictly, not science at all), it is also bad theology:

The world is a complex place, and there is much about the universe that we still don't understand. We are centuries away from closing the many gaps in our current scientific understanding of the natural world.... But it is the business of science to close gaps, and it has long been the central intuition of theology to find a better place to look for God.... Promoting "design" in isolation from God's other attributes is a dangerous and ultimately self-defeating way to get God back into science.

Rather than reconciling religion and science, then, ID puts them in further conflict, damaging both in the process. That is why so many theologians as well as scientists have testified against ID in court.

If ID is an abysmal failure as science, why do so many people continue to press for its adoption in schools? The obvious answer is that ID preserves our status as God's favorite species and seems to imbue the universe with purpose and meaning, while evolutionary biology does neither. In other words, ID, like all forms of creationism, is an extension of religion. This has been recognized by every judge who has ruled on the issue since the Scopes trial of 1925. Curiously, though, Giberson and Miller avoid this issue when tracing the roots of creationism. Instead of singling out religion, they blame two secular movements, populism and atheism.

For Miller, a peculiarly American brand of rugged individualism and distrust of authority has had conflicting effects. First, it has produced America's scientific superiority. Miller notes that in the last three decades, Americans have won about 60 percent of all Nobel Prizes in the sciences.

Is there something in the American character that bore the seeds of this conflict [evolution versus creationism] and provided fertile ground in which it could flourish? I think there is, and I'm not ashamed of that. In fact, I'm downright proud of it.... America is the greatest scientific nation in the world.... Disrespect--that's the key. It's the reason that our country has embraced science so

thoroughly, and why America has served as a beacon to scientists from all over the world. A healthy disrespect for authority is part of the American character, and it permeates our institutions, including the institutions of science. Scientists in this country, whether American by birth or choice, have been allowed to dream of revolutionary discoveries, and those dreams have come true more often in this country than in any other.

But this is a two-edged sword.

If rebellion and disrespect are indeed part of the American talent for science, then what should we make of the anti-evolution movement? One part of the analysis is clear. The willingness of Americans to reject established authority has played a major role in the way that local activists have managed to push ideas such as scientific creationism and intelligent design into local schools.

Giberson agrees:

Americans have never been eager or even willing to be led by intellectual elites. A simple commonsense argument by someone you trust is worth more than the pompous pronouncements of an entire university of eggheads. America is a nation that loves cowboys, and cowboys don't need experts telling them what to think.

But do we really owe our leadership in science to our inner John Waynes? Surely there are other--and equally American--factors: freedom from religious persecution, and money. Our scientific community has been immensely enriched by recent immigrants, especially Jews who fled the Nazis. More important, after World War II our government began funding scientific research at a furious rate, a largesse that attracted hosts of foreign scholars. And even though we have dominated the Nobel Prizes since then, in earlier years we were completely eclipsed by Europe. Until 1930, for example, Americans won only four Nobel Prizes in all of the sciences, while twenty-nine went to Germany and fifteen to the United Kingdom. Germans and Britons can hardly be accused of "disrespect for authority"!

The resistance to evolution in America has little to do with populism as such. Our ornery countrymen do not rise up against the idea of black holes or the proof of Fermat's Last Theorem. It is evolution that is the unique object of their ire, and for this there is only one explanation. The facts are these: you may find religion without creationism, but you will never find creationism without religion. Miller and Giberson shy away from this simple observation. Their neglect of the real source of creationism is inexcusable but understandable: a book aiming to reconcile evolution and religion can hardly blame the faithful.

Yet it is acceptable, it seems, to blame the faithless. For Giberson and Miller, the main aggressors in the "science wars" are the atheists. Books by the "new atheists," they contend, have inflamed religious moderates who might otherwise be sympathetic to evolution, driving them into the creationist corner. In *Finding Darwin's God*, Miller explained that "I believe much of the problem lies with atheists in the scientific community who routinely enlist the material findings of evolutionary biology in support [sic] their own philosophical pronouncements." And Giberson concurs:

Critics of creationism were often rude and dismissive and appeared to have agendas that went beyond the truth of various claims about the natural history of the earth.... These famous critics failed to grasp that creationists are also committed Christians and many of them are reasonable, generous, and motivated by the noblest of intentions. Thoughtful Christians sense something disingenuous about the mean-spirited lambasting that accompanies what should be a civil argument about science.

So the obstacle to understanding is not religion, it is those aggressive atheistevolutionists who won't shut up. But consider this: it is Richard Dawkins who, more than anyone else, has convinced people of the reality and the power of evolution. It is the height of wishful thinking to claim that if he and his intellectual confreres simply stopped attacking religion, creationism would disappear.

Giberson levels another common criticism at evolutionary biologists. Many of us, he claims, see our science as a religion, a kind of Darwin-worship that purports to explain everything, including meaning, purpose, ethics, and religion itself: "The idea that science should be a religion on its own runs like a subterranean reservoir through the writing of these popularizers, gurgling beneath the surface and bubbling into view every time the conversation gets to the now-here-is-what-it-all-means phase." Yes, some scientists (and science writers) have gone overboard with evolutionary psychology, asserting that Darwinism can explain every facet of human behavior. But no serious scientist wants evolution to become anything like a religion, or even a source of ethics and values. That would mean abandoning our main tool for understanding nature: the resolution of empirical claims with empirical data. We do not have "faith" in Darwinism in the same way that others have faith in God, nor do we see Darwin as an unimpeachable authority like Pope Benedict XVI or the Ayatollah Khamenei. Indeed, since 1859 a fair number of Darwin's ideas have been disproven. Like all sciences, evolution differs from religion because it constantly tests its assumptions, and discards the ones that prove false.

III.

In *Finding Darwin's God*, his earlier book, Miller proclaimed a universal theism: "Remember, once again, that people of faith believe their God is active in the present world, where He works in concert with the naturalism of physics and chemistry." Giberson clearly agrees. And where do they find the hand of God in nature? Unsurprisingly, in the appearance of humans.

Giberson and Miller assert that the evolution of humans, or something very like them, was inevitable. Given the way that evolution works, they claim, it was certain that the animal kingdom would eventually work its way up to a species that was conscious, highly intelligent, and above all, capable of apprehending and worshipping its creator. This species did not have to look perfectly human, but it did have to have our refined mentality (call it "humanoid"). One of Miller's chapters is even titled "The World That Knew We Were Coming." Giberson notes that "capabilities like vision and intelligence are so valuable to organisms that many, if not most biologists believe they would probably arise under any normal evolutionary process.... So how can evolution be entirely random, if certain sophisticated end points are predictable?"

Reading this, many biologists will wonder how he can be so sure. After all, evolution is a contingent process. The way natural selection molds a species depends on unpredictable changes in climate, on random physical events such as meteor strikes or volcanic eruptions, on the occurrence of rare and random mutations, and on which species happen to be lucky enough to survive a mass extinction. If, for example, a large meteor had not struck Earth sixty-five million years ago, contributing to the extinction of the dinosaurs--and to the rise of the mammals they previously dominated--all mammals would probably still be small nocturnal insectivores, munching on crickets in the twilight.

Evolutionists long ago abandoned the notion that there is an inevitable evolutionary march toward greater complexity, a march that culminated in humans. Yes, the average complexity of all species has increased over the three-and-a-half billion years of evolution, but that is because life started out as a simple replicating molecule, and the only way to go from there is to become more complex. But now complexity is not always favored by natural selection. If you are a parasite, for instance, natural selection may make you less complex, because you can live off the exertions of another species. Tapeworms evolved from free-living worms, and during their evolution have lost their digestive system, their nervous system, and much of their reproductive apparatus. As I tell my students, they have become just absorptive bags of gonads, much like the students themselves. Yet tapeworms are superbly adapted for a parasitic way of life. It does not always pay to be smarter, either. For some years I had a pet skunk, who was lovable but dim. I mentioned this to my vet, who put me in my place: "Stupid? Hell, he's perfectly adapted for being a skunk!" Intelligence comes with a cost: you need to produce and to carry that extra brain matter, and to crank up your metabolism to support it. And sometimes this cost exceeds the genetic payoff. A smarter skunk might not be a fitter skunk.

To support the inevitability of humans, Giberson and Miller invoke the notion of evolutionary convergence. This idea is simple: species often adapt to similar environments by independently evolving similar features. Ichthyosaurs (ancient marine reptiles), porpoises, and fish all evolved independently in the water, and through natural selection all three acquired fins and a similar streamlined shape. Complex "camera eyes" evolved in both vertebrates and squid. Arctic animals such as polar bears, arctic hares, and snowy owls either are white or turn white in the winter, hiding them from predators or prey. Perhaps the most astonishing example of convergence is the similarity between some species of marsupial mammals in Australia and unrelated placental mammals that live elsewhere. The marsupial flying phalanger looks and acts just like the flying squirrel of the New World. Marsupial moles, with their reduced eyes and big burrowing claws, are dead ringers for our placental moles. Until its extinction in 1936, the remarkable thylacine, or Tasmanian wolf, looked and hunted like a placental wolf.

Convergence tells us something deep about evolution. There must be preexisting "niches," or ways of life, that call up similar evolutionary changes in unrelated species that adapt to them. That is, starting with different ancestors and fuelled by different mutations, natural selection can nonetheless mold bodies in very similar ways--so long as those changes improve survival and reproduction. There were niches in the sea for fish-eating mammals and reptiles, so porpoises and ichthyosaurs became streamlined. Animals in the Arctic improve their survival if they are

white in the winter. And there must obviously be a niche for a small omnivorous mammal that glides from tree to tree. Convergence is one of the most impressive features of evolution, and it is common: there are hundreds of cases.

All it takes to argue for the inevitability of humanoids, then, is to claim that there was a "humanoid niche"--a way of life that required high intelligence and sophisticated self-consciousness--and that this niche remained unfilled until inevitably invaded by human ancestors. But was its occupation really inevitable? Miller is confident that it was:

But as life re-explored adaptive space, could we be certain that our niche would not be occupied? I would argue that we could be almost certain that it would be--that eventually evolution would produce an intelligent, self-aware, reflective creature endowed with a nervous system large enough to solve the very same questions we have, and capable of discovering the very process that produced it, the process of evolution.... Everything we know about evolution suggests that it could, sooner or later, get to that niche.

Miller and Giberson are forced to this view for a simple reason. If we cannot prove that humanoid evolution was inevitable, then the reconciliation of evolution and Christianity collapses. For if we really were the special object of God's creation, our evolution could not have been left to chance. (It may not be irrelevant that although the Catholic Church accepts most of Darwinism, it makes an official exception for the evolution of *Homo sapiens*, whose soul is said to have been created by God and inserted at some point into the human lineage.)

The difficulty is that most scientists do not share Miller's certainty. This is because evolution is not a repeatable experiment. We cannot replay the tape of life over and over to see if higher consciousness always crops up. In fact, there are good reasons for thinking that the evolution of humanoids was not only not inevitable, but was a priori improbable. Although convergences are striking features of evolution, there are at least as many failures of convergence. These failures are less striking because they involve species that are missing. Consider Australia again. Many types of mammals that evolved elsewhere have no equivalents among marsupials. There is no marsupial counterpart to a bat (that is, a flying mammal), or to giraffes and elephants (large mammals with long necks or noses that can browse on the leaves of trees). Most tellingly, Australia evolved no counterpart to primates, or any creature with primate-like intelligence. In fact, Australia has many unfilled niches--and hence many unfulfilled convergences, including that prized "humanoid" niche. If high intelligence was such a predictable result of evolution, why did it not evolve in Australia? Why did it arise only once, in Africa?

This raises another question. We recognize convergences because unrelated species evolve similar traits. In other words, the traits appear in more than one species. But sophisticated, self-aware intelligence is a singleton: it evolved just once, in a human ancestor. (Octopi and dolphins are also smart, but they do not have the stuff to reflect on their origins.) In contrast, eyes have evolved independently forty times, and white color in Arctic animals appeared several times. It is hard to make a convincing case for the evolutionary inevitability of a feature that arose only once. The elephant's trunk, a complex and sophisticated adaptation (it has over forty thousand

muscles!), is also an evolutionary singleton. Yet you do not hear scientists arguing that evolution would inevitably fill the "elephant niche." Giberson and Miller proclaim the inevitability of humanoids for one reason only: Christianity demands it.

Finally, it is abundantly clear that the evolution of human intelligence was a contingent event: contingent on the drying out of the African forest and the development of grasslands, which enabled apes to leave the trees and walk on two legs. Indeed, to maintain that the evolution of humans was inevitable, you must also maintain that the evolution of apes was inevitable, that the evolution of primates was inevitable, that the rise of mammals was inevitable, and so on back through dozens of ancestors, all of whose appearances must be seen as inevitable. This produces a regress of increasing unlikelihood. In the end, the question of whether human-like creatures were inevitable can be answered only by admitting that we do not know--and adding that most scientific evidence suggests that they were not. Any other answer involves either wishful thinking or theology.

Miller opts for theology. Although his new book does not say how God ensured the arrival of *Homo sapiens*, Miller was more explicit in *Finding Darwin's God*. There he suggested that the indeterminacy of quantum mechanics allows God to intervene at the level of atoms, influencing events on a larger scale:

The indeterminate nature of quantum events would allow a clever and subtle God to influence events in ways that are profound, but scientifically undetectable to us. Those events could include the appearance of mutations, the activation of individual neurons in the brain, and even the survival of individual cells and organisms affected by the chance processes of radioactive decay.

In other words, God is a Mover of Electrons, deliberately keeping his incursions into nature so subtle that they're invisible. It is baffling that Miller, who comes up with the most technically astute arguments against irreducible complexity, can in the end wind up touting God's micro-editing of DNA. This argument is in fact identical to that of Michael Behe, the ID advocate against whom Miller testified in the Harrisburg trial. It is another God-of-the-gaps argument, except that this time the gaps are tiny.

Miller raises another argument also used by creationists and theists as proof of celestial design: the so-called "fine tuning of the universe." It turns out that the existence of a universe that permits life as we know it depends heavily on the size of certain constants in the laws of physics. If, for example, the charge of the electron were slightly different, or if the disparity in mass between a proton and a neutron were slightly larger, or if other constants varied by more than a few percent, the universe would differ in important ways. Stars would not live long enough to allow life to emerge and evolve, there would be no solar systems, and the universe would lack the elements and the complex chemistry necessary for building organisms. In other words, we inhabit what is called a "Goldilocks universe," where nature's laws are just right to allow life to evolve and to thrive. This observation is called "the anthropic principle."

At first glance, its explanation appears trivial. As Miller says, "Taking as a starting point the observation that you and I are alive, at least in the immediate present, it's obvious that we must live in a universe where life is possible. If we didn't, we wouldn't be here to talk about it. So, in a certain sense the fact that we live in a life-friendly universe merits little more than a big 'Duh.'" True. But this raises a deeper question: why do the constants of the universe just happen to have those life-promoting values? The answer given by creationists is that this is no accident: a beneficent God (or an intelligent designer) crafted those physical laws precisely so that somewhere in the universe intelligent life would evolve--life so intelligent that it could work out the laws of physics and, more important, apprehend their creator. This answer--known as the strong anthropic principle--is scientifically untestable, but it sounds so reasonable that it has become one of the biggest guns in the creationist arsenal. (It is important to grasp that anthropic principles concern the conditions required for the existence of *any* life, and say nothing about the inevitability of complex and intelligent life.)

Also, scientists have other explanations, ones based on reason rather than on faith. Perhaps some day, when we have a "theory of everything" that unifies all the forces of physics, we will see that this theory requires our universe to have the physical constants that we observe. Alternatively, there are intriguing "multiverse" theories that invoke the appearance of many universes, each with different physical laws; and we could have evolved only in one whose laws permit life. The physicist Lee Smolin has suggested a fascinating version of multiverse theory. Drawing a parallel with natural selection among organisms, Smolin proposed that physical constants of universes actually evolve by a type of "cosmological selection" among universes. It turns out that each black hole--and there are millions in our universe--might give rise to a new universe, and these new universes could have physical constants different from those of their ancestors. (This is analogous to mutation in biological evolution.) And universes with physical constants close to the ones we see today happen to be better at producing more black holes, which in turn produce more universes. (This resembles natural selection.) Eventually this process yields a population of universes enriched in those having just the right properties to produce stars (the source of black holes), planets, and life. Smolin's theory immensely raises the odds that life could appear.

The idea of multiple universes may seem like a desperate move--a Hail Mary thrown out by physicists who are repelled by religious explanations. But physics is full of ideas that are completely counterintuitive, and multiverse theories fall naturally out of long-standing ideas of physics. They represent physicists' attempts to give a naturalistic explanation for what others see as evidence of design. For many scientists, multiverses seem far more reasonable than the solipsistic assumption that our own universe with its 10,000,000,000, 000,000 planets was created just so a single species of mammal would evolve on one of them fourteen billion years later.

And yet Miller seems to favor the theological explanation, or at least gives the anthropic principle a theological spin:

The scientific insight that our very existence, through evolution, requires a universe of the very size, scale, and age that we see around us implies that the universe, in a certain sense, had us in mind from the very beginning.... If this universe was indeed primed for human life, then it is only

fair to say, from a theist's point of view, that each of us is the result of a thought of God, despite the existence of natural processes that gave rise to us.

Miller equates the faith of religious believers with physicists' "faith" in a naturalistic explanation for physical laws:

Believers ... are right to remind skeptics and agnostics that one of their favored explanations for the nature of our existence involves an element of the imagination as wild as any tale in a sacred book: namely, the existence of countless parallel simultaneous universes with which we can never communicate and whose existence we cannot even test. Such belief also requires an extraordinary level of "faith" and the nonreligious would do well to admit as much.

Well, physicists are not ready to admit as much. Contrary to Miller's claim, the existence of multiverses does not require a leap of faith nearly as large as that of imagining a God. And some scientific explanations of the anthropic principle are testable. Indeed, a few predictions of Smolin's theory have already been confirmed, adding to its credibility. It may be wrong, but wait a decade and we will know a lot more about the anthropic principle. In the meantime, it is simply wrong to claim that proposing a provisional and testable scientific hypothesis--not a "belief"--is equivalent to religious faith.

IV.

The most common way to harmonize science and religion is to contend that they are different but complementary ways of understanding the world. That is, there are different "truths" offered by science and by religion that, taken together, answer every question about ourselves and the universe. Giberson explains:

I worry that scientific progress has bewitched us into thinking that there is nothing more to the world than what we can understand.... Science has perhaps gotten as much from the materialistic paradigm as it is going to get. Matter in motion, so elegantly described by Newton and those who followed him, may not be the best way to understand the world.... I think there are ways, though, that we can begin to look at the creation and understand that the scientific view is not all-encompassing. Science provides a partial set of insights that, though powerful, don't answer all the questions.

Usually the questions said to fall outside science include those of meaning, purpose, and morality. In one of his last books, *Rocks of Ages: Science and Religion in the Fullness of Life*, Stephen Jay Gould called this reconciliation NOMA, for "non-overlapping magisteria": "Science tries to document the factual character of the natural world, and to develop theories that coordinate and explain these facts. Religion, on the other hand, operates in the equally important, but utterly different, realm of human purposes, meanings and values--subjects that the factual domain of science might illuminate, but can never resolve." Gould offered this not as a utopian vision, but as an actual description of why the realms of science and religion do not overlap. As a solution to our perplexity, this is no good. In a spirit of pluralism it ignores the obvious conflicts

between them. Gould salvaged his idea by redefining his terms--the old trick, again--writing off creationism as "improper religion" and defining secular sources of ethics, meanings and values as being "fundamentally religious."

The NOMA solution falls apart for other reasons. Despite Gould's claims to the contrary, supernatural phenomena are not completely beyond the realm of science. All scientists can think of certain observations that would convince them of the existence of God or supernatural forces. In a letter to the American biologist Asa Gray, Darwin noted:

Your question what would convince me of Design is a poser. If I saw an angel come down to teach us good, and I was convinced from others seeing him that I was not mad, I should believe in design. If I could be convinced thoroughly that life and mind was in an unknown way a function of other imponderable force, I should be convinced. If man was made of brass or iron and no way connected with any other organism which had ever lived, I should perhaps be convinced. But this is childish writing.

Similarly, if a nine-hundred-foot-tall Jesus appeared to the residents of New York City, as he supposedly did to the evangelist Oral Roberts in Oklahoma, and this apparition were convincingly documented, most scientists would fall on their knees with hosannas.

Scientists do indeed rely on materialistic explanations of nature, but it is important to understand that this is not an a priori philosophical commitment. It is, rather, the best research strategy that has evolved from our long-standing experience with nature. There was a time when God was a part of science. Newton thought that his research on physics helped clarify God's celestial plan. So did Linnaeus, the Swedish botanist who devised our current scheme for organizing species. But over centuries of research we have learned that the idea "God did it" has never advanced our understanding of nature an iota, and that is why we abandoned it. In the early 1800s, the French mathematician Laplace presented Napoleon with a copy of his great five-volume work on the solar system, the *Mechanique Celeste*. Aware that the books contained no mention of God, Napoleon taunted him, "Monsieur Laplace, they tell me you have written this large book on the system of the universe, and have never even mentioned its Creator." Laplace answered, famously and brusquely: "*Je n'avais pas besoin de cette hypothese-la*," "I have had no need of that hypothesis." And scientists have not needed it since.

In a common error, Giberson confuses the strategic materialism of science with an absolute commitment to a philosophy of materialism. He claims that "if the face of Jesus appeared on Mount Rushmore with God's name signed underneath, geologists would still have to explain this curious phenomenon as an improbable byproduct of erosion and tectonics." Nonsense. There are so many phenomena that would raise the specter of God or other supernatural forces: faith healers could restore lost vision, the cancers of only good people could go into remission, the dead could return to life, we could find meaningful DNA sequences that could have been placed in our genome only by an intelligent agent, angels could appear in the sky. The fact that no such things have ever been scientifically documented gives us added confidence that we are right to stick with natural explanations for nature. And it explains why so many scientists, who have learned to disregard God as an explanation, have also discarded him as a possibility.

This brings us to the second reason why Gould's explanation does not cohere. It is all well and good to say, as he did, that religion makes no claims about nature, but in practice it is not true. Out of the thousands of religious sects on this planet, only a handful do not have adherents or dogmas that make empirical claims about the world. Here are some. Jesus was born of a virgin and, after crucifixion, came back to life. After Mary's death, her physical body was transported to heaven. The Prophet Mohammed ascended to heaven on the back of a white horse. After death, every being is reincarnated in some other form. The god Brahma emerged from a lotus flower that grew from the navel of Vishnu, and, on Vishnu's command, created the universe. God listens and responds to prayer. Sea mammals come from the chopped-off fingers of the Inuit god Sedna. You will gain wealth and happiness if you send money to the ministry of Creflo Dollar.

Those are the dogmas. To see what the faithful actually believe, consider that more than 60 percent of Americans believe in miracles, the virgin birth of Jesus, his divinity and resurrection (Giberson and Miller are among them), the survival of the soul after death, and the existence of Hell and Satan. Regardless of what liberal theologians claim, most of us are not deists or Unitarians. And if you think that Americans see the Bible as mere metaphorical poetry, I invite you to visit a gospel church in Wasilla, Alaska, or on the South Side of Chicago.

Many religious beliefs can be scientifically tested, at least in principle. Faith-based healing is particularly suited to these tests. Yet time after time it has failed them. After seeing the objects cast off by visitors to Lourdes, Anatole France is said to have remarked, "All those canes, braces and crutches, and not a single glass eye, wooden leg, or toupee!" If God can cure cancer, why is He impotent before missing eyes and limbs? Recent scientific studies of intercessory prayer--when the sick do not know whether they are being prayed for--have not shown the slightest evidence that it works. Nor do we have scientifically rigorous demonstrations of miracles, despite the Vatican's requirement that two miracles be proven for canonizing every saint. Holy relics, such as the Shroud of Turin, have turned out to be clever fakes. There is no corroborated evidence that anyone has spoken from beyond the grave. And what about the ancient "foundational" miracles, such as those supposedly performed by Christ, Buddha, and Mohammed? We were not there when they happened, so we cannot test them. But at least we can apply the same standards to these as we do to other Biblical or Koranic claims.

Like Giberson, Miller rejects a literal interpretation of the Bible. After discussing the fossil record, he contends that "a literal reading of the Genesis story is simply not scientifically valid," concluding that "theology does not and cannot pretend to be scientific, but it can require of itself that it be consistent with science and conversant with it." But this leads to a conundrum. Why reject the story of creation and Noah's Ark because we know that animals evolved, but nevertheless accept the reality of the virgin birth and resurrection of Christ, which are equally at odds with science? After all, biological research suggests the impossibility of human females reproducing asexually, or of anyone reawakening three days after death. Clearly Miller and Giberson, along with many Americans, have some theological views that are not "consistent with science."

What, then, is the nature of "religious truth" that supposedly complements "scientific truth"? The first thing we should ask is whether, and in what sense, religious assertions are "truths." Truth implies the possibility of falsity, so we should have a way of knowing whether religious truths

are wrong. But unlike scientific truths, religious ones differ from person to person and sect to sect. And we all know of clear contradictions between the "truths" of different faiths. Christianity unambiguously claims the divinity of Jesus, and many assert that the road to salvation absolutely depends on accepting this claim, whereas the Koran states flatly that anyone accepting the divinity of Jesus will spend eternity in hell. These claims cannot both be "true," at least in a way that does not require intellectual contortions.

Assertions about God's nature also differ among faiths. Giberson explains, for example, that "centuries of Christian reflection on the nature of God have highlighted various characteristics of God: justice, love, goodness, holiness, grace, sovereignty, and so forth." But to those of other faiths, God can be vengeful, as Yahweh was in the Old Testament. Jews cannot imagine an incarnated God, the Word made flesh. Hindus, like ancient Greeks, accept multiple gods with different personalities. To deists, god is apathetic, while many theologians in all the monotheistic faiths claim that we cannot know anything about God's attributes. So which of these many characterizations is "true"? Anything touted as a "truth" must come with a method for being disproved--a method that does not depend on personal revelation. After all, thousands of people have had delusional revelations of "truth" with horrifying consequences.

Perhaps what we mean by "religious truths" are "moral truths," such as "Thou shalt not commit adultery." These rules are not subject to empirical testing, but they do comport with our reasoned sense of right and wrong. But for almost every "truth" such as this there is another one believed with equal sincerity, such as "Those who commit adultery should be stoned to death." This dictum appears not only in Islamic religious law, but in the Old Testament as well. (It seems wrong, by the way, to call these truths religious. Beginning with Plato, philosophers have argued convincingly that our ethics come not from religion, but from a secular morality that develops in intelligent, socially interacting creatures, and is simply inserted into religion for convenient citation.)

In the end, then, there is a fundamental distinction between scientific truths and religious truths, however you construe them. The difference rests on how you answer one question: *how would I know if I were wrong?* Darwin's colleague Thomas Huxley remarked that "science is organized common sense where many a beautiful theory was killed by an ugly fact." As with any scientific theory, there are potentially many ugly facts that could kill Darwinism. Two of these would be the presence of human fossils and dinosaur fossils side by side, and the existence of adaptations in one species that benefit only a different species. Since no such facts have ever appeared, we continue to accept evolution as true. Religious beliefs, on the other hand, are immune to ugly facts. Indeed, they are maintained in the face of ugly facts, such as the impotence of prayer. There is no way to adjudicate between conflicting religious truths as we can between competing scientific explanations. Most scientists can tell you what observations would convince them of God's existence, but I have never met a religious person who could tell me what would disprove it. And what could possibly convince people to abandon their belief that the deity is, as Giberson asserts, good, loving, and just? If the Holocaust cannot do it, then nothing will.

V.

Giberson and Miller are thoughtful men of good will. Reading them, you get a sense of conviction and sincerity absent from the writings of many creationists, who blatantly deny the most obvious facts about nature in the cause of their faith. Both of their books are worth reading: Giberson for the history of the creation/ evolution debate, and Miller for his lucid arguments against intelligent design. Yet in the end they fail to achieve their longed-for union between faith and evolution. And they fail for the same reason that people always fail: a true harmony between science and religion requires either doing away with most people's religion and replacing it with a watered-down deism, or polluting science with unnecessary, untestable, and unreasonable spiritual claims.

Although Giberson and Miller see themselves as opponents of creationism, in devising a compatibility between science and religion they finally converge with their opponents. In fact, they exhibit at least three of the four distinguishing traits of creationists: belief in God, the intervention of God in nature, and a special role for God in the evolution of humans. They may even show the fourth trait, a belief in irreducible complexity, by proposing that a soul could not have evolved, but was inserted by God.

Giberson, while abjuring a hands-on God, nevertheless sees deliberate design in our Earth.

Why is [bird] song so pleasant to hear? Why, for example, does almost every scene of undeveloped nature seem so beautiful, from mountain lakes to rolling prairies? If the evolution of our species was driven entirely by survival considerations, then where did we get our rich sense of natural aesthetics?... There is an artistic character to nature that has always struck me as redundant from a purely scientific point of view.... I am attracted to the idea that God's signature is not on the engineering marvels of the natural world, but rather on its marvelous creativity and aesthetic depth. Scientists are not supposed to talk about God this way, for it raises questions that can't be answered.

This is aesthetic design rather than intelligent design, but it is still design. And it ignores scientific explanations, such as E.O. Wilson's "biophilia" theory, which suggests that we evolved to find places like lakes and prairies attractive simply because they provided our ancestors with food and safety.

And neither Miller nor Giberson tell us what circumstances would make them abandon their belief in a personal God. Giberson, in fact, asserts that he cannot be wrong:

As a believer in God, I am convinced in advance that the world is not an accident and that, in some mysterious way, our existence is an "expected" result. No data would dispel it. Thus, I do not look at natural history as a source of data to determine whether or not the world has purpose. Rather, my approach is to anticipate that the facts of natural history will be compatible with the purpose and meaning I have encountered elsewhere. And my understanding of science does nothing to dissuade me from this conviction.

This is creationist-speak, pure and simple. No real scientist would say that his theories are immune to disproof. And so Giberson's personal reconciliation, however edifying it is to him spiritually, must be intellectually unconvincing to the rest of us.

Besides his "aesthetic design" argument, Giberson offers another reason for his faith--we might call it the argument from convenience.

As a purely practical matter, I have compelling reasons to believe in God. My parents are deeply committed Christians and would be devastated, were I to reject my faith. My wife and children believe in God, and we attend church together regularly. Most of my friends are believers. I have a job I love at a Christian college that would be forced to dismiss me if I were to reject the faith that underpins the mission of the college. Abandoning belief in God would be disruptive, sending my life completely off the rails.

This touching confession reveals the sad irrationality of the whole enterprise--the demoralizing conflict between a personal need to believe and a desperation to show that this primal need is perfectly compatible with science.

It would appear, then, that one cannot be coherently religious and scientific at the same time. That alleged synthesis requires that with one part of your brain you accept only those things that are tested and supported by agreed-upon evidence, logic, and reason, while with the other part of your brain you accept things that are unsupportable or even falsified. In other words, the price of philosophical harmony is cognitive dissonance. Accepting both science and conventional faith leaves you with a double standard: rational on the origin of blood clotting, irrational on the Resurrection; rational on dinosaurs, irrational on virgin births. Without good cause, Giberson and Miller pick and choose what they believe. At least the young-earth creationists are consistent, for they embrace supernatural causation across the board. With his usual flair, the physicist Richard Feynman characterized this difference: "Science is a way of trying not to fool yourself. The first principle is that you must not fool yourself, and you are the easiest person to fool." With religion, there is just no way to know if you are fooling yourself.

So the most important conflict--the one ignored by Giberson and Miller--is not between religion and science. It is between religion and secular reason. Secular reason includes science, but also embraces moral and political philosophy, mathematics, logic, history, journalism, and social science--every area that requires us to have good reasons for what we believe. Now I am not claiming that all faith is incompatible with science and secular reason--only those faiths whose claims about the nature of the universe flatly contradict scientific observations. Pantheism and some forms of Buddhism seem to pass the test. But the vast majority of the faithful--those 90 percent of Americans who believe in a personal God, most Muslims, Jews, and Hindus, and adherents to hundreds of other faiths--fall into the "incompatible" category.

Unfortunately, some theologians with a deistic bent seem to think that they speak for all the faithful. These were the critics who denounced Dawkins and his colleagues for not grappling with every subtle theological argument for the existence of God, for not steeping themselves in the complex history of theology. Dawkins in particular was attacked for writing *The God Delusion* as a "middlebrow" book. But that misses the point. He did indeed produce a

middlebrow book, but precisely because he was discussing religion as it is lived and practiced by real people. The reason that many liberal theologians see religion and evolution as harmonious is that they espouse a theology not only alien but unrecognizable as religion to most Americans.

Statistics support this incompatibility. For example, among those thirty-four countries surveyed, we see a statistically strong negative relationship between the degree of faith and the acceptance of evolution. Countries such as Denmark, France, Japan and the United Kingdom have a high acceptance of Darwinism and low belief in God, while the situation is reversed in countries like Bulgaria, Latvia, Turkey, and the United States. And within America, scientists as a group are considerably less religious than non-scientists. This is not say that such statistics can determine the outcome of a philosophical debate. Nor does it matter whether these statistics mean that accepting science erodes religious faith, or that having faith erodes acceptance of science. (Both processes must surely occur.) What they do show, though, is that people have trouble accepting both at the same time. And given the substance of these respective worldviews, this is no surprise.

This disharmony is a dirty little secret in scientific circles. It is in our personal and professional interest to proclaim that science and religion are perfectly harmonious. After all, we want our grants funded by the government, and our schoolchildren exposed to real science instead of creationism. Liberal religious people have been important allies in our struggle against creationism, and it is not pleasant to alienate them by declaring how we feel. This is why, as a tactical matter, groups such as the National Academy of Sciences claim that religion and science do not conflict. But their main evidence--the existence of religious scientists--is wearing thin as scientists grow ever more vociferous about their lack of faith. Now Darwin Year is upon us, and we can expect more books like those by Kenneth Miller and Karl Giberson. Attempts to reconcile God and evolution keep rolling off the intellectual assembly line. It never stops, because the reconciliation never works.

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