

THE PROBLEM OF RELIGION AND SCIENCE CUTS MUCH DEEPER than the (often superficial) debate about evolution. Indeed, the nature of this relationship has been one of the major intellectual problems of the modern world, and a vast literature of works by scientists, theologians, and philosophers addresses it—though the national science standards and science textbooks all but completely ignore it. Contrary to much of the conventional wisdom, this discussion has not become passé, but is, if anything, becoming more lively in light of recent developments in both science and theology.

We begin with a few historical generalizations about the impact of the scientific revolution on religion before discussing four ways of relating science and religion. We will take evolution as our major case study because it has generated the most heated battles in our curricular culture wars, but we will also consider several other areas in the science curriculum where religion is relevant, before drawing a number of educational implications.

## The Scientific Revolution

In Chapter 2 we retold Arthur Eddington's parable of the fisherman who, after a lifetime of fishing with a three-inch mesh net and never catching any fish shorter than three inches, concluded there were no fish in the ocean shorter than three inches. Just as his fishing net determined what he caught, so our conceptual nets determine what we catch in the ocean of reality. Beginning with physics in the 17th century, then in chemistry in the 18th century and biology in the 19th century, scientists discarded older theological and philosophical nets for those of the modern scientific method—and worked a revolution in the process.

All cultures other than modern Western culture have conceived of reality as having a spiritual dimension that could be known through religious experience. In the Western religions, God was understood to be the creator of the world, and believers could understand nature only by seeing it as God's handiwork, designed to fulfill God's purposes. Because nature was the creation of God, it was good; indeed, it was infused by the spirit of God. Reality was understood to have the structure of a cosmic drama, and as actors in that drama, persons were responsible agents.

Not surprisingly, scientists find in reality only what the conceptual net of modern scientific method allows them to catch—what is measurable, what can be discerned through sense perception and scientific instruments, and what is replicable in scientific experiments. The physicists of the 17th century believed that the ultimate constituents of the world were (quantitatively distinguishable) atoms, and that change was the result of their (quantitatively distinguishable) rearrangement in accord with universal causal laws. Matter was inert, dead. Qualitative colors and sounds were exiled from "objective" nature to the "subjective" minds of observers. The real world is matter in motion, a realm of pure factuality with no inherent moral structure; nature is not purposeful. Science is "value free." Although 20th century quantum mechanics discerns a level of indeterminacy in nature, classical science was deterministic. Indeed, much science continues to hold that our character and our actions are determined by our genes and biochemistry, our environment and various contingencies of reinforcement.

Science has radically extended our conception of the universe in terms of both time and space. Ours is not the cozy world of traditional religion, in which the earth was created to be our home a few thousand years ago. According to modern science, the earth came into being some 4.6 billion years ago, an incidental by-product of the cosmic evolution that began with the big bang some 10 or 20 billion years earlier. And from the time Copernicus displaced our world from the center of a divinely created universe, the earth and its inhabitants have seemed increasingly insignificant in the overall scheme of things. As Carl Sagan once put it,

there are cataclysms and catastrophes occurring regularly in the universe and on the most awesome scale. . . . It seems likely that every time a quasar explodes, more than a million worlds are obliterated

and countless forms of life, some of them intelligent, are utterly destroyed. This is not the traditional benign universe of conventional religiosity in the West, constructed for the benefit of living and especially of human beings. Indeed, the very scale of the universe—more than a hundred billion galaxies, each containing more than a hundred billion stars—speaks to us of the inconsequentiality of human events in the cosmic context. (1974, pp. 290–292)

Because science is willing to question the old “truths,” we discover new truths and *progress* becomes possible—both in knowledge and, through technology, in our physical well-being. But if science makes progress possible in human affairs, it appears to deny progress in cosmic affairs. The forces of nature are indifferent to good and evil; science offers no assurance that all things work toward what is good. Evolution, as biologists understand it, has no moral or spiritual purpose, and the second law of thermodynamics tells us that in the long run the universe will run out of energy and die in the cold darkness of space.

One goal of traditional religion was to structure and sustain an understanding of reality as trustworthy; religions provided people with moral and spiritual guidance in living their lives. Science makes no such claims. Rather, its goal is to provide the kind of knowledge that gives us predictive power and, through technology, control over our environment. The philosopher E.M. Adams puts it this way: Before the scientific revolution, humankind faced reality asking, What is demanded of me? How do I set myself right with reality? From within the modern scientific worldview, by contrast, we ask: How do I impose my will on the world? How can I control it (1993, chap. 3)? Arguably, this has been the most profound revolution in human history.

Of course, the great scientists of the scientific revolution were not atheists, and, as we shall see, there are ways of reconciling science and religion. As it is practiced, however, science assumes that God is irrelevant to understanding nature, for scientific method prohibits appeal to miracles, divine purposes, religious experience, or Scripture in its explanations. And, at least implicitly, science has become the arbiter of intellectual respectability; the modern scientific worldview pervades the curriculum.

Yet, students might well wonder whether there is more to reality than scientific nets can catch. Indeed, might our understanding of nature be distorted if we rely on scientific method only? Of course, theologians, using different nets, claim to catch other dimensions of reality.

## The Relationship of Science and Religion

Individuals often take one of four different positions on the relationship of science and religion.

1. *Conflict: Religion Trumps Science.* Science and religion sometimes make conflicting claims about reality; when there is conflict, only religion provides reliable knowledge. It is through inerrant Scripture or religious tradition that we come to know the ultimate truth about nature. No doubt good science would always agree with Scripture or religious tradition; but, unhappily, not all science is good science. Religion trumps science.

Most “creation-scientists,” for example, begin from the assumption that the truth about nature is to be found in Scripture, and they work to find scientific evidence to confirm what they already know to be true. To be a member of the Creation Research Society, a scientist must affirm the divine inspiration of the Bible, the creative acts of God during the Creation week, the historicity of the Great Flood, and Jesus Christ as savior.

2. *Conflict: Science Trumps Religion.* Science and religion sometimes make conflicting claims about reality, but only science provides reliable knowledge. It is through scientific method that we come to know the ultimate truth about nature. If the scientific net doesn’t catch something, it’s because it doesn’t exist. Science trumps religion.

Sometimes this position is called *scientism* or *naturalism* or *scientific materialism*—the “ism” suggesting that a philosophical claim about ultimate reality is being made. On this account, religion possesses no competence to make claims about nature, and scientists need not consider religious claims in constructing their picture of nature.

3. *Independence.* Science and religion cannot conflict because they are incommensurable, autonomous endeavors, each with its own methods, each with its own domain. (This is sometimes called the “two-worlds” approach.) One common expression of this view is that science asks objective “how” questions, whereas religion asks personal “why” questions. Their conceptual nets capture aspects of reality so different that they stand in no logical relationship. Science and religion can each be true (or false) in their own terms; they are conceptual apples and oranges. While working in their own domains, neither scientists nor theologians need consider the conclusions of the other; religion and science can be intellectually compartmentalized.

This position is widely held by both theologians and scientists. Adopting it was, at first, a defensive move made by 19th century theologians who believed that science was able to give a complete account of physical reality. As a result, religion must be about a different world, a different dimension of reality. For these liberals, religion was never meant to be a science textbook; its claims about nature simply reflected the fallible prescientific understanding of ancient cultures. What is central to Scripture is its account of the encounters of people with God. Religion is about our existential situation, not physical reality; it is about the meaning of life, not its chemical composition.

Many scientists have also adopted this view. For example, according to a 1981 resolution of the National Academy of Sciences, “religion and science are *separate and mutually exclusive* [emphasis added] realms of human thought whose presentation in the same context leads to a misunderstanding of both scientific theory and religious belief” (1984, pp. 5–6).

4. *Integration.* Science and religion are commensurable endeavors; they can conflict and they can reinforce each other, for they make claims about the same world. Neither can ignore the other, and neither automatically trumps the other; they provide, in effect, complementary methods for rationally pursuing truth. Because science and religion are each competent to illuminate aspects of the same reality, a fully adequate picture of reality must draw on—and integrate—both.

For integrationists, scriptural passages about nature should not be taken literally, but they must still be taken seriously. There is, of course, a theological risk in the integrationist position, for it leaves theological claims subject to revision, or even falsification, by modern science. Still, theological integrationists would hold with Arthur Peacocke, the distinguished biochemist and theologian, that religion and science are “ultimately converging” in that “the scientific and theological enterprises” are “interacting and mutually illuminating approaches to reality” (1984, p. 51).

Roughly a third of Americans believe that the Bible is inerrant and would presumably adopt the view (if asked) that religion trumps science. Very few scientists take this position; it is, after all, utterly at odds with the normal practice of science. No doubt many scientists believe that science always trumps religion; some say so (often in response to creationists), though most scientists simply don’t go on record about such things. Because many scientists believe in God \_yet make no effort to integrate science and religion, instead compartmentalizing them, we suspect that most religious scientists take the independence position. Most liberal theologians, influenced by the intellectual authority of modern science, have adopted some version of either the independence or integrationist positions.

Over the last several decades a shift from the independence to the integrationist position appears to have occurred among both theologians and scientists. Certainly a literature of dialogue has grown rapidly. Why? There are several reasons. First, some scholars argue that recent developments in science—particularly in quantum mechanics, cosmology, chaos theory, and ecology—have provided openings for religious analyses: the world of 20th century science appears to be more hospitable to religion than the classical scientific world of atoms and determinism. Second, recent work in the history, philosophy, and sociology of science has convinced a good number of scholars that science is culturally shaped rather than pristinely “objective.” At the same time, many theologians have argued that (liberal) theology can be “rational” or “objective” in some sense; theological claims can be testable—though not in quite the same way

as scientific claims. That is, theology and science are not nearly so different as has often been believed, and integration has become a possibility.

## Standards and Textbooks

No discussion of the relationship of science and religion appears in the 262 pages of the national science standards, though the standards do claim that “explanations on [sic] how the natural world changes based on myths, personal beliefs, religious values, mystical inspiration, superstition, or authority may be personally useful and socially relevant, but they are not scientific” (National Research Council [NRC], 1996, p. 201). The standards also acknowledge that “science is only one way of answering questions and - explaining the natural world”—but they ignore any of the alternatives (p. 138). Presumably, science and religion are distinct domains. At only one point is there any mention of the relevance of religion \_to science classes; it is a fleeting suggestion that we will consider in \_due course.

Of the 12 high school science textbooks we reviewed (in biology, earth sciences, and physics) only 2 discussed the relationship of science and religion.<sup>1</sup> The first, a biology text, devoted three pages to reviewing Galileo’s troubles with the church, the bogus claims of “creation-science,” and Darwin’s statement, in the last paragraph of the *Origin of Species*, that “the powers of life” have been “breathed by the Creator” into nature—from which the text concludes that evolution need not be incompatible with religion (*Biological Science*, 1996, p. 16). (It is doubtful that, in the end, Darwin actually believed this; more important, why should we accept Darwin as having settled this question?) The second, a physics text, asserted that religion “has to do not with nature, but with meaning and its implications for personal and communal life.” Hence “science and religion are as different as apples and oranges” and “unless one has a shallow understanding of either or both, there is no contradiction in being religious and being scientific in one’s thinking” (*Conceptual Physics*, 1992, p. 12). Unfortunately, the discussion is only two paragraphs long and does little to discourage shallow thinking.

What can we conclude? The standards and the texts completely ignore one of the most momentous questions of modern intellectual and cultural history: the relationship of science and religion. Of course, the nature of this relationship is deeply controversial, but that would seem to be a reason for discussing rather than ignoring it. Indeed, by ignoring the controversy, and by ignoring religion, science education *implicitly* takes sides, teaching students *uncritically* to believe either that science always trumps religion or that they are independent endeavors. Although one or the other of these views might be correct, surely students are not *educated* about the relationship of science and religion, or the possible limitations of science, if they are taught this uncritically.

In fact, one can argue that conventional science and science education are committed in fact, if not necessarily in principle, to scientism or philosophical naturalism, for scientific method and science education allow religion no philosophical room to make claims or provide evidence about nature. Religion is discredited a priori.

## Evolution and Biology

Although theologians put up some resistance to evolution after the publication of Darwin’s *Origin of Species* in 1859, it is striking how quickly mainline theologians came to accept evolution as God’s way of doing things. Indeed, evolution did not become a major issue for most religious conservatives until the 1920s. Those conservatives who read the first chapter of Genesis as “literally” true concluded that evolution is problematic for several reasons. It took too much time: after all, God created humankind (and perhaps the world) within the last six thousand years. More important, God created each species specially, “after its own kind.” Species don’t evolve. Many conservatives also held that evolution “reduces” people to animals by blurring the lines between them. For some religious conservatives—such as William Jennings Bryan—the major issue was social Darwinism, which used scientific theory to sanction (animal-like) brutality in business

and warfare. Finally, some religious conservatives came to believe that there is scientific evidence against evolution and for the special creation (or the “abrupt appearance”) of species.

Liberal theologians, by contrast, have accepted evolution, reading Genesis mythically or symbolically rather than literally. In the 19th century, many theologians in Reform Judaism and the mainline Protestant denominations began to argue that religions can be *progressive* by drawing on modern science and liberal social and political ideas to reform their traditions. The human condition should be understood not in terms of a *fall* from grace, but in terms of “evolutionary” progress. For these liberals, biological evolution was not a problem; indeed, it appeared to fit the progressive pattern of existence.

Still, evolution presents a problem for some liberals—though it is not much acknowledged in our culture wars—for as contemporary neo-Darwinism understands it, evolution is inherently *purposeless*. Evolutionary change is the result of natural selection working on the random mutation and recombination of genes. The genius of Darwin’s account of evolution (as Darwin well knew) lay in denying divine design and giving a fully “naturalistic” explanation of evolution. The human eye is no longer to be explained in terms of design and God’s purposes, but in terms of the incremental survival value that mutations producing slightly greater light sensitivity give to individuals. It makes no scientific sense to say that evolution is the transition from morally or spiritually lower to higher forms of life; human beings are not the end (or purpose) of evolution, but an “accidental” result. Or, as Stephen Jay Gould puts it, we are but a minor species in the Age of Bacteria (1997, chap. 14).<sup>2</sup>

Nonetheless, most Jewish, Catholic, and mainline Protestant theologians accept evolution, reconciling it with their religious commitments in one or the other of several ways. Many theologians have adopted the *independence position* outlined above: science and religion are conceptually different endeavors; the Bible isn’t about how nature works, and evolution has no implications for what is central to religion—its account of the meaning of life. This also appears to be the position of the National Association of Biology Teachers: “evolutionary theory, indeed all of science, is necessarily silent on religion and neither refutes nor supports the existence of a deity or deities” (n.d., p. 1).

There are a variety of ways of integrating religion and evolution. Catholicism, for example, accepts evolution but claims that, as the *Catechism* of the Church puts it, “the Universe was created ‘in a state of journeying’ toward an ultimate perfection yet to be attained, to which God has destined it. We call ‘divine providence’ the dispositions by which God guides his creation toward this perfection” (1994, p. 80). Evolution *is* purposeful, though God has chosen to work through the “secondary” causes of nature. Moreover, God is a personal God who, on occasion, intervenes in the affairs of this world by way of miracles. And, as Pope John Paul II recently affirmed, God directly intervened in evolution to create a break between animals and humankind: Adam and Eve were real people; God created them and their descendants—unlike animals—with immortal souls (1996a, p. 352).

Liberal theologians often reject the traditional conception of a transcendent, creator God, arguing instead that God is *immanent*, a creative and purposeful force working *within* us and all of nature, moving us to higher moral and spiritual planes of existence through evolution. Variations on this view are held by “Process” theologians (drawing on the influential work of Alfred North Whitehead), some feminist theologians, and some New Age thinkers.

Typically, theologians who argue for integrationist positions draw on the commitments and resources of their religious traditions (Scripture, history, and religious experience) to develop a more adequate, inclusive understanding of reality than either science or theology can provide by itself. In the process, the claims of both science and religion may need to be modified or reformulated.

Some advocates of “intelligent design theory” forego theological commitments, however, and argue that God is the best possible scientific explanation available for the evolutionary evidence. So, for example, gaps in the fossil record, or complex, interrelated changes in cellular development are best explained in terms of coordinated design in nature.

In the end, there are *several* alternatives to orthodox neo-Darwinism and fundamentalist creationism, and yet almost all discussions of evolution are framed in terms of these two polarized positions. In fact,

surveys suggest that a significant minority of Americans take some kind of middle position. According to a 1991 Gallup Poll, while 47 percent of Americans believe that God created humankind within the last 10,000 years and 9 percent believe that God had no part in evolution, 40 percent of the respondents believe that God directs evolution. The remaining 4 percent believe something else or claim no opinion (1991, p. 231).

### Standards and Textbooks

The *National Science Education Standards* emphasize that evolution is central to modern biology and recommend that the curriculum include it in grades 5 through 8 as well as in high school biology courses (National Research Council [NRC], 1996, pp. 158, 181–187). The standards say nothing about creation-science or religious interpretations of nature.

Each of the biology texts we reviewed includes long accounts, covering several chapters, of biological and human evolution; indeed, two of the five texts begin with evolution as the central organizing theory of modern biology. Each text presents all of the usual geological, fossil, physiological, genetic, and biochemical evidence for evolution. One text includes a fairly substantial discussion of biology and its relationship to natural theology before Darwin, and concludes that Darwin “subverted” the traditional religious understanding of the world (*Biology*, 1993, p. 422). No text mentions any scientific arguments against evolution or discusses the possibility of design in nature.

We must also note, however, that a growing number of science teachers, fearing controversy, are not discussing evolution. Moreover, at least some teachers include creationism of one kind or another in biology courses even though it is not in the texts and is not part of their official curriculum.

### The Big Bang and Cosmology

For several decades now most cosmologists and physicists have agreed that the origins of the universe can be traced back 10 or 20 billion years to a “big bang.” Whereas many people have perceived evolution as a threat to religion, some theologians and scientists have taken the big bang to corroborate the idea of creation. In his 1951 address to the Pontifical Academy of Science, Pope Pius XII declared that the big bang bears witness to “the primordial *Fiat lux*,” confirming “the contingency of the universe” and “the epoch when the cosmos came from the Hands of the Creator” (quoted in Jastrow, 1978, p. 142). The astronomer Robert Jastrow ended his popular book *God and the Astronomers* by describing the modern cosmologist who has finally “scaled the mountains of ignorance” and “is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries” (1978, pp. 105–106).

If Pius and Jastrow were saying that the big bang *confirms* theological accounts, most scientists and theologians would disagree. The “hands of the Creator” are not, after all, detectable by scientific method. In fact, science may not be able to say anything about what caused the big bang. No doubt some cosmologists believe that they can get very close to the big bang—to within a fraction of a second of it—but because the laws of nature are themselves the *product* of the big bang those laws cannot be used to explain it. As the astrophysicist William Stoeger puts it,

[the big bang cannot] be considered as a beginning either of the universe or of time . . . much less of creation in the theological sense of that word. Rather, it underscores the fact that our universe . . . was once dominated by such extreme conditions that none of the categories we now rely upon to describe physical reality would have been applicable, including those of space and time, matter, and particle. (1996, p. 193)

If the cause of the big bang is of some theological interest, so is its immediate aftermath. Over the past decade some scientists, philosophers, and theologians have argued that there is cosmological evidence that the universe was *fine-tuned* to produce life, for the odds against life in the wake of a big bang are almost

infinitesimal *and yet there is life*. (Such claims often go under the label the “Anthropic Principle.”) For example, had the expansion rate one second after the big bang been smaller by one part in a hundred thousand million million, the universe would have collapsed; had it been one part in a million stronger, it would have expanded too quickly for life to form. If the strong nuclear force were slightly weaker, only hydrogen would exist; if it were slightly stronger, all hydrogen would have converted to helium and stable stars could not have existed. And these coincidences could be multiplied many times (Barbour, 1990, pp. 136–137). According to Stephen Hawking, “The odds against a universe like ours emerging out of something like the Big Bang are enormous” (quoted in Boslough, 1985, p. 121). What is the most reasonable explanation for such coincidences? Arguably, that the universe was *designed* to support life.

## Creation

Not all religious traditions include the idea of creation. Followers within some traditions believe the universe to be eternal. Some Hindu texts tell of vast cycles of creation and dissolution: “The Himalayas, it is said, are made of solid granite. Once every thousand years a bird flies over them with a scarf in its beak that brushes the ranges as it passes. When by this process the Himalayas have been worn away, one day of a cosmic cycle will have collapsed.” The gods themselves are created and then die as ultimate reality—Brahman—oscillates between the fullness of being and pure potentiality: “Just as the spider pours forth its thread from itself and takes it back again . . . even so the universe grows from [and dissolves back into] the Imperishable” (Smith, 1991, p. 68).

Other religious traditions are agnostic about creation. When the Buddha was asked whether the world was eternal, he responded with the parable of a foolish man who had been shot with an arrow but would not consent to be treated until he learned all of the details about who had shot him. The religious life does not depend on dogmas of creation: whether the world is eternal or not “there still remain birth, old age, death, sorrow, lamentation, misery, grief, and despair” (Burt, 1955, p. 35). What is religiously important is escape from suffering and the wheel of rebirths, not metaphysical speculation.

In contrast to the Eastern religions, creation is part of the Western Scriptural traditions: In the beginning God created the heavens and the earth. Unlike Christianity, Judaism has placed rather more emphasis on how to live—and the Law—than on what to believe; it has been open to a variety of ways of reading Genesis, and has made “no systematic attempt” to define “an orthodox cosmology” (Katz, 1978, p. 148). The idea of creation was written into the Christian creeds, however, and acquired considerable theological importance. There are, of course, a number of Creation narratives in the Bible (Genesis 1:1–2:3, 2:4–3:24, Job 38–41, Psalms 74, Isaiah 40–48, and John 1), though Genesis 1 has become the most prominent. Although scholars differ on the translation and meaning of Genesis, the orthodox Christian tradition is *not* that God created order out of existing chaos (one reading of Genesis 1:1) but that God created all that is, the world and perhaps time as well, out of nothing: *creation ex nihilo*.

The alternative—and a secondary theme in much theology—has been God’s *continuing creation*, which might be understood in either of two ways. In the first, God continually sustains creation ontologically: creation is not an event in time, but the continuing dependence of the world on God for its existence at any time. As the physicist and theologian John Polkinghorne once put it, “God is not a God of the edges, with a vested interest in beginnings. God is the God of all times and all places” (1993, p. 18). In the second, God continually brings new and higher forms of being into existence. This latter view is, at one and the same time, evolutionary and creationist. These several forms of creation need not be incompatible, but may simply reflect different emphases. What is important in any of these “creationist” accounts is that the existence of the world depends on, and is ultimately explainable in terms of, God; scientific accounts are, at best, incomplete.

As we’ve seen, for many theologians and scientists, science and religion are radically different kinds of endeavors; the Genesis narrative should not be read as historical fact—and the big bang can neither falsify nor verify Biblical or theological claims about the world. Yet, for an increasing number of theologians and

scientists, the big bang *does* have theological relevance. If the big bang does not *confirm* creation *ex nihilo*, it is at least *consonant* with it, and the evidence from cosmology of a “fine-tuned” universe may be evidence for a creator God. Needless to say, the God of the big bang is not obviously the personal God of much traditional religion. What is important for those who take the integrationist position is the apparent convergence of science and (liberal) theology, each providing evidence for the role of God in creating the universe.

### Standards and Textbooks

According to the national science standards “the origin of the universe remains one of the greatest questions in science,” and the standards recommend that students learn about the big bang theory (NRC, 1996, p. 190). The standards also note that “the age of the universe and its evolution into galaxies, stars, and planets—and eventually life on earth—fascinates and challenges students” (NRC, 1996, p. 188). The standards say nothing, however, about relating the big bang to religion; nor do they make any reference to the anthropic principle. Two of the three physics texts we reviewed discussed the big bang theory and cosmological evolution; none mentioned any other account of the origins of the universe. One text devoted five sentences to the cosmological evidence for a “fine-tuned” universe, but did not relate the evidence to God or provide any context for making sense of it religiously.

### Nature and Ecology

Environmentalists and scholars often claim that Western culture has been singularly destructive and bears special responsibility for our environmental crisis. Many of them attribute to modern science an intellectual framework that is particularly congenial to the exploitation of nature. Of course, science provides the know-how to create the technology that has been so destructive, but at a deeper level it conceives of nature as inert, dead, and value free; because science discerns only quantitative distinctions in reality, it can make no sense of the idea that nature is sacred or that it imposes moral or spiritual requirements on us. Indeed, a goal of science is to provide precisely that kind of knowledge of causal laws that allows us to manipulate and exploit nature for our own purposes—whatever they might be.

Others have argued, however, that Western religious traditions are complicit in this responsibility. One reason modern science developed in the West was that the Bible long ago laid the groundwork for “disenchanted the world.” By emphasizing a single, transcendent creator-God, the Bible began to secularize nature. Arguably, this was a point of the Creation narrative in Genesis 1: God created the sun and moon, the plants and animals; they were not themselves deities, but lifeless objects. God is the only deity.

The religious sources of our environmental crisis may cut deeper still, however. People often argue that the Bible is anthropocentric in the sense that God gave humankind *dominion* over nature (Genesis 1:26–29, Genesis 9:1–3, Psalms 8:5–8): the plants and animals are to serve our purposes. Moreover, many theologians draw a sharp distinction between spirit and matter, elevating the former and devaluing the latter. Only persons are immortal and of value; this world, nature, is of only passing value as our temporary home.

### Eco-Theology

We can argue on secular grounds that it is in our long-term self-interest to protect the environment. Of course, what is in our long-term self-interest doesn’t always move us to act in the here and now; moreover, the long term is often “discounted” in the cost-benefit analyses done by policymakers. Theologians have argued, in response, that only a religious understanding of nature can ground an adequate environmental ethic.

Over the past several decades, many Jewish and Christian theologians have mined the Bible for examples of God’s care for nature: after the flood, God covenanted not just with Noah and his human family, but with “every living thing” never to destroy the world again (Genesis 9:8–17); God declared that the



Sabbath is for animals (as well as for people) to rest, and even the land shall rest by lying fallow every seventh year (Exodus 23:10–12, Leviticus 25:1–5); the Psalms celebrate the beauty and goodness of nature (e.g., Psalm 104); and in the New Testament, Jesus affirmed God's care for the sparrows and the lilies of the field (Matthew 6:26–29). Of course, in the first chapter of Genesis, God declares creation to be good *before* the creation of Adam and Eve; nature is good in and of itself, not simply in serving human purposes.

As a result of reflection on these and other passages, theologians have argued that the “dominion” that God gave humankind over nature is best understood as *stewardship*. The world belongs to God: “The earth is the Lord's and the fullness hereof” (Psalms 24:1). We are obligated to care for nature not simply because it is in our long-term self-interest, but because God requires it of us. God's creation must be treated with reverence.

Some Christian theologians have recently resurrected an incarnational or sacramental theology in which the idea of God as trinity bridges the gulf between the transcendent Creator and nature. Christ was the incarnation of God in human flesh. Moreover, through Christ as “Logos” all things were created (John 1), and through Christ all things in heaven and on earth are redeemed (Colossians 1:15–20) that, in the end, “God may be all in all” (I Corinthians 15:25). As God is present in the wine and bread, so God is present in the working of the world: nature isn't inert but is animated by the spirit of God.

Some liberal theologians have gone well beyond Biblical texts to reshape traditional interpretations of God and nature. As we saw in our discussion of evolution, many theologians appeal to an *immanent* God who works through evolution, transforming the world. The work of Alfred North Whitehead and the process theologians who follow him have been particularly influential, as have been various forms of “creation spirituality” developed by Matthew Fox and Thomas Berry. These theologians have extended our conception of God's action from a largely historical to a broadly cosmic context; the story of God is not simply that of a brief span of time on the earth; it is the story of the evolving universe understood spiritually.

Ecofeminist theologians have argued that the transcendent creator-God of the Bible, who is disembodied mind and who speaks with power and authority, is conceived in narrowly masculine terms, and they would replace this male God with an immanent God who speaks to us from within and, in Rosemary Radford Ruether's words, “beckons us into communion” with all of nature (1992, p. 254). Reality isn't dualistic, split between mind and matter, God and creation. Sallie McFague (1993) has suggested that we think of God as a creator-mother who gives birth to the universe, or that we reconceive nature as God's body.

Many eco-theologians have been influenced by non-Western religions that place a much greater emphasis on the divinity of nature than do Judaism and Christianity. Within Native American and African religious traditions, nature embodies those spirits and divini\_ties that the monotheistic traditions exorcised, and within Eastern religions—particularly Hinduism, Buddhism, and Taoism—all of reality is understood as being in some sense one with God or the Divine (Brahman, Nirvana, the Tao). These traditions have been much less anthropocentric than have the Western traditions. Human beings are but a small part of reality, not its masters, and we are intimately related to all of nature, with which we must live in harmony.

An impressive body of denominational and ecumenical responses to the environmental crisis now exists. In fact, a broad consensus cuts across conservative and liberal traditions regarding theological conceptions of stewardship. For example, after a 1993 “summit” on the environment, an ecumenical group of Jewish, Christian, and Native American religious leaders concluded that

a consensus now exists, at the highest level of leadership across a significant spectrum of religious traditions, that the cause of environmental integrity and justice must occupy a position of utmost priority for people of faith. . . . We pledge to take the initiative in interpreting and communicating theological foundations for the stewardship of Creation. (“Statement,” 1991, p. 637)

Many eco-theologians emphasize the relationship between ecology and economics. The combination of consumerism and technology has been particularly destructive, and, therefore, the solution to the crisis is, in part, a matter of social justice: placing environmental constraints on the marketplace, adopting more modest lifestyles, and encouraging globally coordinated redistribution of the earth's resources. It is “manifestly unjust,” Pope John Paul II has said,

that the privileged few should continue to accumulate excess goods, squandering available resources, while masses of people are living in conditions of misery. Today, the dramatic threat of ecological breakdown is teaching us the extent to which greed and selfishness—both individual and collective—are contrary to the order of creation, an order which is characterized by mutual interdependence. . . . (1989/1996b, p. 233)

Some liberation theologians have begun to extend the concept of justice beyond humankind to include nature. According to the authors of a report to the World Council of Churches: “People across the earth are fighting for liberation from the pain of oppression. . . . Liberation [now] needs to be extended to animals, plants, and to the very earth itself, which sustains all life” (*Liberating Life*, 1990, p. 252).

### Standards and Textbooks

The national science standards emphasize the importance of understanding ecosystems and the threat to their survival when “humans modify ecosystems as a result of population growth, technology, and consumption” (NRC, 1996, p. 186). In their sole recommendation to include some study of religion in science courses (the one exception to the silence on religion we mentioned earlier), the standards suggest that students might investigate various factors affecting environmental quality, including “the role of economic, political, and religious views” (NRC, 1996, p. 198). Each of the biology and earth science texts we reviewed includes one or several chapters on ecosystems and brief discussions of pollution and the ecological crisis, but none mentions religious interpretations of the problem or, more generally, of nature.

### Other Issues

We suggest, all too briefly, a few more places where questions about the adequacy—or correctness—of science might be raised on religious grounds.

- *Technology.* Particular forms of technology—nuclear weapons, for example—may be intrinsically problematic on religious grounds, but the primary religious problem with technology is, arguably, the *technological ethos* our culture has developed. From within that ethos we tend to reconceptualize moral and spiritual problems as technological problems: health is a matter of high-tech medicine rather than prayer or living well; sexual responsibility is a matter of condoms and birth control pills rather than chastity and virtue; environmental protection is a matter of clean energy rather than simpler lifestyles and social justice. As we begin to think technologically we naturally reconceive the world—and its people—as objects to be manipulated, and, in Martin Buber’s terms, the “I-Thou” language of personal relationships gives way to the “I-It” language of “objective” detachment (1958). Our sense of the sacred has withered, and we no longer feel reverence toward nature. Not only is there no moral compass built into technology or the science that shapes it, but the omnipresent “technological imperative” demands that we think and act technologically.

- *Genetic engineering.* Some forms of gene therapy involve only the individuals who are treated and are relatively uncontroversial, but “germ-line” therapy that affects genetic inheritance opens the door to social engineering and raises major moral and theological questions. The recent successful cloning of mammals makes these issues particularly urgent. Some theologians reject out-of-hand the idea of “playing God” by tampering with divinely created human nature, while some more liberal theologians argue that because God works through us and through evolution we can be “coworkers” with God, using judicious genetic interventions to help fulfill the divine potential in human nature.

- *Health and healing.* All religious traditions have provided spiritual explanations for sickness and health and have used prayer, meditation, and other spiritual means to restore health. Within modern Western civilization scientific accounts of sickness and health gradually undermined these religious interpretations. In the last several decades, however, something of a cultural shift has taken place as various forms of holistic medicine have acquired a measure of respectability even within the medical establishment, and as people have more fully appreciated the role of the mind (or soul) in healing. Indeed, there are now some efforts

under way to test scientifically the efficacy of prayer and other spiritual practices in healing. All of this is deeply controversial. What does seem clear is that traditional scientific accounts of health and healing can no longer be *assumed* to be adequate. Neither the science standards nor the national health education standards discuss religious interpretations of any of these issues.

## Constitutional Constraints

Before we can draw out the educational implications of our discussion, we must be clear about the constitutional constraints within which science education must proceed. Three Supreme Court rulings are particularly relevant.

As we have seen, in *Abington v. Schempp* (1963) the Court made it clear that it is *permissible* to teach students about the Bible and religion in public schools when this is done “objectively as part of \_a secular program of education.”<sup>3</sup> It is undoubtedly constitutional \_to teach students about religious accounts of origins and nature. Of course, the purpose of such teaching cannot be to proselytize or indoctrinate students.

In *Epperson v. Arkansas* (1968) the Supreme Court struck down an Arkansas law that prohibited the teaching of evolution. The First Amendment, Justice Abe Fortas wrote, “mandates governmental neutrality between religion and religion, and between religion and nonreligion.”<sup>4</sup> The purpose of the Arkansas law, however, was “to blot out a particular theory because of its supposed conflict with the Biblical account, literally read.”<sup>5</sup> Because its purpose was to protect Christian fundamentalism, it was not religiously neutral.

If the teaching of evolution could not be prohibited, then perhaps teaching creation-science could be required; but in *Edwards v. Aguillard* (1987) the Court struck down Louisiana’s “balanced treatment” act. Citing a paper trail of comments by the legislators who passed the act, Justice William Brennan concluded its purpose was to shore up fundamentalist Christianity and discredit evolution “by counterbalancing its teaching at every turn with the teaching of creation science.”<sup>6</sup>

Because the *purpose* of both the Arkansas and Louisiana laws was religious, they ran afoul of the neutrality required by the Establishment Clause. The Court has also repeatedly held, however, that a religious purpose need not invalidate a law or policy if there is *also* a *secular* purpose for it. Justice Fortas found none for the Arkansas law; nor could Justice Brennan for the Louisiana act. But surely there is at least one powerful secular reason for requiring students to study religious accounts of origins and nature: a good liberal education requires it. If students are to think in an informed and critical way about matters of controversy and importance (like the origins of life), they must understand religious as well as secular points \_of view.

Indeed, as we argued in Chapter 1, there may be a *constitutional* reason for *requiring*, not just permitting, students to learn about religious accounts of origins. Because the Establishment Clause requires public schools (as governmental agencies) to be religiously neutral, and because the only way to make sense of neutrality is in terms of fairness to the contending alternatives, schools must teach students about religion if they teach ways of thinking about the world that are critical of religion.

As we have seen, there are ways of reconciling modern science and much liberal religion; it is not at all clear, however, how conservative religious claims about origins and nature can be reconciled with science. Should our position be that it is permissible to teach scientific ways of understanding origins and nature that conflict with conservative religion so long as they can be reconciled with liberal religion? Is this neutral among religions—as the Establishment Clause requires? Obviously not.

But is it clear that science—as it is commonly practiced and taught—is neutral regarding even liberal religion? As we have seen, neo-Darwinian accounts of evolution conflict with the teleological accounts of evolution found in some versions of liberal theology, and it is hard to reconcile ecofeminist theology with conventional scientific interpretations of nature. Indeed, a good deal of liberal theology makes claims about nature that modern science either ignores or considers false.

Perhaps most troublesome, however, is that by ignoring religion in teaching science, we teach students *uncritically* to conceive of nature in exclusively secular terms. By systematically allowing students to remain

ignorant not just of creationism and conservative religion, but of liberal ways of integrating science and religion, science education profoundly biases the thinking of students.

Clearly the solution cannot be to censor science; this would be to provide religion with a curricular veto—hardly a neutral scheme. A true neutrality would require two things. First, students must learn about *various* alternative religious ways of conceiving nature—both conservative and liberal. Second, they must learn about the various ways of relating science and religion; they must understand the controversy over whether science and religion conflict, are conceptually independent, or need to be integrated.

It is important to keep in mind that schools can't privilege fundamentalism as the only alternative to science. As we have seen, the Establishment Clause requires neutrality among religions. The discussion must include all of the major religious ways of understanding nature. No doubt there is a practical problem here that stems from the number of religious views that are available, but there are not so many *types* of accounts. In any case, when neutrality is hard to come by, it would seem incumbent on us constitutionally to try to approximate rather than ignore it.

Where in the curriculum we teach about religious accounts of nature is, of course, crucial. Some have argued that Justice Brennan's ruling in *Aguillard* prohibited teaching about religious accounts of origins in science classes, but (carefully read) Brennan ruled the Louisiana act unconstitutional because it had a religious *purpose*, leaving open the possibility that a properly secular purpose could justify teaching *about* religion in science courses. With the proper purposes, then, where we teach about religion is an educational rather than a constitutional question—and as we shall see shortly, we can read even the national science standards as providing secular reasons for including some discussion of religion in science classes.

## The Educational Implications

The relationship between science and religion has at least the following implications for education.

- *The secularization of Western civilization* is one of the major trends of modern history, and certainly one of the major reasons for this has been the growing cultural authority of modern science. Indeed, the scientific revolution was, perhaps, the most important of all revolutions in human history because it has so radically changed our understanding of the universe, of what it means to be a person, of what it means to be rational, of what is important and ultimately meaningful. Intellectual respectability in the modern world (and in the curriculum) is now largely a matter of scientific respectability. The history of science, therefore, is not just about science; it is about modern culture. One task of a liberal education is to locate students historically in the most important ongoing cultural conversations. The scientific revolution and its cultural impact should be a major theme of both history and science courses.

- *Science as a discipline.* We don't teach the "subject" of nature—which might be open to various scientific and religious interpretations—but rather the "discipline" of science, as defined by scientific method. Although science textbooks include perfunctory chapters on scientific method, they rarely include any discussion of the relationship of science to religion; nor do they include any discussion of religious alternatives to scientific theories in the body of the texts. The effect of this is that we *implicitly* teach students either that science always trumps religion or that the two are incommensurable endeavors. Both positions are deeply controversial among theologians—and even among some scientists.

Arguably, the a priori refusal of scientists to consider religious evidence, theological arguments, or design explanations for cosmic or biological evolution suggests that scientific method and the practice of science are dictated by philosophical or ideological convictions about reality that cannot themselves be scientifically verified. Indeed, one might argue that science proceeds on the *faith* that scientific conceptual nets will prove adequate, in the end, to catch everything. But how do we know that now?

A good liberal education requires that when we disagree about matters of great importance, we teach students the conflicts; we teach them about the contending alternatives. Indeed, if students are to think *critically* about science and its relationship to other domains of knowledge, their education can't be limited to

scientific perspectives on these relationships. Of course, a part of what is at issue is what counts as an *other* domain of knowledge; some believe that science and religion share an overlapping domain.

- *Fairness.* We do not advocate “balanced treatment” or “equal time” for religion in science classes. We do recommend that science texts and courses provide some context for understanding connections and conflicts with religion by putting them into historical and philosophical perspective. Texts should acknowledge that these relationships are controversial and can be understood in various ways; they must show some sophistication.

All science texts and courses should include some discussion \_of the relationship of science and religion in an opening chapter or \_in opening lectures, as part of a broader review of the history and - philosophy of science and scientific method. Sections of texts and courses dealing with evolution, the big bang, ecology, and other religiously important and controversial issues should provide some context for understanding what is at issue religiously. For example, biology texts and courses should explain why religious conservatives reject evolution *and* why religious liberals accept it (but may still have problems with neo-Darwinism).

This is what we called, in Chapter 2, a *minimal* fairness. A *robust* fairness would require a course in religious studies that treats religious interpretations of nature in greater depth in the context of the study of various religious traditions, taught by teachers certified in religious studies. By their very nature science courses can't be robustly fair; but the curriculum as a whole can be. Science teachers aren't prepared to deal with religious perspectives on nature. We do recommend that all prospective science teachers take an undergraduate course in science and religion.

- *Theory and fact.* Some religious conservatives argue that evolution should only be taught as theory—meaning by this, as *speculation*—rather than as fact. This argument has a point, though it is often misunderstood. In science, a theory is not a hypothesis or (mere) speculation, but a comprehensive conceptual scheme that relates a broad range of phenomena in a way that provides explanatory power. Theories can be confirmed. No doubt some aspects of evolution remain controversial among scientists (gradualism versus punctuated equilibrium, for example), but most scientists take evolution and neo-Darwinian accounts of it to be confirmed; these matters aren't mere speculation.

But it is one thing to teach students that neo-Darwinism is good science; it is another thing to teach them that they are justified in believing it to be true, *all things considered*. Whether neo-Darwinism is either true or an adequate account of evolution is, in part, a philosophical question, and answers depend on how we assess the relationship of science and religion. As we know, this relationship is controversial.

It is not the proper task of public schools to encourage, much less *uncritically* encourage, students to accept secular rather than religious interpretations of nature. It is their task to enable students to understand both and to think in informed ways about their relationship. Students must learn what scientists take to be good science; they must also learn that what is true, *all things considered*, may be something else. One purpose of a liberal education is to make sure that students are in a position to make “all things considered” judgments, rather than accepting uncritically the conventional wisdom of any discipline, science included.

If we take religious neutrality seriously we have to “bracket” truth claims regarding matters of religious controversy. Just as teachers and texts cannot teach that religious creationism is true or false, so they cannot teach that theories that conflict with it are true or false.

- *Creation-science and intelligent design.* To the extent that creation-science assumes a particular reading of Scripture as its starting point, it has no claim for inclusion in the science curriculum *as science*—though, obviously, any truly *scientific* evidence put forward by creation-scientists may have a legitimate claim to be taken seriously. Advocates of “intelligent design” theories often distinguish their approach sharply from that of creation-scientists, arguing that they do not start from (a literal reading of) Genesis, but from scientific evidence for levels of complexity and interdependence in nature that can only be plausibly explained in terms of design. Because mainstream science is committed to *philosophical naturalism*, they argue, it doesn't allow design arguments to be considered. Indeed, intelligent-design theorists sometimes claim that they are more truly scientific in their approach, because they don't rule out explanations on philosophical grounds.

Of course, if we take either intelligent design theory (or creation-science, for that matter) to be *nothing more than* science, there is no argument to be made for including either one in the curriculum as a matter of *religious neutrality*. If they are science, the argument for including them should be made in terms of good science education. We believe that scientists should be free to determine both what counts as good science and what range of alternative scientific theories should be included in the curriculum when scientists disagree among themselves. Given the number of its advocates, there may be no more obligation to include intelligent design in the science curriculum than any scientific theory held by a relatively small minority of scientists.

Having said this, we also note that science changes, and scientists have, on occasion, come to realize they have been overly dogmatic in their criteria for determining what counts as good science. Some design theories in both cosmic and biological evolution are grounded in sophisticated analyses of evidence and strike us as warranting discussion. Moreover, the ideal of a liberal education is always to be inclusive rather than narrow.

We would add that legislators are not likely to be competent \_to determine what counts as good science; the balanced-treatment laws were heavy-handed and misguided efforts from the beginning. We believe that it *does* fall within the competence of legislatures to require that students study religion—and religious conceptions of nature and origins—as part of a good liberal education, however. Obviously such study must be done in a way that has educational integrity, does not privilege a particular religious tradition, and does not proselytize but maintains religious neutrality.

- *The principle of cultural location and weight.* Although a good liberal education provides students with alternative ways of understanding controversial issues, it will not present those alternatives in the abstract, but in context. Creation-science, theories of intelligent design, theological accounts of evolution, and neo-Darwinism aren't simply alternative items on a cafeteria line that students should be free to choose depending on their tastes. If they are to make educated judgments about the alternatives, they should understand how widely held the different views are and within which scientific and religious traditions. Which are consensus views, which are controversial views, and for whom? And what can each view say in defense of itself or in criticism of its competitors?

- *Primary sources.* As is always the case in dealing with controversial issues, it is important to use primary sources and let advocates of the contending alternatives speak for themselves. This is particularly important when textbooks are not at all open to some of those alternatives. Again, we are not advocating equal time, but science education must take place in the context of liberal education, and on particularly important and controversial issues, it must expose students to a wider range of voices than they now hear.

- *Teachers' responsibilities.* Needless to say, neither the ideal curriculum nor ideal textbooks are just around the corner. This being the case, we recommend (1) that science teachers familiarize themselves with the basic issues regarding the relationship of science and religion, particularly in their own discipline(s); (2) that when they have an informed understanding of the basic issues, they provide students with some sense of what is at issue religiously at appropriate points in their classes, using such supplementary readings, from several religious traditions, as are available; and (3) that they remain neutral on questions of ultimate truth (as opposed to what counts as good science).

- *The science standards again.* Although the standards say virtually nothing about religion, we take our recommendations to be in their spirit. Consider the following statements from the standards. *In science courses* students should learn “the difference between scientific and other questions” and “appreciate what science and technology can reasonably contribute to society and what they cannot do” (NRC, 1996, pp. 169–170). In studying science “students need to understand that science reflects its history and is an ongoing, changing enterprise.” Students should learn about “the role that science has played in the development of various cultures” (NRC, 1996, \_p. 107). Most important, *students should learn how scientific knowledge “connects to larger ideas, other domains, and the world beyond”* [emphasis added] (NRC, 1996, p. 36). This being the case, teachers need to be able to make “conceptual connections” to “other school subjects” and be able to use “scientific understanding and ability when dealing with personal and societal

issues” (NRC, 1996, p. 59). Finally, we’ve noted that the standards suggest that students might study religious views of the environment (NRC, 1996, p. 198). That is, the standards conceive of science education as requiring some understanding of the development and influence of science in history, and its relevance to social issues, other subjects in the curriculum, decision making, “larger ideas,” and “other domains.” So even though the standards say virtually nothing explicit about religion, they seem implicitly to require some discussion of religion nonetheless.

- *Shifting boundaries.* Finally, it is important to remember that the conventional disciplinary boundaries have been challenged from a variety of directions over the past several decades. Many *secular* postmodernist scholars have attacked the “objectivity” of modern science, arguing that it is culturally biased, reflecting the interests and ideology of its time, place, and class. Some scientists argue that recent developments in cosmology, chaos theory, and quantum mechanics make the world of late-20th-century science a rather more mysterious world, one more open to religious interpretation, than the *\_old* deterministic billiard-ball world of classical science. And, finally, liberal theologians have turned more and more to integrationist approaches in developing new theological interpretations of nature. As culturally significant as they are, all of these developments (and others) should be mirrored in some way in science education.

We want to be very clear about what we are *not* arguing in this chapter. We are not arguing that any particular scientific claims are false, that scientific method is inadequate for understanding reality, or that any particular religious claims about nature are true. (Indeed, we are inclined to think that modern science is the greatest of all human intellectual achievements.) But the relationship of science and religion, and the truth of various scientific and religious claims about nature, are deeply controversial. If students are to be liberally educated, they must be initiated into a discussion in which they hear a *variety* of voices, not just those of scientists. And it is unfortunate that the usual way of framing the discussion makes Christian fundamentalism the sole alternative to modern science, when there are various moderate, liberal, and non-Christian theological alternatives as well.

To some considerable extent, modern science has come to define what it is reasonable to believe—not just about nature, but about all of life. For many educators, scientific method defines what it means to be rational. Hence, it is tremendously important that students acquire some critical distance on the claims of science. Unfortunately, educators do nothing to give students the resources to judge the adequacy of science *all things considered*. This is no small matter; it plays a major role in marginalizing religion and *uncritically* constricting our sense of what is reasonable.

## Suggested Readings\_and Resources

The recent literature on science and religion is enormous; we can hardly scratch the surface. For those who need a good introduction to the major issues, the place to start is the work of Ian Barbour, whose encyclopedic understanding of science, theology, and philosophy makes him a superb guide. In *Science and Religion* (1997) Barbour provides both a historical overview of the developing relationship of science and religion and a deeply informed analysis of current science and theology and various ways of understanding their relationship. We have drawn heavily on Barbour and on the philosopher E. M. Adams, whose *Religion and Cultural Freedom* is an illuminating and challenging philosophical study of the relationship of science, religion, and modernity.

Several anthologies provide excellent introductions to the relationship of science and religion generally, as well as to particular issues. See, for example, *Religion and Science* (1996), edited by W. Mark Richardson and Wesley J. Wildman; *Physics, Philosophy, and Theology: A Common Quest for Understanding* (1988), edited by Robert J. Russell and colleagues; *Science and Theology* (1998), edited by Ted Peters; and *Evidence of Purpose* (1994), edited by Sir John Templeton.

Steven Katz’s “Judaism, God, and the Astronomers,” in Robert Jastrow’s *God and the Astronomers* (1980), is a superb account of how Jewish and Christian thinking about creation and evolution differ. Two of George Marsden’s essays provide excellent accounts of conservative Protestant views of science: “Evangelicals and the Scientific Culture,” in *Religion and Twentieth Century American Intellectual Life* (1989), edited by Michael J. Lacey; and “Understanding Fundamentalist Views of Science,” in *Science and Creationism* (1984), edited by Ashley Montagu.

The historian of science Ronald Numbers has written a superb history of creation-science called *The Creationists* (1992). In a series of books Berkeley law professor Philip Johnson has argued that Darwinism is, essentially, a closed philosophical theory that rules much of the relevant evidence out of bounds a priori; see his *Darwin on Trial* (1991), and *Reason in the Balance: The Case Against Naturalism in Science, Law, and Education* (1995). In *Darwin's Black Box* (1997), the biochemist Michael Behe provides a sophisticated argument for intelligent design in dealing with evolution. *Pandas and People* (1989) is a short, low-key, but controversial textbook supplement designed to inform students about intelligent design theory as an alternative to conventional evolutionary theory.

Teilhard de Chardin's *The Phenomenon of Man* is a classic (if difficult) statement of divinely guided evolution. For a good, more recent and readable theological exploration of evolution, see Philip Hefner's *The Human Factor: Evolution, Culture, and Religion* (1993). Conrad Hyers provides an interesting and thoughtful reading of the Genesis Creation narratives and their relationship to science in *The Meaning of Creation* (1984). Several highly respected scientists with considerable theological sophistication have argued forcefully for integrating science and religion. See, for example, biochemist Arthur Peacocke's *Creation in a World of Science* (1979) and *Theology for a Scientific Age* (1990), or any of the many works of physicists Paul Davies and John Polkinghorne. The theologian Langdon Gilkey's *Maker of Heaven and Earth* (1959) has been the classic statement of what we have called the "independence" position, but also see his more recent "integrationist" study *Nature, Reality, and the Sacred* (1993). In *Religion and Creation* (1996) Keith Ward looks at Hindu, Muslim, Jewish, and Christian thinking about creation, focusing primarily on the 20th century.

*Worldviews and Ecology* (1994), edited by Mary Tucker and John Grim, is a good collection of essays on ecology from the perspectives of the major world religions. For a more comprehensive anthology, see *This Sacred Earth: Religion, Nature, Environment* (1996), edited by Roger Gottlieb, a superb collection of documents and essays from various Western religious traditions. In *Religion and the Order of Nature* (1996) Seyyed Hossein Nasr explores how nature has been understood in the world's religions, describes the secularization of nature by modern science, and argues for returning to the idea that nature is sacred. In *The Universe Story* (1992) the physicist Brian Swimme and theologian Thomas Berry offer a spiritual interpretation of the universe from the Big Bang to the present day.

Two of the most influential ecofeminist theologies of nature are Rosemary Radford Ruether's *Gaia and God: An Ecofeminist Theology of Earth Healing* (1992) and Sallie McFague's *The Body of God: An Ecological Theology* (1993).

The theologian David Ray Griffin has written extensively about the theological implications of *postmodern* ways of thinking science and religion; see especially his introduction to *The Reenchantment of Science* (1988). Also see Nancy Murphey's insightful works, especially *Anglo-American Postmodernity: Philosophical Perspectives on Science, Religion, and Ethics* (1997).

*Darwin*, by Adrian Desmond and James Moore is a superb biography, a good read, and especially helpful on Darwin and religion. For critiques of religious interpretations of evolution see Jacques Monod's *Chance and Necessity* (1971), Richard Dawkins' *The Blind Watchmaker* (1986), and most of the many works of Stephen Jay Gould. In *Dreams of a Final Theory* (1992) the distinguished physicist Stephen Weinberg rejects accounts of a "fine-tuned" universe, arguing that a "chilling impersonality" is characteristic of the laws of nature (p. 245).