

# ANTIEVOLUTION AND CREATIONISM IN THE UNITED STATES

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KEY WORDS: science, religion, creation-evolution controversy, intelligent design, evolution

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## ABSTRACT

Evolution is considered controversial by a substantial minority of Americans. Religious opposition explains this, but this opposition is comprised of a broad continuum of religious views. It runs from “young earth creationism” through “old earth creationism” (including “day-age,” “gap,” and “progressive creationism”) to “theistic evolutionism.” Historically, antievolutionists have attempted to ban evolution and to present it on an equal footing with “creation science.” Scholars largely ignored antievolutionism until efforts to pass “equal time for creation and evolution” laws stimulated both political and scholarly activism. Lately, there are efforts to discourage the teaching of evolution by requiring teachers to read disclaimers before teaching it, to teach it as “theory, not fact,” or to present fancied “evidence against evolution.” Recently, “intelligent design theory,” a restatement of William Paley’s Argument from Design, has surfaced. Although rejected by scientists, intelligent design arguments and publications are appearing at the college level (in nonscience courses) as accurate representations of scientific scholarship.

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## INTRODUCTION

According to a 1996 poll of adult Americans conducted by the National Science Board, only 44% agreed with the statement, “Human beings, as we know them today, developed from earlier species of animals” (National Science

Board). Forty percent disagreed, and 16% answered “don’t know.” The same survey showed that 52% of American adults either agreed or didn’t know that “[t]he earliest humans lived at the same time as the dinosaurs” (32% agreed, 20% didn’t know).

And yet, the National Academy of Sciences states unequivocally that:

Evolution pervades all biological phenomena. To ignore that it occurred or to classify it as a form of dogma is to deprive the student of the most fundamental organizational concept in the biological sciences. No other biological concept has been more extensively tested and more thoroughly corroborated than the evolutionary history of organisms (National Academy of Sciences 1984).

There is a gap between the acceptance of evolution in the scientific community and its acceptance among the general public. It appears that among well-accepted scientific theories (heliocentrism, cell theory, atomic theory, plate tectonics), evolution alone is rejected by nonscientists. In a poll by the American Museum of Natural History, for example, 78% of adult Americans accepted the theory of continental drift (“continents gradually change their positions”) (American Museum of Natural History 1994).

A significant variable in understanding antievolutionism is the degree to which a literal interpretation of holy texts is considered essential to theology. Thus Biblical-literalist Christians, ultraconservative Jews, and Koranic-literalist Muslims object to evolution. Because the number of Jews and Muslims in the United States is small compared with Christians, and because the most active antievolutionists are Christian, I focus on Christians in this review. Antievolution and creationism in other countries are beyond the scope of this chapter; however, useful discussions can be found in Edis (1994), Goodman (1995), Groves (1991), and Scott (1991).

Religious opposition to evolution propels antievolutionism. Although antievolutionists pay lip service to supposed scientific problems with evolution, what motivates them to battle its teaching is apprehension over the implications of evolution for religion. Conservative Christians who are strongly literalist in their views fear that if their children learn evolution, they will cease to believe in God. Without God to guide them, children will grow up to be bad people. In the words of Henry R Morris, a prominent creationist, “Evolution is at the foundation of communism, fascism, Freudianism, social darwinism, behaviorism, Kinseyism, materialism, atheism, and in the religious world, modernism and neo-orthodoxy” (Morris 1963, p. 24). Conservative Christians also believe that the child who loses faith in God also is lost to salvation. Clearly, antievolutionists’ motives for opposing the teaching of evolution to their chil-

dren are strong. As shown below, however, the strict literalist view is not universally held by the majority of Christians in the United States.

Rejecting evolution has a long history in America. Antievolutionism has been a political and social movement in this country for most of this century. In this review, I define terms and issues critical to an understanding of the movement and briefly discuss the history, motivations, and evolution of antievolutionism. I argue that antievolutionism has evolved from the purely religious opposition of the Scopes era to creation science, and to the present neocreationism period. The academic response to creationism has been an unusual mixture of scholarship and activism. An explosion of books and articles from the mid-1970s through the late 1980s was motivated less by scholarly interest than by efforts to oppose antievolutionists in their attempts to legally impose their views on the public education system. The actual writings themselves were overwhelmingly written not for other scholars but for members of the general public. Oddly, there have been few social-scientific analyses—anthropological, sociological, or psychological—of this antievolution movement. Unlike with other social issues—such as antiabortion or animal rights—there is a marked shortage of research on “what makes these people tick.”

The review concludes with the implications of a recent development in neocreationism: the movement of antievolutionism to secular schools of higher learning.

## DEFINITIONS

### *Evolution*

“Evolution” in its most basic sense is a simple idea: Change through time has taken place. The universe has a history: The present is different from the past. Physical and chemical evolution include the formation of elements in the nuclear blast furnaces of evolving stars, the formation of galaxies, and the formation of star systems with planets. The earth has changed greatly in the past four billion years; the present is different from the past.

Darwin’s “descent with modification” is the most useful definition of biological evolution. Darwinism is a specific kind of evolution: Living things descend with modification from ancestors through natural selection. In the 1940s and 1950s, classical natural selection theory coupled with genetic theory became known as the synthetic theory of evolution, or neo-Darwinism. Late-twentieth-century explanations of the rate and manner of biological evolution include Eldredge and Gould’s theory of “punctuated equilibria,” speculations about natural selection above (species selection) and below (selfish genes) the level of organism or population, and nonselective mechanisms bringing about

evolutionary change (neutralism or non-Darwinian evolution) (Dawkins 1976, Eldredge 1989, Eldredge & Gould 1972, King & Jukes 1969, Stanley 1981). The relationship between evolution and developmental biology is an active area of research. Evolutionary biological theory has progressed beyond classical Darwinism and even neo-Darwinism, although the current consensus is that neo-Darwinism explains much, if not most, of biological evolution.

### *Creationism*

Creationism generally refers to the idea that a supernatural entity(s) created the universe and humankind. Creation stories are extensively studied in comparative religion and in the anthropology of religion. Christian creation theology stories take a wide range of forms, from the general—"God created"—to the specific—exactly what, how, and when God created. Thus, if someone responds "yes" to the survey question "Are you a creationist?" the survey will obtain little useful information about what that person believes.

**SPECIAL CREATIONISM AND DEISM** To understand the variety of creationisms, it may be useful to consider various forms or poles of Christian theology (McGrath 1994, Torrance 1981). Special Creationism and Deism can be seen to contrast the most strongly. Special Creationism is the doctrine that God created the universe and all that is in it—including human beings—as a special act, or as a series of special acts. God is seen as a personal (though not necessarily anthropomorphic) entity concerned and directly involved with His creation, and especially concerned with the doings of humankind. God also actively interacts with the universe and with humankind.

Deism, however, is the theological view that God set in motion the laws of nature and "sat back" from then on. The universe came about gradually, probably beginning with the Big Bang and the subsequent formation of stars and galaxies from swirling dust clouds, and so on to the present. In this review, the key distinction between Deism and Special Creationism is that with Deism, God "is left with nothing to do," in the words of Johnson (1990). Deists envision a far less "hands-on" God than do Special Creationists, which is a major difference and source of conflict between the two theologies. The God of the Deist is a grand and awe-inspiring force but not a God one would be inclined to supplicate. Conservative Christians, especially those defining themselves as born again, treasure a personal relationship with God, who they feel is guiding their lives. Various Christian theologies can be arranged along a continuum of belief about the personality or impersonality of God, with Deists at one end and Special Creationists at the other. Special Creationists themselves can be ranged along a continuum.

THE CREATION/EVOLUTION CONTINUUM

Most members of the public define the creation/evolution controversy dichotomously with creationists on one side and evolutionists on the other, but in truth there is a continuum of positions rather than a dichotomy (see Figure 1). The continuum reflects theological conservatism and liberalism but also reflects inversely the degree of acceptance of modern science. Special Creationists can be divided into two groups: Young Earth Creationists and Old Earth Creationists.

*Young Earth Creationism*

Young Earth Creationists (YECs) are Special Creationists who believe that the universe came into being only a few thousand years ago. The most conservative YECs are Flat Earthers, who accept little of the modern scientific consensus (DeFord 1931). Charles K Johnson, head of the International Flat Earth Society, headquartered in Lancaster, California, believes seriously that earth is as the ancients perceived it: circular and flat, not spherical (Schadewald 1991).

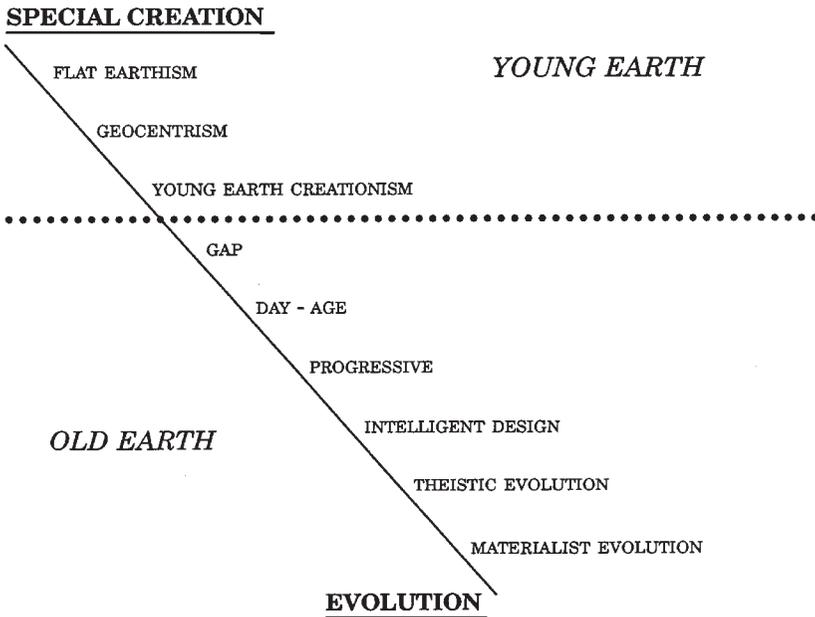


Figure 1 The creation-evolution continuum. For simplicity, statements are shown at equal spacing along a continuum. In reality, some viewpoints are closer together and some are farther apart than shown.

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The earth is shaped like a coin, not a ball. The International Flat Earth Society has only about 200 members (Schadewald 1980) and is insignificant in the antievolution movement. It is an example, however, of extreme Biblical-literalist theology: The earth is flat because the Bible *says* it is flat, regardless of what science tells us.

Geocentrists are somewhat more liberal YECs. They accept that the planet is a sphere but deny that the sun is the center of the solar system. Like Flat Earthers, they reject virtually all of modern physics and chemistry as well as biology. Geocentrism is a somewhat larger but still insignificant component of modern antievolutionism. Still, at the Cleveland Bible-Science Association creationism conference in 1985, the plenary session debate was held between two Geocentrists and two Heliocentrists (Bible-Science Association 1985).

Flat Earthers and Geocentrists believe in a universe and planet that are only a few thousand years old, much as did Bishop Ussher and John Lightfoot. Technically, they are YECs, but within antievolutionist circles the term YEC is usually reserved for the followers of Henry Morris, founder and recently retired director of the Institute for Creation Research (ICR) and arguably the most influential creationist of the late twentieth century. Few of these so-called classical YECs interpret the flat-earth and geocentric passages of the Bible literally, but they reject modern physics, chemistry, and geology concerning the age of the earth. They deny biological descent with modification.

YEC AND THE INSTITUTE FOR CREATION RESEARCH Henry Morris can be said to have defined antievolutionism in its modern form. In 1963, he and John C Whitcomb published *The Genesis Flood* (Whitcomb & Morris 1963), a seminal work that outlined a scientific rationale for Young Earth Creationism. As the title suggests, the authors accept Genesis literally, including not just the special, separate creation of human beings and all other species, but the historicity of Noah's Flood. Although efforts to make a literal interpretation of the Bible compatible with science, especially geology, occurred throughout the eighteenth and nineteenth centuries, *The Genesis Flood* was the first significant twentieth-century effort. The book made it possible for religious antievolutionists to argue that evolution was not only religiously objectionable but also scientifically flawed. Creation science was fleshed out by subsequent books and pamphlets by Morris and those inspired by him.

The ICR was founded by Morris and others in the early 1970s to promote scholarship in YEC science—especially flood geology—and to train students (Numbers 1992). It remains the flagship creationist institution to which all other YEC organizations look. It has a large publishing arm called Masterbooks, a graduate school conferring masters degrees in science and science education, and a public museum. Most other YEC organizations sell and other-

wise distribute ICR books, pamphlets, filmstrips, videos, movies and other materials through their newsletters, and the movement leans heavily on Morris's writings and perspectives (Toumey 1994). The ICR also organized Back to Genesis revivals sponsored by local churches, during which ICR faculty lecture for one to three days, promoting both the theology and the science of creation science. Thousands of people attend these sessions, which are held at least once a month. Other outreach activities include radio programs broadcast on several Christian radio networks and occasional tours to the Grand Canyon and other sites.

Very little actual research is performed by ICR faculty. Publications are almost entirely on Christian apologetics. In a review of the ICR graduate school, a visiting committee of scientists concluded that "no member of the resident faculty of the ICR has continued an active and published research program since arrival at the ICR. The Institute for Creation Research can therefore not be considered to be a scientific research institution" (Wills et al 1990, p. 22).

In addition to the Institute for Creation Research, there are several other regional and national YEC organizations. Near Minneapolis is located the Bible-Science Association, which publishes a nationally distributed newsletter. Australian evangelist Ken Ham, a former ICR employee, formed his own Answers in Genesis ministry, located in Florence, Kentucky. Ham distributes the Australian four-color magazine *Creation ex Nihilo* as a premium to his members, and he also circulates a newsletter. He is currently planning to establish a Genesis Park theme park and museum in Kentucky which will present the Flood, the creation of Adam and Eve, and other elements of Genesis as historical fact.

The student group Students for Origins Research began at the University of California, Santa Barbara in 1975 and became a registered nonprofit organization in 1979. Its newspaper was distributed free on campuses around the country during the 1980s, and the organization metamorphosed in the early 1990s into Access Resource Network (ARN). Its publications have had a couple of format changes, and ARN currently publishes a journal called *Origins and Design*. Its orientation has shifted a bit from fairly strict YEC to promotion of design theory (discussed below).

### *Old Earth Creationism*

The idea that the earth is ancient was well established in science by the mid-1800s and was not considered a radical idea in either the Church of England or the Catholic Church (Eiseley 1958). Modern YECs are not only on the fringes of modern science, they are also on the fringes of modern theology. From the mid-1700s onward, different explanations have been devised to accommodate

the idea of Special Creationism with scientific data and theory showing that the earth was ancient. These views retained the critical element of Special Creation: that God is personally involved. The present may indeed be different from the past, but God was seen as the active causal agent of the observed changes.

**GAP THEORY** One of the better-known accommodations of religion to science was the Gap or Restitution Theory, which claimed that there was a large temporal gap between Gen. 1:1 and Gen. 1:2 (Young 1982). Articulated from about the late eighteenth century on, Gap Theory assumes a pre-Adamic creation that was destroyed before Gen. 1:2, when God started all over again to create the world in six days and to create Adam and Eve. The gap between two separate creations allows for an accommodation of the proof of the ancient age of the earth with Special Creationism.

**DAY-AGE THEORY** Another attempt to accommodate science to a literal, or mostly literal, reading of the Bible is the Day-Age Theory, which was more popular than the Gap Theory in the nineteenth and earlier part of twentieth centuries (Young 1982, p. 57). Science and religion are both accommodated by having each of the six days of creation be not a 24-h day but a long period of time, even thousands or millions of years. Many literalists have found comfort in what they regard as a rough parallel between organic evolution and Genesis, in which plants appear before animals and human beings appear last.

**PROGRESSIVE CREATIONISM** Although some modern activist antievolutionists may still hold to Day-Age and Gap theories, the view held by the majority of today's Old Earth Creationists (OECs) is some form of Progressive Creationism (PC). The PC view blends Special Creationism with a fair amount of modern science. Progressive Creationists, such as Hugh Ross of Reasons to Believe ministries, have no problems with scientific data concerning the age of the earth or the long period of time it has taken for the earth to come to its current form. Ross, an astronomer with a PhD from the University of Toronto, even cites the Big Bang as evidence of the creative power of God. Although the PC view accepts modern physical science, it incorporates only parts of modern biological science.

Progressive Creationists (PCs) believe that God created "kinds" of animals that were of a higher taxonomic level than species. Most PCs accept that God created creatures containing at least as much genetic variation as a family (e.g. Felidae, Cercopithecidae) and considerable "evolution within a kind" then occurred. A created cat kind would have possessed sufficient genetic variability to differentiate into lions, tigers, leopards, pumas, bobcats, and housecats through the normal microevolutionary processes of mutation and recombina-

tion, natural selection, genetic drift, and speciation. The literature speaks of “horizontal” change, which is considered acceptable because it is within the kind. Although microevolution can explain horizontal change, evolution taking place within a kind is limited because genetic variation is limited: It is not possible to derive one kind from another. “Basic body plans,” as creationists call them, are distinct from one another, and thus “vertical” changes between kinds cannot occur (Ramm 1955). In antievolution literature, vertical change equates with macroevolution, or evolution above the species level. The basic body plans of major phyla that appear in the so-called Cambrian explosion are seen by most Old Earth Creationists as evidence of Special Creation.

YECs hold similar views of created kinds, but they believe that all the kinds were created during the six, 24-h days of Genesis. Although YECs hold to the same “microevolution/horizontal”-vs-“macroevolution/vertical” dichotomy, they interpret the fossil record quite differently than such OECs as PCs. The YECs look at the patterned distribution of fossils in the geological column as merely an artifact of the formation of geological strata after the waters of Noah’s Flood receded. All the kinds were created at one time, and for a variety of reasons sorted themselves out in the pattern (e.g. unicellular below multicellular, invertebrates below vertebrates) shown by paleontologists. To a PC, the distribution of fossils in the geological column is real and is the result of the special creation of different kinds at different times, followed by some differentiation within these kinds. For both YEC and OEC, however, God is a hands-on God who intervenes to produce a world that accomplishes His as yet-unknown purpose.

There rarely are sharp boundaries along a continuum. There is a sharp division between YEC and OEC but far less clarity between and among the various OEC persuasions. Even though OECs accept most of modern physics, chemistry, and geology, they are not too dissimilar to YECs in their rejection of descent with modification (the evolutionist’s explanation of the fossil record).

**THEISTIC EVOLUTION** In Figure 1, Progressive Creationism is followed by Theistic Evolutionism (TE), a theological view in which God created but relied more upon the laws of nature to bring about His purpose. According to TE, one species can give rise to another: Descent with modification can occur. Proponents of TE vary in whether and how much God is allowed to intervene—some Theistic Evolutionists (TEs) are close to being Deists. Other TEs see God as intervening at critical intervals during the history of life—especially in the origin of human beings—and, in turn, are closer to PCs. In one form or another, TE is the view of creation taught at the majority of mainline Protestant seminaries, and it is the official position of the Catholic church. In 1996, Pope John Paul II reiterated the Catholic TE position, according to

which God created, evolution occurred, human beings may indeed have been descended from more primitive forms, and the Hand of God was required for the production of the human soul (John Paul II 1996).

**MATERIALIST EVOLUTIONISM** On the continuum in Figure 1, TE is followed by Materialist Evolutionism (ME), a nonreligious view. Today, all science operates under a *methodological materialism* that assumes that scientific epistemology is limited to formulating explanations of the natural world on the basis of natural, rather than supernatural, causes. Materialist Evolutionists (MEs) go beyond science and propose that the laws of nature are not only sufficient to explain all of nature and evolution but that the supernatural does not exist. This is *philosophical materialism (naturalism)*, the idea that there is nothing in the universe beyond matter, energy, and their interactions. This view has a long history in Western thought, but as a philosophy it is distinct from the methodological materialism that informs science in the late twentieth century. When scientists such as William Provine and Richard Dawkins present philosophical materialism as the inevitable outgrowth of science or evolution (Dawkins 1987, Provine 1988), they reinforce the view encouraged by Morris and other antievolutionists that “one cannot be an evolutionist and a Christian.”

I now review the legal history of the response to antievolutionism, which stimulated the scholarly analysis of the antievolution movement that began in the mid-1970s.

## LEGAL HISTORY

### *Creation Science*

John T Scopes was tried in 1925 for violating a Tennessee law that banned the teaching of evolution. Such laws were struck down in 1968 by the Supreme Court in *Epperson v. Arkansas*. Of more concern for antievolutionists was the reemergence of evolution in high-school textbooks, from which the subject had been systematically deleted since about the 1930s (Grabiner & Miller 1974). After the Soviet Union beat the United States into space by launching Sputnik in the late 1950s, Congress began to pour money into upgrading public K–12 education. Beginning in 1959, the Biological Sciences Curriculum Study, a group of university scientists and master teachers, prepared a series of high-school biology textbooks that placed evolution squarely at the center of biology education. Because these books received the imprimatur of the government (they were sponsored by the National Science Foundation), they sold well and encouraged commercial publishers to rewrite their textbooks to include evolution.

The reemergence of evolution in the curriculum roused the antievolutionists to respond. In 1963, Whitcomb and Morris published *The Genesis Flood*, arguing that there were scientific data supporting a Biblical-literalist Special Creationism. The idea began to evolve that even if it were no longer possible to ban evolution, children could be given a scientific (and thus legal) alternative to evolution so they would not have to “believe” it. In 1978, a Yale law student named Wendell Bird wrote an article in the *Yale Law Review* presenting a legal justification for teaching both evolution and creation science (Bird 1978). The “equal time” movement was born.

During the early 1980s, a series of bills promoting equal time for the teaching of creation science was introduced in at least 26 state legislatures, some more than once (Scott 1994). Most of them were clones of a model bill developed by a South Carolina respiratory therapist, Paul Elwanger, which was influenced by an ICR model resolution for equal time (Morris N.d.). The bills defined creation science as including the ideas of “a worldwide flood” and other YEC mainstays, including the special creation of human beings. If so-called evolution science was taught, then creation science, its proposed parallel, must be taught as well. Arkansas and Louisiana each passed similar Elwanger-type bills, and both bills were taken to court.

**ARKANSAS AND LOUISIANA** Arkansas’s equal time law was declared unconstitutional in 1982 after a full trial dubbed “Scopes II.” Opposing the law were leaders of many religious organizations. Joining the lead plaintiff, Methodist Rev. Bill McLean, were the bishops or other leaders of Roman Catholic, Episcopalian, African Methodist Episcopal, Presbyterians, and Southern Baptist churches, and Reform Jews (Larson 1985). The ACLU arranged pro bono representation by a leading New York law firm and assembled an all-star cast of witnesses from the fields of science, philosophy of science, education, and theology. The *McLean v. Arkansas* decision was a rousing victory for the anti-creationists: Federal District Judge Overton not only struck down the law but declared that creation science failed as science. Having lost badly, the state did not appeal.

The failure of the Arkansas equal time law slowed but did not halt the effort to pass legislation. At virtually the same time as the Arkansas decision was being issued, Louisiana passed a similar equal time law which was challenged by both proponents and opponents: one side suing to immediately implement the law and the other requesting an injunction. The lawsuits took a long time to wend their ways through the courts, and there was no full trial as there had been in Arkansas. Finally, in 1987, the Supreme Court decided in *Edwards v. Aguillard* that equal time laws like Louisiana’s violated the establishment clause of

the First Amendment of the Constitution because they promoted an inherently religious idea: creationism (Larson 1985, Numbers 1992).

### *The Scholarly Response*

The scientific community was appalled at the proliferation of such laws, and in 1980–1981 a loose coalition of scientists and teachers formed Committees of Correspondence in most of the states (Weinberg 1982). Led by biologist Wayne Moyer, then-director of the National Association of Biology Teachers, and retired high-school biology teacher Stanley Weinberg, this coalition evolved by 1983 into the National Center for Science Education (NCSE), which remains an organization consisting primarily of scientists who support the teaching of evolution in the public schools and oppose creation science and other religiously based attacks on evolution. Weinberg's occasional "Memorandum to Liaisons to State Committees of Correspondence," which he began in March 1981, and later, the NCSE's *Creation/Evolution Newsletter*, helped scientists and others keep abreast of legal and other developments in the antievolution movement.

In the summer of 1980, the American Humanist Association established a journal entitled *Creation/Evolution*, which was intended to provide nonscientists with understandable scientific refutations of creationist arguments. Prominent evolutionary scientists actively supported the antirealist movement by analyzing and refuting the scientific arguments of creation science in publications read by the general public such as *Creation/Evolution*, *Science 82*, *The New Republic*, *Natural History*, and others. They argued that creation science argumentation characteristically pulls out odd bits of data from the mainstream scientific literature and then proclaims that these out-of-context statements are proof that evolution did not occur. Because of the arcane nature of many of these arguments, specialized knowledge from biology, astronomy, geology, biochemistry, and anthropology was needed to refute factual claims made by antievolutionists.

Scientists, many of them associated with Weinberg's Committees of Correspondence network, testified against equal time laws in their state legislatures, helping to persuade legislators not to pass such bills. The role of scientists was critical: If creationism could indeed be made scientific, then it would deserve a place in the curriculum. Scientists were the only ones qualified to judge whether creationism was in fact scientific and whether it was good scholarship. When equal time provisions were suggested in local school-board meetings, teachers greatly appreciated the input of scientists (Lewin 1981). Typical of the combined activism and scholarship of the period, one publication documented the obvious: that creation science articles were not being published in

refereed journals (Scott & Cole 1985). The authors argued that documenting the missing scholarly foundation to creation science was necessary to blunt the claims being made at school boards and in court that creation science was a legitimate scientific alternative to evolution.

Most of the anticreation science books and articles appearing between 1975 and 1990 were written or edited by natural scientists rather than social scientists and focused on natural science. They criticized the failure of creation science to follow tenets of accepted scholarship as well as its distortions of empirical data (Brush 1982; Dalrymple 1983; Eldredge 1982; Futuyma 1983; Godfrey 1983, 1985; Jukes 1984; McGown 1984; Montagu 1984; Morrison 1982; Newell 1982; Strahler 1987; Wilson 1983). Creation science was readily shown to be factually wrong, conceptually confused, and based on deplorable principles of scholarship.

Philosophers of science (Kitcher 1982; Ruse 1982, 1988), historians (Larson 1985, Numbers 1982), and social scientists were not inactive at this time, however. Many joined natural scientists to lobby for keeping evolution in the curriculum and creation science out at this time. Educators and others reviewed the history of evolution in textbooks (Grabiner & Miller 1974; Nelkin 1982; Skoog 1979, 1984) while other scholars looked broadly at social, legal, and educational issues (La Follette 1983, Mayer 1982, Moyer 1981, Orlich et al 1975, Zetterberg 1983). Theologians looked with fresh interest at the question of creation theology (Frye 1983, Gilkey 1985). Lawyers and social scientists contributed to a special issue of *Science, Technology and Human Values* (La Follette 1982). On the whole, however, the sociological and anthropological analysis of antievolutionism seems to have been neglected in comparison with the outpouring of literature on the science of creationism (good analyses are McIver 1988a,b; Kehoe 1983, 1985). According to Godfrey & Cole (1996), most of the anticreationist literature produced between 1977 and 1985 (the dates of their search of computerized databases) came from natural scientists and was weighted toward analyzing the scientific claims of the creationists. Legal and political issues were the next largest category, and sociological and anthropological analysis was less than 10% of the total.

Some sought to understand the phenomenon of antievolutionism by studying and analyzing public opinion. Gallup Polls revealed that nearly half of Americans agree with the basic tenets of YEC: "God created man pretty much in his present form within the last 10,000 years" (Gallup 1982). During the 1980s, several polls of students, teachers, and even lawmakers were conducted to assess the scope and depth of antievolutionism and the acceptance of creationism. (Almquist & Cronin 1988; Ellis 1983; Eve & Harrold 1986; Zimmerman 1987a,b, 1988). Not all of these polls asked comparable questions, however, and many of them yielded ambiguous data because key terms such as

evolution and creationism were not defined. Many studies were admittedly done without adequate financial support for proper sampling and sufficient sample size for statistical validity, yet all the results tended in the same direction. As Gallup had found, there was a surprisingly high rejection of a major tenet of science among the American public and an openness to teaching creation science as a matter of “fairness,” even among people who were not conservative Christians.

It is doubtful whether scientists would have been involved in such analyses if the creation and evolution issue had not become politicized. There had been no secular scholarly response to Whitcomb & Morris’s *The Genesis Flood* when it appeared in 1963, but a decade later when such ideas were used to justify legislation that would radically change science education in the United States, the science community did not remain silent. This response was not only individual, but institutional. The National Academy of Sciences published a widely distributed booklet for teachers that stated clearly that evolution is essential to science education and that “creationism has no place in a science curriculum at any level” (National Academy of Sciences 1984, p. 7). Many scientific associations, including the American Association for the Advancement of Science, the American Anthropological Association, the American Association of Physical Anthropologists, and many state academies of science passed resolutions supporting evolution and/or condemning creation science (Matsumura 1995a). Such organizations often urged their members to become involved in supporting evolution education and/or opposing creation science.

The academic community appeared to lose interest in the antievolution movement after the *McLean* and *Edwards* decisions (Godfrey & Cole 1995). Immediately after *Edwards*, prominent scientist Stephen Jay Gould proclaimed the controversy to be over (Gould 1987). Even though scholarly interest in creationism appeared to diminish, the controversy itself did not decline; it only took new forms.

After the defeat of YEC-type equal time laws, it was minimally necessary to devise new terms, if not new strategies. I refer to this period of antievolutionism after *Edwards* as Neocreationism. Equal time for creation science is still being pushed, although in the 1990s it occurs more often at the local school-board level than in the state legislatures. Over the past two years alone, NCSE has received requests for assistance from schools or school districts wrestling with equal time provisions in Alabama, California, Florida, Georgia, Illinois, Louisiana, Maine, Michigan, Montana, Nevada, New Hampshire, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Texas, Washington State, and Wisconsin.

## NEOCREATIONISM

Neocreationism refers to a mixed bag of antievolution strategies brought about by legal decisions against equal time laws. Although academics concluded that *Edwards* sounded the death knell for creation science, Neocreationism has evolved the avoidance of terms related to creation, such as creation science. A school district in Louisville, Ohio, which had had an equal time regulation in place before *Edwards*, rewrote the science curriculum to “avoid mention of creationism in its curriculum guide, calling it alternative theories to evolution and adding it to the science classes” (Kennedy 1992). In addition to “alternatives to evolution,” the outlawing of equal time laws has resulted in the generation of many other synonyms for creation science, such as “evidence against evolution,” “initial complexity theory,” and “intelligent design theory.”

## EVIDENCE AGAINST EVOLUTION

All creation and evolution court cases in the past 30 years have been decided on the basis of the First Amendment’s Establishment Clause, which calls for neutrality toward religion in public institutions. Because creationism promotes religion, it cannot be required in the curriculum. Similarly, individual teachers who sought on free-speech (academic freedom) grounds to teach creationism have lost in court: Students have a right to be free from proselytization in elementary and secondary schools (*Webster v. New Lennox*, *Peloza v. San Juan Capistrano*). Before *Edwards*, antievolutionists would argue that teachers should teach evolution but also teach creation science to balance it. After *Edwards*, a shift in emphasis can be seen in the neocreationist argument that when teachers teach evolution, they should teach the evidence against evolution to balance it. The wording ironically comes from *Edwards* itself, or at least from a dissenting opinion in the case. In a dissent to *Edwards*, Justice Scalia wrote that “the people of Louisiana, including those who are Christian fundamentalists, are quite entitled, as a secular matter, to have whatever scientific evidence there may be against evolution presented in their schools, just as Mr. Scopes was entitled to present whatever scientific evidence there was for it.” Creationist legal strategist Wendell Bird even recommended this approach immediately after the *Edwards* decision (Bird 1987). Because the substance of creation science had always consisted of criticisms of evolution, it was easy to repack-age creation science as evidence against evolution.

For example, in the spring of 1996, a bill was narrowly defeated in Ohio (Scott 1996b) to mandate the teaching of evidence against evolution. The proposed law read, in part: “Whenever a theory of the origin of human beings, other living things, or the universe that might commonly be referred to as ‘evolution’ is included in the instructional program provided by any school dis-

strict or educational service center, both evidence and arguments supporting or consistent with the theory and evidence and arguments problematic for, inconsistent with, or not supporting the theory shall be included.”

Also during the spring of 1996, Georgia’s legislature considered similar legislation, which stated, in part, that “teachers shall have the right to present and critique any and all scientific theories about such origins and all facets thereof.” This legislation also failed to pass, but evidence against evolution is emerging as a popular approach. It is attractive to legal specialists among the antievolutionists because it appears to avoid the Establishment Clause of the First Amendment by not obviously promoting religion. Presenting evidence against evolution per se is only bad science, which the First Amendment does not forbid.

## EVOLUTION AS THEORY OR FACT

In 1996, the State of Tennessee debated and narrowly defeated a bill that would have made teachers who taught evolution as a fact—rather than as a theory—subject to dismissal for insubordination (Matsumura 1995b). In late 1995, Alabama passed a state science curriculum that required that evolution be taught “as theory rather than fact” (Scott 1995). These are not the first such cases; NCSE has records of school-board controversies or individual teachers’ complaints concerning pressure to teach evolution as a theory and not fact from Alabama, Arkansas, California, Florida, Georgia, Louisiana, Pennsylvania, Texas, and Wisconsin, among other places.

The problem is that “theory” and “fact” are used differently in science and among the public. In science, a theory is a logical construct of facts, hypotheses, and laws that explains a natural phenomenon. To the general public, however, a theory is not an explanation, but a hunch or guess. To teach evolution as a theory in this sense is to teach it as something students don’t have to take seriously. The State Senator in Tennessee who proposed the 1996 legislation described theories as “whims.” Many a school-board meeting has erupted over evolution being presented dogmatically as fact, and letters to editors regularly fulminate with outrage over children being “forced” to “believe” in evolution.

More than one factor contributes to this vehemence. One cause is the underlying, if usually unspoken, fear many nonscientists have that “evolution means you can’t believe in God.” There has been no pressure for teachers to present the theories of heliocentrism, gravitation, the cell, the atom, or relativity non-dogmatically, but these theories do not have consequences for some religions. People react as though they believe that when evolution is presented as a fact, it must be believed in and that students will then have to give up their faith. Most Americans do not seem to understand that Catholicism, mainline Protes-

tantism, and all but ultraorthodox Judaism have accommodated evolution into their theologies. There are concerns about parental control as well: If parents can't control something as basic as the religious beliefs of their children, what is left?

## DISCLAIMERS

In addition to calling evolution "just a theory," Neocreationists also qualify it by requiring teachers to disclaim the topic before teaching it. In 1994, the school board of Tangipahoa Parish, Louisiana, frustrated by legal restrictions against presenting creationism with evolution, compromised by requiring teachers to read a statement to students before evolution is taught, telling them that evolution "should be presented to inform students of the scientific concept and not intended to influence or dissuade the Biblical version of Creation or any other concept."

Similarly, Alabama's state board of education followed its 1995 decision that evolution must be presented as theory rather than fact by requiring all biology textbooks to have a disclaimer pasted on the inside cover that warned students that evolution was "a controversial theory" and that "No one was present when life first appeared on earth. Therefore, any statement about life's origins should be considered as theory, not fact." Similar disclaimers are being considered in other states.

A disclaimer may not obviously promote religion, but because many teachers will feel inhibited, disclaimers do discourage the teaching of evolution. Because the goal of antievolutionism is not the introduction of creationism into the curriculum but the removal of evolution from it, the teacher who omits evolution from the curriculum must be considered a victory for the antievolution side.

## INTELLIGENT DESIGN

In 1989, shortly after the *Edwards* Supreme Court decision, *Of Pandas and People*, a supplemental textbook for high-school biology was published (Davis & Kenyon 1989). Its publication signified the increasing OEC influence in the neocreationist movement and introduced the term Intelligent Design (ID). ID is promoted primarily by university-based antievolutionists who tend to be PCs rather than YECs. Dean Kenyon, for example, a tenured professor of biology at San Francisco State University, and Percival Davis, who teaches at Hillsborough Community College, in Tampa, Florida, advocate ID.

ID is a lineal descendent of William Paley's Argument from Design (Paley 1803), which held that God's existence could be proved by examining his

works. Paley used a metaphor: He claimed that if one found an intricately contrived watch, it was obvious that such a thing could not have come together by chance. The existence of a watch implied a watchmaker who had designed the watch with a purpose in mind. Similarly, because there is order, purpose, and design in the world, naturally there is an omniscient designer. The existence of God was proven by the presence of order and intricacy.

The vertebrate eye was Paley's classic example, well known to educated people of the nineteenth century, of design in nature. Darwin deliberately used the example of the vertebrate eye in *The Origin of Species* to demonstrate how complexity and intricate design could come about through natural selection, which of course is not a chance phenomenon. In creationist literature, evolution is synonymous with chance. In scientific accounts, there are random or chance elements in the generation of genetic variation, but natural selection, acting upon this genetic variation, is the antithesis of chance. In the PC tradition, ID allows for a fair amount of microevolution, but supporters deny that mutation and natural selection are adequate to explain the evolution of one "kind" to another, such as chordates from echinoderms, or human beings from apes. These and the origin of life are considered too complex to be explained naturally, thus ID demands that a role be left for the intelligent designer, God.

ID literature is more sophisticated than creation science literature, perhaps because it is (except for *Of Pandas and People*) usually directed toward a university audience rather than to the general public, at least up to now. One is less likely to find discussions of the vertebrate eye and more likely to find DNA structure or cellular complexity held up as too complex to have evolved by chance. *Of Pandas and People*, for example, weaves information theory into an exposition of the "linguistics" of the DNA code in an attempt to prove that DNA is so complex we can't explain it by using natural causes.

ID supporters concentrate on areas in evolutionary theory that are not yet well understood, though some of the evolutionary transitions and other phenomena that are supposedly too complex to be explained through natural causes are already partly explained, or are active areas of research. ID supporters, including YECs, emphasize the lack of "transitional fossils" between major groups, and of course connections among the phyla and subphyla will never be revealed through the fossil record (though many class transitions are). On the other hand, biochemical comparisons are allowing plausible linkages to be proposed and tested. Origin-of-life research is booming, with many working hypotheses, including a precellular DNA world preceded by an even earlier and more primitive RNA world. An especially active area in origin-of-life research involves self-organizing qualities of matter—supplementing, rather than replacing, natural selection at biochemical levels (Eigen 1992, Kauffman 1993). The relationship between living and nonliving is becoming more of a

continuum and less of a dichotomy. Similarly, the more we learn about the biochemical, neurological, and behavioral similarities between our species and the great apes (Ruvolo 1997), with whom we shared a common ancestor, the less likely it appears that there is an unbridgeable gulf “too complex” to cross.

### *Antievolution at the University*

One of the leading exponents of ID is Phillip Johnson, who holds an endowed chair at Boalt Hall School of Law, University of California, Berkeley. Johnson appeared on the anticreationist scene in 1991 with the publication of his book, *Darwin on Trial* (Johnson 1993). Because of Johnson’s academic credentials, and because he ignored arguments about the age of the earth and was even faintly contemptuous of YEC, the book was perceived as different from traditional creation science, even though no new arguments were presented. *Darwin on Trial* was reviewed by people and in journals that would never have reviewed a publication by Morris (Gould 1992, Hull 1991, Jukes 1991). All concluded that Johnson lacked a solid grounding in the theory and factual basis of evolutionary science.

Although Johnson is an evolution basher, his main concern is not with whether scientific data do or do not support evolution, but with broader questions of purpose and meaning. He believes in a personal God who actively intervenes in the world, not a Deistic God who “doesn’t do anything important.” Darwinism—evolution by natural selection—like all of science is done in a methodological materialistic framework. It explains the history of the world without recourse to supernatural forces. In Johnson’s view, if Darwinism is true then one is forced into some sort of Deistic view of God rather than a personal view, which would be theologically unbearable. Therefore evolution, and Darwinism especially, cannot be true. He is contemptuous of those who revise their theology on the basis of empirical evidence: “No one ever puts it the other way around: If God exists, what reason is there to believe in blind, naturalistic evolution in the first place?” (Bethell 1992, p. 14). In this approach, if in few others, Johnson echoes Morris, who said (referring to geological evidence for the Flood) that “[n]o geological difficulties, real or imagined, can be allowed to take precedence over the clear statements and necessary inference of Scripture” (Morris 1970, p. 33).

Darwinism is the focus of Johnson’s complaint about the materialism of science. In his second book on this theme, *Reason in the Balance* (Johnson 1995), Johnson makes even more clear his concern that evolution and science in general, by explaining phenomena in terms of natural cause, eliminate the necessity for a deity. Of course, if science can explain phenomena using natural cause, this does not mean that a believer cannot believe that God is the ulti-

mate cause. Ironically, science can never rule out God as causal agent, precisely because of the methodological materialism Johnson decries. Johnson, however, argues against this view as too Deistic—again—God is left with nothing important to do.

Few scientists reviewed *Reason in the Balance*, mostly because it does not deal much with scientific issues and is rather more obviously theological and philosophical in nature. *Reason in the Balance* makes it clear that underlying Johnson's objection to evolution is the conflict between theism and naturalism (materialism) as philosophies. Modern scientists do explain the natural world without reference to God, but this is because by doing so scientists get better answers more quickly. Johnson conflates the methodological materialism of science with philosophical materialism: If one restricts oneself to natural explanations, one must therefore be a philosophical materialist (Scott 1993, Scott & Sager 1992). (Ironically, he is joined in this view by evolutionary biologists Provine and Dawkins!) Theism vs materialism is a legitimate philosophico-religious debate, but it is irrelevant to science. Scientists do not reject supernatural explanation out of religious animosity but out of practicality: If we can conclude that God did it, then we'll stop looking, and if there is a natural explanation, it won't be found. At one time, spirits were thought to cause disease. Most of us are glad that scientists kept looking and found microorganisms.

In 1996, Michael Behe, a biochemist at Lehigh University, published the most scholarly and scientific ID book to date, *Darwin's Black Box* (Behe 1996), which offers little comfort to typical antievolutionists. Behe accepts that natural selection produces most of the complex structural adaptations of plants and animals, and he even accepts that modern living things descended with modification from common ancestors. In a debate with Kenneth Miller, a biologist at Brown University, during the summer of 1995, Behe accepted that human beings and chimps share a common ancestor. Still, Behe asserted that there are things that can't be explained through natural processes. He claims that at the level of cell biochemistry lie "irreducibly complex" processes and structures, such as the blood-clotting cascade and the rotor motor of a microorganism's flagellum. Such structures cannot be broken down into component parts, says Behe, and therefore cannot be explained through the incremental activity of natural selection. They therefore could not have evolved, and because they could not have evolved they must have been specially created. Behe argues, as did Paley, that complexity is proof that there must be an intelligent designer, but his examples of complexity are biochemical.

Because Behe is a research scientist with a track record of legitimate publications (though not in evolutionary biology), his book has been reviewed with more seriousness than Johnson's *Darwin on Trial* (Coyne 1996, Gross 1996, Miller 1996, Orr 1996, Shreeve 1996). Although Behe claimed in *Darwin's*

*Black Box* that his views would sweep the scientific world in a manner comparable to the discoveries of “Newton and Einstein, Lavoisier and Schroedinger, Pasteur, and Darwin” (Behe 1996, p. 233), the response from the scientific community thus far has been decidedly tepid. Reviewers were quick to point out flaws both in reasoning and in factual and conceptual understanding.

ID proponents are not Luddites, objecting to science and its technological fruits, but they do not like naturalistic evolution. Like all conservative Christians, they insist on a significant explanatory role for God, and in life having a divinely directed purpose and meaning. To them, evolution epitomizes the offensive, strictly materialist framework in which scientists practice science today. Science itself, however, is not objected to—only its materialism in regard to theologically sensitive issues (Scott 1996b).

Allowing for the intervention of the deity in evolution, but not in the rest of science, is spelled out in an afterword addressed to teachers in *Of Pandas and People* (Hartwig & Meyer 1993). The authors argue that there are two different kinds of science: “inductive” and “historical.” Supposedly, the goal of historical sciences “is not to find new laws or regularities but to reconstruct past conditions and events” (Hartwig & Meyer 1993, p. 159). This will come as a surprise to astronomers, geologists, evolutionary biologists, and anthropologists, but the authors are quite serious. They feel that it is inappropriate to allow “intelligent intervention” in inductive science because the goal is to understand the natural world as it “normally operates on it’s [sic] own, i.e. *in the absence of intelligent intervention*” (italics in original). In the historical sciences, “the goal is to reconstruct past events and conditions. Thus there is no need to impose such restrictions. Quite the reverse. As we have seen, the explanation of certain artifacts or features may require reference to intelligence. Intelligent agents may have left traces of their activity in the natural world. The historical scientist need not turn a blind eye to them” (Hartwig & Meyer 1993, p. 159). Although the intelligence is not specifically identified as a personal, hands-on Christian God, it is doubtful that the authors wish teachers to teach that extraterrestrials from Alpha Centauri guided the development of life on earth.

On close inspection, historical science boils down to those scientific topics that have implications for conservative Christian theology, especially the Big Bang, the origin of life, and the origin of humankind (and to a lesser degree, but still important, the production of basic body plans during the Cambrian explosion). For these events, the door must be left open for Special Creation, the intervention of the “intelligence.” So much of nature can be explained through natural processes that a direct creative role for God must be retained somewhere, or else the conservative Christian must slide toward Deism and an unacceptably impersonal God with “nothing important to do.” In theology, the “God of the Gaps” problem is the problem raised by requiring direct interven-

tion of God into the natural world. If God is the stop-gap explanation for “un-understood” natural phenomena, when natural explanations are found for them God is diminished. For this reason, Catholic and mainline Protestant theologians have rendered unto science the explanation of most aspects of the natural world. ID creates a God of the Gaps problem and is thus subject to the same theological criticisms.

Much as do their creation science predecessors, ID supporters end up defining acceptable science on the basis of preexisting religious ideology. I have discussed elsewhere the relationship of ideology (such as feminism, environmentalism, or Marxism) to scholarship, expressing reservations about whether a religiously based ideology such as Special Creationism can ever be truly scholarly (Scott 1996b). Can ID make the grade? Thus far, even if the quality of argumentation and the scientific credentials of its proponents are superior to those of creation science, there are still many indications that ID advocates are finding it difficult to approach sensitive subject matter from a scholarly, rather than an ideological, position. For example, nothing in nature should be placed off-limits to scientific inquiry merely because it has consequences for an ideology. In his contemplation of the tremendous complexity of cell phenomena, Behe considers it futile to look for natural explanations. Sadly, otherwise competent scientists associated with ID seem already to have made up their minds about what topics in the realm of the unexplained are unexplainable.

Scholarly analyses of ID have been highly critical, and it is likely that ID will not be very persuasive among scientists. Where Old Earth, ID books like Behe’s and Johnson’s currently are most likely to be found is in the auditoria of local school-board meetings, being held aloft as “proof” that scientists are giving up on evolution and that evolution should be taught as only a theory, or disclaimed in some way. Johnson’s books and *Of Pandas and People* are already being promoted as “alternatives to evolution.” In 1996, Governor Fob James of Alabama used his contingency funds to purchase copies of *Darwin on Trial* to send to every biology teacher in the state (Anonymous 1996).

Because they are Old Earthers, Neocreationists do not seem as radical or extreme as YECs, and they are more likely to be accepted by the American public. Although proponents of ID do not yet have the numbers or the money that the YEC organizations have, and although they do not have massive outreach programs aimed at the general public, they are an energetic force that will have to be reckoned with. The most active ID proponents are, in fact, associated with secular institutions of higher learning rather than with sectarian, specialized organizations such as the ICR. Their view of how to promote the “cause” is more like that of activist academics than revivalist ministers. For example, a new, ID “think tank,” supported by private foundation money, has been estab-

lished in Seattle as the Center for Renewal of Science and Culture and is already supporting postdoctoral students (Scott 1997).

Old Earth, ID publications by Behe, Johnson, and others will have a more profound effect on antievolutionism than creation science publications because they are being discussed at the university and college level, where the far more numerous publications of Morris are regarded primarily as curiosities. Articles and books by more moderate antievolutionists tend to be used not in science courses, but in “science studies,” social problems, or philosophy courses taught by social scientists or philosophers less familiar with the facts and theory of evolution than are science faculty.

It is significant that not only evolution but the nature of science itself is being challenged. Both evolution and methodological materialism are well entrenched in science, but they are uniformly accepted neither among the general public nor in nonscientific parts of academia. There are, of course, many critiques of science in academia (e.g. Gross & Levitt 1994), and the materialistic basis of science is not uniformly embraced. In February 1997, a major secular university—the University of Texas, Austin—sponsored a conference “dedicated to fostering dialogue between naturalists and theists on the impact of metaphysical and methodological ideas on the development, interpretation, and presentation of scientific knowledge” (J Koons, personal communication). In a sense, evolution appears better buffered in academia than is philosophy of science: The Texas conference was sponsored by the philosophy department and organized around philosophical themes such as the nature of science, rather than the “truth” of evolution. There has not yet been a conference scheduled at a secular university for the purpose of discussing whether evolution occurred, and it is not likely to happen in the near future.

## THE FUTURE

There are many varieties of creationism and antievolutionism extant today, and they reach different parts of the American public. At the local school-board level, there will be a continuation or even an increase in the current level of antievolutionism, including the outlawed equal time for creation science, depending on the future election of religious right-oriented school board members. However, the chief danger to evolution education comes less from teachers promoting creation science than from teachers just quietly ceasing to teach evolution because it is too controversial. Currently, high-school biology textbooks do include evolution, though they do not always get the science right (National Center for Science Education/People for the American Way 1990). Whether textbook publishers will hold the line in the face of pressure to downplay or qualify evolution remains to be seen.

In the mid to late 1990s, university-based antievolutionism is a small but growing movement. For now, participants are dwarfed in both number and effectiveness by the more public efforts of organizations such as the ICR, with its Back to Genesis road shows and media programs. YEC is still the most frequently encountered antievolutionism that K–12 teachers have to cope with, but more and more it is being augmented by “arguments against evolution,” ID, or other neocreationist positions. However, because a university-based antievolution movement has great potential to reach future decision-makers (who are being educated in universities today), this component of the movement may be highly influential in the future, even if it is small today. Future generations of college graduates may think that books like those of Johnson or Behe represent modern scientific scholarship on science and evolution. This will only exacerbate the problem of antievolution at the K–12 level and in the general public: After all, members of Congress, captains of industry, and members of local school boards are almost always college graduates.

Faculty in fields with a historical component, which include astronomy, geology, biology, and anthropology, need to be explicit in their treatment of evolution so that members of the educated public understand this important scientific concept. Scientists in these fields recognize that evolution is an organizing principle in their disciplines but often fail to make this explicit to students. Biologists will, for example, teach principles of systematics and taxonomy without mentioning that the genus/species classification of organisms is possible because the splitting and branching process of evolution generates hierarchy. Astronomers will discuss galaxy formation and not use the “e-word.” It is impossible to teach a physical anthropology course (or any introductory anthropology course) without teaching evolution, thus ironically it may be that most students who learn about evolution do so in departments classified as “social science” rather than natural science. This places an important responsibility upon anthropologists, who may by default be the major purveyors of evolutionary theory at the college level. We may need to spend even more time in our classes on principles of evolution than we perhaps have in the past. As members of a field that also includes the consideration of religion as part of the human way of life, anthropologists may in fact be the scientists best able to cope with the myriad aspects of the creation/evolution controversy.

The scientific establishment itself is not going to give up on evolution any more than it is going to give up on the periodic table of elements, but the amount of public support for evolution, including financial support for evolution-oriented research from federally funded organizations such as the National Science Foundation and the National Institutes of Health, may well dwindle even further if evolution loses yet more support among the general public.

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### Literature Cited

- Almquist AJ, Cronin JE. 1988. Fact, fancy and myth on human evolution. *Curr. Anthropol.* 29(3):520–22
- American Museum of Natural History. 1994. *Science and Nature Survey*. Off. Public Affairs, Am. Mus. Nat. Hist.
- Anonymous. 1996. Surprise gift. No charge. *Educ. Week*, Apr. 3, p. 5
- Behe M. 1996. *Darwin's Black Box: The Biochemical Challenge to Evolution*. New York: Free Press
- Bethell T. 1992. Darwin in the dock. *Am. Spect.*, June, pp. 14, 16
- Bible-Science Association. 1985. 1985 Bible-Sci. Assoc. Conf. Sched., Aug. 14–15, Cleveland, Ohio
- Bird W. 1978. Freedom of religion and science indoctrination in public schools. *Yale Law J.* 87:515–70
- Bird W. 1987. The Supreme Court decision and its meaning. *ICR Impact* Ser. 170, Aug., 4 pp.
- Brush SG. 1982. Finding the age of the earth by physics or by faith? *J. Geol. Educ.* 30: 34–58
- Coyne JA. 1996. God in the details. *Nature* 383:227–28
- Dalrymple GB. 1983. Can the earth be dated from decay of its magnetic field? *J. Geol. Educ.* 31:124–33
- Davis P, Kenyon DH, eds. 1989. *Of Pandas and People*. Dallas, TX: Houghton. 170 pp.
- Dawkins R. 1976. *The Selfish Gene*. New York: Oxford. 224 pp.
- Dawkins R. 1987. *The Blind Watchmaker*. New York: Norton
- DeFord CS. 1991. (1931). *A Reparation: Universal Gravitation a Universal Fake*. Fairfield, WA: Ye Galleon. 62 pp.
- Edis T. 1994. Islamic creationism in Turkey. *Creat./Evol.* 34:1–12
- Edwards v. Aguillard, 482 U.S. 578 (1987)
- Eigen M. 1992. *Steps Toward Life: A Perspective in Evolution*. Oxford: Oxford Univ. Press. 173 pp.
- Eiseley L. 1958. *Darwin's Century*. Garden City, NY: Anchor. 387 pp.
- Eldredge N. 1982. *The Monkey Business: A Scientist Looks at Creationism*. New York: Washington Square (Pocket Books). 157 pp.
- Eldredge N. 1989. *Macroevolutionary Dynamics*. New York: McGraw-Hill. 226 pp.
- Eldredge N, Gould SJ. 1972. Punctuated equilibria: an alternative to phyletic gradualism. *Models in Paleobiology*, ed. TJM Schopf, pp. 82–115. San Francisco: Freeman, Cooper. 250 pp.
- Ellis WE. 1983. Biology teachers and border state beliefs. *Society* Jan./Feb:26–30
- Epperson v. Arkansas, 393 U.S. 97 (1967)
- Eve R, Harrold FB. 1986. Creationism, cult archaeology and other pseudoscientific beliefs: a study of college students. *Youth Soc.* 4:396–421
- Eve R, Harrold FB. 1991. *The Creationist Movement in Modern America*. Boston: Twayne. 234 pp.
- Frye R. 1983. *Is God a Creationist? The Religious Case Against Creation-Science*. New York: Scribner's
- Futuyma DJ. 1983. *Science on Trial: The Case for Evolution*. New York: Pantheon. 251 pp.
- Gallup G Jr. 1982. The Gallup poll. *The New York Times* Aug. 29, p. 22
- Gilkey L. 1985. *Creationism on Trial: Evolution and God at Little Rock*. Minneapolis: Winston
- Godfrey LR, ed. 1983. *Scientists Confront Creationism*. New York: Norton. 324 pp.
- Godfrey LR, ed. 1985. *What Darwin Began*. Boston: Allyn & Bacon. 312 pp.
- Godfrey LR, Cole JR. 1995. A Century after Darwin: scientific creationism and academe. In *Cult Archaeology and Creationism: Understanding Pseudoscientific Beliefs About the Past*, ed. FB Harrold, RA Eve, pp. 99–123. Iowa City: Univ. Iowa Press. Expanded ed.
- Goodman S. 1995. Creationists in Canada. *Natl. Cent. Sci. Educ. Rep.* 15(1):10–11
- Gould SJ. 1987. Creationism battle is over. *Minneap. Star & Trib.*, July 19
- Gould SJ. 1992. Impeaching a self-appointed judge. *Sci. Am.* July, pp. 118–21
- Grabner JV, Miller PD. 1974. Effects of the Scopes trial. *Science* 185(4154):832–37
- Gross PR. 1996. The Dissent of man. *Wall Street J.*, July, p. A11
- Gross PR, Levitt N. 1994. *Higher Superstition*. Baltimore, MD: Johns Hopkins Press

- Groves C. 1991. Creationism in Australia: Down but Not Out? *Natl. Cent. Sci. Educ. Rep.* 11(2):21
- Hartwig MD, Meyer SC. 1993. A note to teachers. See Davis & Kenyon 1989, pp. 153–61
- Hull DL. 1991. The God of the Galapagos. *Nature* 352:485–86
- John Paul II. 1996. Magisterium (Message to Pontifical Academy of Sciences) L'Osservatore romano, Oct. 30, p. 3, 7
- Johnson P. 1990. A reply to my critics. In *Evolution as Dogma*, ed. PE Johnson, pp. 33–37. Found. Thought Ethics. Dallas: Haughton
- Johnson P. 1993. *Darwin on Trial, Downers Grove, IL: Inter-Varsity.* 220 pp. 2nd ed.
- Johnson P. 1995. *Reason in the Balance.* Downers Grove, IL: Inter-Varsity. 245 pp.
- Jukes TH. 1984. The creationist challenge to science. *Nature* 308:398–400
- Jukes TH. 1991. The persistent conflict. *J. Mol. Evol.* 33:205–6
- Kauffman S. 1993. *The Origin of Order.* New York: Oxford Univ. Press
- Kehoe A. 1983. The word of God. See Godfrey 1983, pp. 1–12
- Kehoe A. 1985. Modern antievolutionism: the scientific creationists. See Godfrey 1983, pp. 165–85
- Kennedy J. 1992. Teaching of creationism splits Louisville parents. *The Repository*, Sept. 30, p. B4
- King JL, Jukes TH. 1969. Non-Darwinian evolution. *Science* 164:788–98
- Kitcher P. 1982. *Abusing Science: The Case Against Creationism.* Cambridge: MIT Press. 213 pp.
- La Follette M, ed. 1982. Introduction: creation sciences and the law. *Sci. Technol. Soc.* 40:9–10
- La Follette M, ed. 1983. *Creationism, Science, and the Law.* Cambridge, MA: MIT Press
- Larson EJ. 1985. *Trial and Error: The American Controversy over Creation and Evolution.* New York: Oxford. 222 pp.
- Lewin R. 1981. A response to creationism evolves. *Science* 214:635–36
- Matsumura MV. 1995a. *Voices for Evolution.* Berkeley, CA: Natl. Cent. Sci. Educ. 176 pp.
- Matsumura MV. 1995b. Tennessee upset: "Monkey bill" law defeated. *Natl. Cent. Sci. Educ. Rep.* 15(4):6–7
- Mayer W. 1982. Evolutionary theory vs. creationist doctrine. *J. Coll. Sci. Teach.* 11(5): 270–76
- McGown C. 1984. *In the Beginning: A Scientist Shows Why the Creationists Are Wrong.* Buffalo: Prometheus
- McGrath AE. 1994. *Christian Theology: An Introduction.* Oxford: Blackwell
- McIver T. 1988a. *Antievolution: An Annotated Bibliography.* Jefferson, NC: McFarland
- McIver T. 1988b. Christian reconstructionism, post-millennialism, and creationism. *Creat./Evol. Newsl.* 8(1):10–17
- McLean v. Arkansas, 529 F. Suppl. 1255 (1982)
- Miller KR. 1996. Darwin's black box. *Rep. Natl. Cent. Sci. Educ.* 16(4):In press
- Montagu A, ed. 1984. *Science and Creationism.* New York: Oxford Univ. Press. 415 pp.
- Morris HR. N.d. Resolution for Equitable Treatment of Both Creation and Evolution. *Inst. Creat. Res. Impact* #26
- Morris HR. 1963. *The Twilight of Evolution.* Grand Rapids, MI: Baker Book House. 103 pp.
- Morris HR. 1970. *Biblical Cosmology and Modern Science.* Phillipsburg, NJ: Presbyterian and Reformed
- Morrison D. 1982. Astronomy and creationism. *Mercury* Sept.-Oct., pp. 144–47
- Moyer WA. 1981. Arguments for maintaining the integrity of science education. *Am. Biol. Teach.* 43(7):380–81
- National Academy of Sciences. 1984. *Science and Creationism: A View from the National Academy of Sciences.* Washington, DC: Natl. Acad. Press
- National Center for Science Education. People for the American Way. 1990. *Biology Textbooks 1990: The New Generation.* Washington, DC: People Am. Way. 73 pp.
- National Science Board. 1996. *Science and Engineering Indicators—1996*, pp. 7-7–7-8. Washington, DC: US Gov. Print. Off., Natl. Sci. Board, pp. 96–21
- Nelkin D. 1982. *The Creation Controversy: Science or Scripture in the Schools.* New York: Norton
- Newell ND. 1982. *Creation and Evolution: Myth or Reality?* New York: Columbia Univ. Press
- Numbers RL. 1982. Creationism in twentieth-century America. *Science* 218(4512): 538–44
- Numbers RL. 1992. *The Creationists.* New York: Knopf. 458 pp.
- Orlich DC, Ratchiff JL, Stronck DR. 1975. Creationism in the science classroom. *Sci. Teach.* 42(5):43–45
- Orr HA. 1996. Darwin v. intelligent design (again). *Boston Rev.* 21(6):28–31
- Paley W. 1803. *Natural Theology: Or, Evidences of the Existence and Attributes of the Deity, Collected from the Appearances of Nature.* London: Faulder. 5th ed.

- Pelozo v. San Juan Capistrano Unif. Sch. Dist., 37 F. 3rd 517 (1994)
- Provine W. 1988. Scientists, face it! Science and religion are incompatible. *Scientist* 2:10
- Ramm B. 1955. *The Christian View of Science and Scripture*. London: Paternoster
- Ruse M. 1982. Darwinism defended: a guide to the evolution controversies. Reading, MA: Addison-Wesley
- Ruse M. 1988. *But Is It Science? The Philosophical Question in the Creation/Evolution Controversy*. Buffalo, NY: Prometheus. 406 pp.
- Ruvolo M. 1997. Genetic diversity in hominoid primates. *Annu. Rev. Anthropol.* 26:515-40
- Schadewald RJ. 1980. Earth orbits? moon landings? A Fraud! Says this prophet. *Sci. Dig.*, July, pp. 58-63
- Schadewald RJ. 1991. Introduction to Charles DeFord's *Reparation*. See DeFord 1991
- Scott E. 1991. Creationism in New Zealand. *Natl. Cent. Sci. Educ. Rep.* 11(2):20-21
- Scott E. 1993. Review article: Darwin prosecuted. *Creat./Evol.* 33:42-47
- Scott E. 1994. The Evolution of creationism: the struggle for the schools. *Nat. Hist.* 103: 10, 12-13
- Scott E. 1995. State of Alabama distorts science, evolution. *Natl. Cent. Sci. Educ. Rep.* 15(4):10-11
- Scott E. 1996a. Creationism, ideology, and science. In *The Flight From Science and Reason*, ed. PR Gross, N Levitt, MW Lewis. *Ann. NY Acad. Sci.* 775:505-22
- Scott E. 1996b. Close Ohio vote scuttles evidence against evolution bill. *Natl. Cent. Sci. Educ. Rep.* 16(1):18
- Scott E. 1997. Old earth moderates poised to spread design theory. *Rep. Natl. Cent. Sci. Educ.* 17(1):25-26
- Scott E, Cole HP. 1985. The elusive scientific basis of creation science. *Q. Rev. Biol.* 60(1):21-30
- Scott E, Sager TC. 1992. Review article: *Darwin on Trial*, by Phillip Johnson. *Creat./Evol.* 31:47-56
- Shreeve J. 1996. Design for living. *New York Times Mag.*, Aug. 4
- Skoog G. 1979. The coverage of evolution in high school biology textbooks, 1900-1977. *Sci. Educ.* 63(5):621-40
- Skoog G. 1984. The coverage of evolution in high school biology textbooks published in the 1980's. *Sci. Educ.* 68(2):117-28
- Stanley SM. 1981. *The New Evolutionary Timetable, Fossils, Genes, and the Origin of Species*. New York: Basic Books. 222 pp.
- Strahler AN. 1987. *Science and Earth History: The Evolution/Creation Controversy*. Buffalo, NY: Prometheus
- Torrance TF. 1981. *Christian Theology and Scientific Culture*. Oxford: Oxford Univ. Press
- Toumey C. 1994. *God's Own Scientists*. New Brunswick, NJ: Rutgers Univ. Press. 289 pp.
- Webster v. New Lennon Sch. Dist., 122, 917 F. 2nd 1004 (1990)
- Weinberg S. 1982. Pro-evolution public interest (letter). *BioScience* 32(3):168
- Whitcomb JC, Morris HR. 1963. *The Genesis Flood: The Biblical Record and Its Scientific Implications*. Phillipsburg, NJ: Presbyterian & Reformed
- Wills C, Lerner LS, Olson EC, Eimers LE, Dickerson RE. 1990. Report of visitation, Aug. 7-10, 1989, p. 22. Calif. State Dep. Educ: Private Postsecondary Educ. Div.
- Wilson DB. 1983. *Did the Devil Make Darwin Do It? Modern Perspectives on the Creation-Evolution Controversy*. Ames, IA: Iowa State Univ.
- Young DA. 1982. *Christianity and the Age of the Earth*. Grand Rapids, MI: Zondervan. 188 pp.
- Zetterberg JP. 1983. *Evolution versus Creationism: The Public Education Controversy*. Phoenix, AZ: Oryx
- Zimmerman M. 1987a. The evolution-creation controversy: opinions of Ohio high school biology teachers. *Ohio J. Sci.* 7:115-21
- Zimmerman M. 1987b. Ohio school board presidents view of the evolution-creationism controversy, Part 1. *Ohio Cent. Sci. Educ. Newsl.*, Oct., pp. 1, 3, 11
- Zimmerman M. 1988. Ohio school board presidents view of the evolution-creationism controversy, Part 2. *Ohio Cent. Sci. Educ. Newsl.*, Jan., pp. 1, 2

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