

Professionalization of American Scientists: Public Science in the Creation/ Evolution Trials

Author(s): Thomas F. Gieryn, George M. Bevins and Stephen C. Zehr

Source: *American Sociological Review*, Vol. 50, No. 3 (Jun., 1985), pp. 392-409

Published by: American Sociological Association

Stable URL: <https://www.jstor.org/stable/2095548>

Accessed: 19-11-2019 13:08 UTC

---

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <https://about.jstor.org/terms>



*American Sociological Association* is collaborating with JSTOR to digitize, preserve and extend access to *American Sociological Review*

JSTOR

# PROFESSIONALIZATION OF AMERICAN SCIENTISTS: PUBLIC SCIENCE IN THE CREATION/EVOLUTION TRIALS\*

THOMAS F. GIERYN

GEORGE M. BEVINS

STEPHEN C. ZEHR

Indiana University

*The boundary between science and religion has long been a site for cultural and professional conflict. We examine the testimony of scientists at the Scopes "Monkey Trial" in 1925 and at the McLean "Creation-Science" trial in 1981–82. The two trials were public occasions for scientists to present ideologies of science that legitimated their professional claims to cognitive authority, public financing and control over part of the public school curriculum. The rhetoric of scientists at each trial was directed toward a separate professional goal: at Scopes, scientists differentiated scientific knowledge from religious belief in a way that presented them as distinctively useful but complementary; at McLean, the boundary between science and religion was drawn to exclude creation scientists from the profession. Both goals—(1) differentiation of a valued commodity uniquely provided by science, and (2) exclusion of pseudoscientists—are important for scientists' establishment of a professional monopoly over the market for knowledge about nature. Each goal, however, required different descriptions of "science" at the two trials, and we conclude that this ideological flexibility has contributed to the successful professionalization of scientists in American society.*

The 1925 trial of John Scopes in Dayton, Tennessee, is a landmark of American cultural history. Scopes was indicted for teaching Darwinian theories of evolution to a public school biology class, in violation of a recently passed statute making it illegal to teach ideas that contradicted the Bible. The famous "Monkey Trial" was neither legally nor culturally decisive. The verdict against Scopes was later overturned on a legal technicality, and in 1981, creation and evolution returned to court in *Rev. Bill McLean et al. v. Arkansas Board of Education*. U.S. District Court Judge William Overton was asked to rule on the constitutionality of a statute requiring "balanced-treatment" of two theories of origins—"creation-science" and "evolution-science"—in science classrooms of Arkansas public schools.

Although a comparison of *Scopes* and *McLean* would seem natural for a cultural sociology of American society, neither trial has attracted much sociological attention. The few available studies examine the trials (mainly) as expressions of enduring efforts by Christian fundamentalists to make curricula of public schools consistent with their religious values

(Cole, 1931; Furniss, 1954; Hofstadter, 1963; Grossbach, 1964; Bates, 1976; Nelkin, 1982; Marsden, 1980; Numbers, 1982; Cavanaugh, 1982). Our strategy is different: we examine the trials not in the context of the history of American religion, but in the context of the professionalization of American science (cf. Cole, 1983:91–99).

Media coverage of the *McLean* trial emphasized its similarities to *Scopes*, presenting it as a kind of cultural déjà vu with headlines such as "Monkey Trial Revisited" and "Scopes II." Our analysis suggests that *differences* between the trials may be more significant and consequential than similarities. These differences are especially evident in descriptions of science and of scientific knowledge, particularly those provided by testifying scientists or by attorneys representing them. We interpret *Scopes* and *McLean* as occasions for "public science," where scientists present "rhetoric, argument and polemic [designed] to persuade the public or influential sectors thereof that science . . . is worthy of receiving public attention, encouragement and financing" (Turner, 1980:589–90).

In each trial, scientists confronted an impediment to the expansion of their "cognitive authority" (cf. King, 1971) and public support: certain beliefs of traditional religion. To overcome this impediment, the rhetoric of scientists testifying at the trials presented images and ideologies of science that demarcated it from religious belief in ways that identified its uniqueness and utility. However, this ideologi-

\*Direct all correspondence to: Thomas F. Gieryn, Department of Sociology, Indiana University, Bloomington, IN 47405.

We thank Peggy L. Kerr, David Zaret, Larry J. Griffin, William Corsaro, Allen Grimshaw, Nicholas Mullins, Bernice Pescosolido, and Anne Figert for their help.

cal separation of science from religion was accomplished with rhetoric that differed in substance from one trial to the next. Scientists constructed different images of science at *Scopes* and at *McLean* by attributing different qualities and utilities to scientists and to their knowledge. Our empirical task in this paper is to describe ideological differences in public science at *Scopes* and *McLean*.

The theoretical task is to explain *why* ideologies of science took on different characteristics at the two trials. Our interpretation is guided by recent developments in sociological theories of professionalization, and it focuses on the link between scientists' public "presentations of self" and changes in the professional goals of the scientific community between 1925 and 1981. We begin with a review of the "market model" of professionalization, and then consider its relevance for explaining ideological differences in public constructions of science at *Scopes* and *McLean*.

#### SCIENTISTS AND PROFESSIONALIZATION

The "market model" describes the historical ascent of professions (medicine and law are prototypical) in terms of ideological and organizational maneuvers designed to create occupational monopolies over markets for desired services or commodities (e.g., Freidson, 1970; Berlant, 1975; Parry and Parry, 1976; Larson, 1977; Klegon, 1978; Collins, 1979; Saks, 1983). "Professionalization" appears as a form of occupational control: organizational innovations restrict the supply of practitioners (through training and licensing programs) and standardize professional practice by threat of sanction (through codes of ethics enforced by professional associations). The rise of professions to positions of relatively high prestige, resources, authority and autonomy results from successful struggles to obliterate, absorb, or dominate competing providers of "similar" services or commodities. The market model has roots in Max Weber's ([1925] 1978:341-43) analysis of "open and closed economic relationships": modern professions—like the historic guilds—seek "closure" of a market by excluding the competition as "outsiders."

The market model begins with the assumption that professions emerge victorious from competition with *multiple* providers of similar or overlapping services. For example, American physicians (roughly from 1900 to 1930) appropriated certain obstetrical services traditionally provided by midwives. The successful professionalization of obstetricians resulted from a combination of ideological tactics (they depicted midwives as unscientific and

relatively risky) and organizational tactics (they secured government licensing programs to reduce the range of services that midwives could legally provide).<sup>1</sup>

An important step in physicians' control of the market for obstetrical services was the construction of a *social boundary* between professional physicians and the competing midwives. In order to persuade potential clients, and in order to persuade government officials to "close" the market through licensing, obstetricians demarcated themselves from midwives by presenting their techniques and training as distinctively superior. Other sociologists of medicine note the importance of creating and publicly defending social boundaries around the professionalizing occupation. Starr (1982:37) suggests that "members of an aspiring profession need to fix boundaries to separate them from other practitioners," and Larson (1977:xii) adds that "groups of people attempt to negotiate the boundaries of an area in the social division of labor and establish their control over it."

Erection of social boundaries around a niche in the division of labor aids professionalization in two ways: (1) Boundaries create demand for a distinctive commodity by demarcating the professional's services from similar—but in crucial ways dissimilar—services provided by outsiders. (2) Boundaries serve to exclude providers of "similar" services who falsely claim (according to insiders) to be within the profession. Both are essential steps toward the monopolization of a profession's market, for the boundaries can be used to deny expertise, authority and thus employment and material resources to potentially competitive outsiders.

Curiously, the kinds of questions now asked about the professions of medicine and law are rarely asked about science.<sup>2</sup> Do scientists at-

<sup>1</sup> Brickman (1983:68) reports that in New York City in 1915, 1,448 midwives delivered 53,000 babies. Physicians denigrated midwives' competence: they were "quick to characterize the midwife as 'ginguzzling . . . with her pockets full of forcing drops, her mouth full of snuff, her fingers full of dirt and her brains full of arrogance and superstition'" (Haller, 1981:166). This public ideology probably contributed to the 1907 passage of a New York statute that banned midwives use of forceps or any other mechanical device, banned their use of any drug but disinfectants, and limited them to "simple" delivery situations (Brickman, 1983:84 n. 17). The New York City Health Department then began to license midwives, and the percentage of deliveries attended by midwives in the City dropped from about 40% at the turn of the century to about 8% by 1933.

<sup>2</sup> Sociological studies of the professionalization of science include Daniels (1967), Ben-David (1971), Beer and Lewis (1974), Kuklick (1980), and Barber (1983: Ch. 7).

tempt to monopolize the provision of distinctive, desired services or commodities? How, historically, have scientists defeated providers of "similar" commodities? Who are the losers in such battles? What ideological and organizational strategies have scientists used to create and control a market, and to legitimate claims to expertise, authority and public support? In a word: is the market model of professionalization applicable to the rise of science in twentieth-century American society?

The production and societal consumption of *knowledge* displays the essential features of a market: a multiplicity of producers sell desired commodities or services to a multiplicity of consumers. These days, the State (at several levels of government) is a primary consumer of knowledge, although it invests in knowledge as a fiduciary of the ultimate clients, its citizens.<sup>3</sup> The State patronizes the production and dissemination of *selected kinds* of available knowledge (cf. Useem, 1976). The total Federal expenditure for scientific research and development in 1983 reached nearly \$40 billion (National Science Board, 1983:44); poetry gets much less State patronage, religion none at all (the Establishment Clause of the first amendment requires that "Congress shall make no law respecting the establishment of religion, or prohibiting the free exercise thereof").

The success of scientists in enlarging their share of the market for knowledge, and in increasing public demand for their distinctive commodity, is due in part to the kind of ideological and organizational maneuvers used by obstetricians to wrest a market from midwives. Norbert Elias (1982:40) uses a market model of professionalization to explain this rise of science: "By virtue of their monopolistic control of an existing fund of knowledge and of the skills needed for . . . producing new knowledge, [scientists] can exclude others from these resources." Moreover, the ideological and rhetorical styles used by scientists to control the market for knowledge resemble those used by other successful professions. In a study of public addresses and popular writings by British "statesman for science" John Tyndall (1820–1893), Gieryn (1983:782) finds that the rhetoric in defense of enlarged public support for science took the form of "boundary-work: the attribution of selected characteristics to the institution of science (i.e., to its practitioners, methods, stock of knowledge, values and work organization) for purposes of constructing a social boundary that distinguishes some intellectual

activities as 'non-science.'" Tyndall's boundary-work demarcated Victorian science from two other knowledge-producing institutions—religion and mechanics—in a way that denied the cognitive authority of these competitive providers of knowledge and that justified increased public support for scientific education and research.

*Scopes* and *McLean* are episodes in continuing efforts of American scientists to control the market for knowledge by demarcating their profession and its distinctive commodities from competitive producers. The *immediate* professional stake at both trials is control over a segment of the public school curriculum. John Meyer (1977:66) notes that "education functions in society as a legitimating theory of knowledge . . . as authoritative." Inclusion of Biblical theories of nature in public school *science* classes challenges evolutionary theory and threatens the cognitive authority of scientists over this sphere of knowledge.

In addition, boundary-work at *Scopes* and *McLean* was directed toward the two professional goals identified above. The ideology of science at *Scopes* was directed toward the first: to differentiate commodities of science from those of other forms of knowledge in order to enlarge public demand for *scientific* knowledge. The ideology of science at *McLean* was directed toward the second professional goal: to protect public investments in science by excluding as non-scientific a potential competitor for those resources. We now describe ideological differences in public science at *Scopes* and *McLean*, and then demonstrate how these distinctive ideologies were used by scientists in their pursuit of professional goals that changed substantially from 1925 to 1981.

## SCOPES TRIAL: DISTINGUISHING SCIENCE FROM RELIGION

### *Historical Setting*

On March 13, 1925, the Tennessee legislature approved a bill stating "That it shall be unlawful for any teacher [in public schools] to teach any law that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals." The anti-evolution act faced little public opposition in the state (Furniss, 1954:89), and it was signed into law by Governor Austin Peay on March 21, 1925. Roger Baldwin, director of the American Civil Liberties Union in New York, believed that the law infringed on academic freedom and that it breached the wall between church and state (Ginger, 1958:78). The ACLU offered financial

<sup>3</sup> A second client for knowledge is industry, which (in 1983) spent over \$44 billion for scientific research and development (National Science Board, 1983:44).

support and legal counsel for a test case of its constitutionality.

In the Eastern Tennessee town of Dayton (pop. 1750), George Washington Rappelyea (native New Yorker, engineer in charge of local mines for the Cumberland Coal Company and a lonely anti-fundamentalist) cajoled John Thomas Scopes (well-liked, 24-year-old first-year science teacher and athletic coach at Rhea Central High School) to serve as guinea pig. Scopes could not deny that he (and perhaps every other biology teacher in Tennessee) had violated the new law, because the official biology text in use since 1909—Hunter's *Civic Biology*—contained rudimentary descriptions of Darwin's idea of evolution, and praised it as "the theory on which we today base the progress of the world." Scopes allowed himself to be arrested, and with his indictment the stage was set. If Dayton was the stage, two leading actors came from outside.<sup>4</sup> The prosecution enlisted the legal counsel of three-time Presidential candidate William Jennings Bryan, who (although not having worked a trial in 28 years) had become in his twilight the leading spokesman for fundamentalist causes. The ACLU defense team included the criminal lawyer Clarence Darrow, who had acquired a fame equal to Bryan's as the defender of lost causes (for details, cf. Furniss, 1954:3–6; Ginger, 1958:18–21; de Camp, 1968: Chs. 1–5).

The prosecution strategy was narrow: to convict Scopes by presenting testimony of students saying that he had taught them evolution, and to avoid debate on the merits or constitutionality of the law itself. As the trial heated up, however, attorneys for the prosecution willingly defended the anti-evolution law as "right." Their affirmation reflected the enduring popular appeal of four fundamentalist values: (1) The Bible is exact and literal truth, inerrant and infallible (de Camp, 1968:28). Bryan worried that if fundamentalists sacrificed the authority of the Bible as factual explanation of human origins, then Biblical authority over moral and spiritual conduct would be diminished as well (Ginger, 1958:28). (2) Religion stands *against* science in "an engagement between two great armies for a victory of eternal significance" (Furniss, 1954:41). A

victory for evolution and science could come only at the expense of Biblical authority, and Bryan felt that "the worst enemies were the men who professed both Christianity and evolution [for] their contradictory doctrine was an anaesthetic that deadens the Christian's pain while his religion is being removed" (in Ginger, 1958:39). (3) Faith in the Bible is more valuable than scholarly wisdom. Bryan once said, "to educate a man without giving him religion is like sending out a ship without a pilot. If we have to give up either religion or education, we should give up education" (in Ginger, 1958:88; cf. Furniss, 1954:39–40). (4) Curricula of public schools should be controlled by local taxpayers and not, as the ever-populist Bryan put it, by experts "who measure men by diplomas and college degrees" (in Hofstadter, 1963:128).

The defense was content to lay a foundation for later appeal of the case, hoping to use the Dayton circuit court as springboard to an eventual hearing in the U.S. Supreme Court. There was little question that Scopes was guilty, and so the defense strategy focused on the constitutionality of the law. Four issues were emphasized: (1) The anti-evolution law violates Section 12, Article XI of the Tennessee Constitution, which read in part, "Knowledge, learning and virtue, being essential to the preservation of democratic principles . . . , it shall be the duty of the General Assembly . . . to cherish literature and science." By making it illegal to teach evolution, the legislature was hindering science, not cherishing. (2) The law violates constitutional freedoms of religion, because the State has adopted the holy writings of *one* religious tradition, the Christian Bible, as the sole standard of truth. (3) The law is unacceptably vague. The Biblical story of Divine Creation is open to various interpretations, and the phrase "descended from a lower order of animals" is too facile to describe the complexities of human evolution. (4) The centerpiece of the defense case: if the Bible were reasonably interpreted in a non-literal way, its account of creation is *compatible* with scientific theories of evolution. Thus, the law is internally contradictory, for Scopes could violate the second clause (by teaching evolution) while complying with the first clause by not *necessarily* denying the Biblical story of creation. Shortly after the trial, defense attorney Arthur Garfield Hays (1925:157) wrote in *The Nation*: our defense "led to the position that evolution and the story of creation in the Bible are not necessarily inconsistent. . . . The evidence would completely answer the bigots contention that we must choose between science and religion or even between science and the Bible."

<sup>4</sup> The *dramatis personae* also included: Judge John T. Raulston, presiding over the circuit court of Rhea County, Tennessee. Counsel for the prosecution: Bryan of Coral Gables; "General" Ben McKenzie, district attorney; J. Gordon McKenzie, Ben's son and county judge; Sue and Herbert Hicks, Dayton attorneys; A. T. Stewart, circuit attorney general. Counsel for the defense: Darrow of Chicago; John R. Neal, former dean of the University of Tennessee law school; Arthur Garfield Hays and Dudley Field Malone, New York attorneys (Ginger, 1958:4).

The local audience was initially hostile to the defense of Scopes. Mencken wrote for his *Baltimore Sun*: "It will be no more possible in the Christian valley to get a jury unprejudiced against Scopes than it would be possible in Wall Street to get a jury unprejudiced against a bolshevik" (in Tompkins, 1965:37). Judge Raulston also showed sympathy for the prosecution, as evidenced by his decision to exclude expert testimony by eminent scientists. The defense had seen the trial as an opportunity to educate the American public about science and about the truth of evolutionary theory. The ACLU brought in scientists to explain evolution and its practical implications, to show its centrality to work in their particular discipline, and to argue that it is not necessarily incompatible with a loose reading of Genesis. But the prosecution argued that the scientists' testimony was irrelevant for determining Scopes's guilt, because the jury could comprehend well enough on its own the *letter* of the law (Ginger, 1958:142). Raulston concurred with the prosecution: "I think the Court understands some things as well as the scientists" (in de Camp, 1968:351).

Ironically, the scientists' testimony *was* made public. Darrow sensed that Raulston might exclude his expert witnesses, and so he asked the scientists to write down what they were planning to tell the court about evolution. On the morning Raulston was to exclude the scientists' testimony, the Judge arrived at the courthouse to find stenographers transcribing scientists' statements and handing them to the press corps for nationwide circulation. Thus, the cause of "public science" was served in spite of Raulston's exclusion. This "testimony" by scientists, along with descriptions of science by defense attorneys, form the raw data for our analysis of boundary-work at the Scopes trial.

### *Boundary-Work at Scopes*

Success of the defense hinged on their ability to demarcate science from religion in a way that presented them as *distinctive* but *compatible*. The case for Scopes—and for professionalizing scientists—required construction of a boundary between science and religion; this boundary-work emphasized five distinguishing characteristics.

*Ontological differences.* Science interprets a physical, material realm; religion interprets a spiritual realm. New York attorney Arthur Garfield Hays drew the line: "Man . . . is a physical being and lives the life of all other physical beings and is a study for material science. He is spiritual and lives in the realm of spirit and for understanding of that

spiritual side, one must study the science of theology . . . Students have a right to be taught the truth about the whole man rather than half a truth" (229).<sup>5</sup> To demarcate the limited reality claimed for science, the defense introduced a distinction between ultimate and immediate causes. The testimony of Harvard geologist Kirtley F. Mather includes: "Science has not even a guess as to the original sources of matter. It deals with immediate causes and effects, not at all with ultimate causes and effects. For science there is no beginning and no ending . . . Natural science deals with physical laws and material realities," not "moral law and spiritual reality" (248).

*Epistemological differences.* The defense argued that scientists offered a distinctive *kind* of knowledge: scientific truths are literal, empirical descriptions of reality; religious truths (such as those in the Bible) are poetic allegories that become preposterous when taken as descriptions of natural facts. Attorney Dudley Field Malone used an allusion to "flat earth theories" to show that commitment to a literal reading of Biblical accounts of nature forces one to accept implausible, absurd beliefs: "the book of Genesis is in part a hymn, in part an allegory . . ., written by men who believed that the earth was flat" (116).

The defense tried to establish the *prima facie*, even common-sense plausibility of scientific descriptions. Hays compared evolution to another scientific theory that few would question as believable: "The Copernican theory is accepted by everybody—we know the earth and the planets revolve around the sun . . . These things we are showing [about evolution] are just as legitimate facts, just as well substantiated" (156). Darrow presented evolution as just plain common sense by relying on "local" evidence sure to impress Daytonians: "Here is the state of Tennessee . . . surrounded by its beautiful mountains, each one of which contains evidence that the earth is millions of years old" (83). Wilbur A. Nelson, State Geologist of Tennessee, suggested that Dayton's coal miners have seen for themselves the fruits of evolution: "The extensive coal deposits of the Tennessee coal field, the edge of which caps the mountain a few miles West of Dayton, are of this [carboniferous] age. [This] is but one illustration of how the different geologic periods passed and life developed over the earth" (240).

*Methodological differences.* Knowledge-claims in science are tentative, incomplete and

<sup>5</sup> References to *Scopes'* material indicate page numbers in the published transcription: *The World's Most Famous Court Trial, State of Tennessee v. John Thomas Scopes* (New York: Da Capo Press Reprint, 1971).

constantly revised; knowledge-claims in religion are a fixed, timeless and final dogma. Malone argued that "theology deals with something that is established and revealed; . . . it is the word of God, and that cannot be changed . . . That is the theological mind. And science is a modern thing . . . The difference between the theological mind and the scientific mind is that the theological mind is closed, because that is what is revealed and settled" (184). Zoologist Horatio Hackett Newman of the University of Chicago asserted that the transitory beliefs of science are, by contrast, at the mercy of nature: "If certain facts entirely out of accord with the law of gravity were to come to light, physicists would be forced either to modify the statement of the law so as to bring it into harmony with the newly-discovered facts, or else substitute a new law . . ." (264).

*Functional differences.* Science and religion are demarcated by their imputed functions: science is practically useful for technological progress; religion is useful for consolation and moral guidance. Malone listed technological achievements said to be dependent on science: "Moses never heard about steam, electricity, the telegraph, the telephone, the radio, the aeroplane, farming machinery, and Moses knew nothing about scientific thought and principles from which these vast accomplishments . . . have been produced" (116). The defense presented evolution not just as abstract theory, but as a source of practical innovations. Earlier, Malone noted, "We expect to show how vital to agriculture is the theory of evolution in connection with the development of important varieties of crops, plants, strawberries, peaches and other products essential to the life and prosperity of the people" (116; cf. 253).

The functions of religion lie elsewhere, as Darrow observed: "I know there are millions of people in the world who derive consolation in their times of trouble and solace in times of stress from the Bible . . . The Bible . . . is a book primarily of religion and morals. It is not a book of science . . . Under it there is nothing prescribed that would tell you how to build a railroad or a steamboat or to make anything that would advance civilization" (78). Science cannot usurp the moral functions of religion: "We have corrupted no morals as far as I know, and I would like to ask the court if there was any evidence in the witnesses produced by the prosecution, of moral deterioration due to the course of biology which Prof. Scopes taught these children . . . [One witness] said that the theory he was taught had not taken him out of the church" (184). Because religious belief and scientific knowledge serve distinctive

ends, both must be taught, as Mather wrote: "To say that one must choose between evolution and Christianity is exactly like telling the child, as he starts for school, that he must choose between spelling and arithmetic. Thorough knowledge of each is essential to success . . . in life" (248). The two cultural realms do not compete.

*Social differences.* Scientists reach public consensus over widely accepted facts; theologians and preachers are forever divided by sectarian squabbles so that religious beliefs ultimately become a matter for private, personal opinion. Darrow mentioned the "warring sects" that make up religion, each with its own interpretation of divine truth: "Who is the chief mogul that can tell us what the Bible means? . . . There are in America at least 500 different sects of churches, all of which quarrel with each other . . . They do not agree among themselves and cannot agree" (78–79). Because of these interminable debates, Darrow concluded that religious beliefs are personal choices: "There are millions of people who believe in evolution and in the stories of creation as set forth in the Bible, and who find no conflict between the two. The defense maintains that this is a matter of faith and interpretation, which each individual must determine for himself" (113).

Religious divisiveness contrasts with the consensus, even unanimity, surrounding acceptance of major scientific facts or theories. Zoologist Maynard Metcalf testified: "I am somewhat acquainted personally with nearly all the zoologists in America . . . , and I doubt if any two of these put exactly the same relative emphasis upon all the numerous interacting 'causes' of evolution. But of all these hundreds of men, not one fails to believe as a matter of course, in view of the evidence, that evolution has occurred" (252). Newman suggested that the "sects" of science—its diverse specialties and disciplines—are woven together by common reliance upon evolutionary theory: "The exact nature of proof of the principle of evolution is that when great masses of scientific data such as are involved in those branches of biology known as taxonomy, comparative anatomy, embryology, serology, paleontology and geographic distribution, are looked upon as the result of evolutionary processes, they take on orderliness, reasonableness, unity and coherence. Not only this, but each subsience becomes more closely linked with the others and all turn out to be but different aspects of one great process" (264–65).

#### *The Professional Stake at Scopes*

The 1920s were far from bountiful for American scientists: public and private investments

in scientific education and research were paltry. Greenberg (1967:63) concludes that "by the eve of the depression the financial condition of American basic research was becoming critical." Fundamentalist Christian fears that science would supplant the Bible as a source of cognitive (and possibly moral) authority combined with other fears to impede scientists' efforts to increase demand for their services. Most private corporations declined to invest in the National Research Fund (proposed in 1925 by George Ellery Hale and blessed by President Hoover) because "the results of an investment in pure science are usually published widely [and] corporations that contributed to the Fund would in effect be helping to supply new knowledge to competitive firms that did not" (Kevles, 1979:187). "Humanists" offered a secular case against government support for *more* science, charging that "the dominance of science and the machine was throwing civilization into a dangerous imbalance" (Kevles, 1979:181).

Organizations of professional scientists recognized the Scopes Trial as a ripe occasion to broadcast an ideology that would enhance a more favorable image of science. Displays of professional solidarity and support, galvanized by the Scopes defense, took several forms. In 1926, the ACLU appealed to the American Association for the Advancement of Science (AAAS) for funds to offset costs of the defense. Scientists "responded so heartily that one mailing turned the deficit into a surplus of over two thousand dollars" (de Camp, 1968:435). *Science* magazine of July 31, 1925, announced the John T. Scopes Scholarship Fund: "... believing that he is entitled to some substantial recognition for the trying experience he has undergone in the service of science . . . , the scientists who were associated with the defense have organized a committee to raise a scholarship fund of \$5000" (Anon., 1925:105). The American Medical Association passed the following resolution at its May 28, 1925, meeting: "Any restriction of the proper study of scientific fact in regularly established educational institutions is inimical to the progress of science and the public welfare" (de Camp, 1968:102; cf. Shipley, 1927:380 for a similar AAAS resolution).

Arguments in defense of Scopes were congruent with professional interests of American scientists in 1925 who sought to expand the market for their distinctive brand of knowledge. The ideology of science at the trial emphasized two points. First, a "rhetoric of utility" was designed to show that everyone benefited in practical ways from scientific discoveries and from their practical applications (cf. Tobey, 1971: Ch. 5). Scientific knowledge

was presented as the fount of telegraphs, telephones, airplanes and improved strains of strawberries. The implication: continued technological progress depends on enlarged investments in scientific education, training and research. The functional differentiation of science from religion was achieved in a way that justified expansion of the "demand" side of the market for scientific knowledge.

Second, scientists and their attorneys at *Scopes* put a boundary *between* science and religion in order to demarcate them into mutually exclusive cultural spheres. Science was presented as literal descriptions of material reality, a keystone to technological progress, a unique means to reach collective agreement over what is so. The ideology of science at *Scopes* was not designed to show the universal superiority of science (among knowledge-producing systems) or to show its incompatibility with religion. Quite the contrary: religion and science are presented as complementary and compatible, both needed and both useful. As Mather put it at the trial, science and religion should "march shoulder to shoulder" toward a "trained and reasoning mind with a faithful and loving heart" (251). This logic rebuffs the zero-sum logic of some fundamentalist Christians: an increase in support for science does not necessarily imply (the scientists argued) a decrease in the authority or significance of religion. The putative complementarity of science and religion makes it difficult to argue *against* increased public support for science on grounds that it destroys traditional values of religion. This element of public science at *Scopes* is a step toward the removal of lingering religious barriers to the expansion of scientific research and education in public institutions.

Was public science at *Scopes* successful in accomplishing these professional goals? The scientists' messages from Dayton reached the public with force, as Scopes recalled decades after the trial: "the affidavits made a tremendous impact on the science education of the country and the world" (in Tompkins, 1965:30). Watson Davis covered the trial for *Science Service*, a non-profit organization created to bring science to the public through the news media. Forty years after the trial, Davis reflected on its importance for public relations: "the material issued at Dayton, along with the commentary of scientists . . . made an impact upon the public . . . The process of convincingly informing the people of scientific truth is laborious and unending. Dramatic events like the Scopes trial are part of the continuing renaissance of scientific understanding" (in Tompkins, 1965:71-73).

Other fallout from *Scopes* suggests that its



"public impact" did not translate into palpable professional gains for scientists. Increased government patronage for scientific research and education did not "take off" until the 1950s (suggesting, perhaps, that the Manhattan Project and Sputnik did more than public science at *Scopes* to increase demand for public investments in scientific knowledge). Neither did the trial accomplish the narrower legal goals pursued by the defense. Not only did the jury convict *Scopes* as expected, but the appeal process produced unexpected futility. In January 1927, the Tennessee Supreme Court reached three decisions: the anti-evolution law was declared constitutional; the lower court conviction of *Scopes* was quashed on a technicality (the Jury, not Judge Raulston, was responsible for imposing fines over \$50); the State Attorney General issued a *nolle prosequi*, a motion to drop the indictment and, implicitly, an acquittal of defendant *Scopes* (Grossbach, 1964:141). With no indictment against *Scopes*, the ACLU could not appeal the case to a still higher court, and its efforts to show the unconstitutionality of anti-evolution laws were stalled. With litigation at an end, scientists missed additional opportunities to present their ideology as front-page news.

Moreover, *Scopes* did not establish the cognitive authority of scientists over "theories of nature" as taught through science textbooks in public schools. Mississippi passed an anti-evolution law in 1926, and two years later voters in Arkansas approved a referendum making it illegal to teach evolution in public schools.<sup>6</sup> The effects of *Scopes* on high school biology textbooks were the reverse hoped for by scientists: "it is easy to identify a text published in the decade following 1925. Merely look up the word 'evolution' in the index or glossary; you almost certainly will not find it" (Grabner and Miller, 1974:833). Publishers did not want to jeopardize sales by including materials on evolution that might infuriate potential buyers with fundamentalist views. Their fears were real: in Texas, Governor Miriam Ferguson (also head of the state textbook commission) "laid down the policy of selecting only those biology texts that contained no mention of evolution. The commission adopted Truman J. Moon's *Biology for Beginners* but only on the condition that three chapters dealing with evolution be eliminated" (Ginger, 1958:211; cf. Gould, 1983:280–90). Publishers' reluctance to include potentially inflammatory descriptions of evolution continued in many texts through

the 1950s. In the 1960s, revamped biology texts prepared by the government-funded Biological Sciences Curriculum Study (BSCS) made evolution a theoretical centerpiece of modern biology. The fundamentalist Christian *opposition* to these new texts leads to our second episode in the boundary dispute between science and religion.

## MCLEAN TRIAL: EXCLUDING PSEUDO-SCIENCE

### *A New Historical Setting*

On 19 March 1981, Governor Frank White of Arkansas signed into law Act 590, titled "Balanced Treatment for Creation-Science and Evolution-Science" (for full text, cf. LaFollette, 1983c:14–19). Act 590 was designed to protect academic freedom of students in public schools by allowing for an informed choice between two models of origins. Creation-Science refers to scientific evidence for the sudden creation of the universe from nothing, limited changes in originally created kinds of plants and animals, separate ancestries for humans and apes, catastrophic floods as explanations for the earth's geology, and a relatively recent inception of the earth. Evolution-Science refers to scientific evidence for the gradual emergence of life from non-life, emergence of naturalistic processes from disordered matter, processes of mutation and natural selection as causes of present diversity in life forms, man's common ancestry with apes, a uniformitarian theory of the earth's geology, and an earth that is several billion years old. Both models would be presented in a "balanced" way to biology classes in Arkansas public schools. Act 590 was designed to guarantee freedom of religious exercise by barring discrimination on the basis of belief in creation or evolution, and thus to prevent establishment of religion in public schools (cf. Nelkin, 1982:138).

Two months after the signing, the ACLU challenged the constitutionality of Act 590, and filed suit on behalf of 23 plaintiffs (the first listed was Rev. Bill McLean, a Presbyterian minister). The trial took place on 7–21 December 1981, in the U.S. District Court at Little Rock. On 5 January 1982, presiding Judge William R. Overton reached a decision favoring the Plaintiffs, and an injunction was entered "permanently prohibiting enforcement of Act 590" (for complete text of decision, cf. LaFollette, 1983c:45–73).

Events leading to Act 590 illustrate not only the changing tactics of a resurgent Christian fundamentalism, but also post-Sputnik efforts to reform science education at the secondary level (Nelkin, 1983:39). The National Science

<sup>6</sup> Though the pattern was different elsewhere: in the two years following the *Scopes* trial, anti-evolution bills were defeated in ten states (Ginger, 1958:212–13).

Foundation gave \$7 million to the American Institute of Biological Sciences for the BSCS that produced new biology textbooks eventually used in about one-half of American high schools. Unlike texts widely used in the thirty years since *Scopes*, BSCS books gave prominent place to evolutionary theory in explanations of biological phenomena. Reforms in science education were buttressed by a 1968 U.S. Supreme Court decision in *Epperson v. Arkansas*, which stated that a 1928 law forbidding the teaching of evolution in public schools was an unconstitutional entanglement of government with religion.

These reforms were opposed by Christian fundamentalists, who insisted "that science education must respect beliefs that are outside the dominant scientific culture," such as a religious faith in the accuracy of the Genesis account of creation (Nelkin, 1982:175). "Scientific creationists" advance many of the same Christian fundamentalist principles offered by their predecessors at *Scopes*, but their tactics are different. Now, "scientific" methods and discourse are used to discover "scientific" evidence supporting the Biblical model of origins. As in 1925, the goal is to make the curriculum of public schools consistent with the beliefs of fundamentalism. Although the Establishment Clause prevents the introduction of sectarian religious training in government schools, it cannot prevent introduction of scientific evidence for an alternative scientific hypothesis such as the creation-science model of origins.

Act 590 in Arkansas is one of many attempts by national and local creationist organizations to attack the *exclusive* teaching of evolutionary theory in public school science classes (cf. Nelkin, 1982 for a history of the creation-science movement and of "science-textbook controversies"). The task of defending Act 590 in court fell to Arkansas Attorney General Steve Clark. Five points were emphasized (cf. Holtzman and Klasfeld, 1983:87; Nelkin, 1982:141; excerpts from the Defense Pre-Trial Brief are in LaFollette, 1983c:33-44): (a) Act 590 promotes scientific inquiry by encouraging research on a fuller range of theoretical explanations of origins. To restrict attention to evolutionary theory is dogmatic and a perversion of the value placed by scientists on an "open competition in the marketplace of ideas." Arguments in the scientific community over the details of classical evolutionary theory are presented as evidence for its possible weaknesses, an additional reason why consideration of the creationist alternative should be encouraged. (b) Act 590 promotes academic freedom by allowing students and teachers to assess for themselves the creationist alternative. Clark hoped to portray the Plaintiffs as

censors who were trying to limit teaching to evolutionary theory by preempting a rival. (c) The teaching of creation-science can be restricted to scientific evidence for the account in Genesis. The creationist model of origins may be coincident with certain Christian beliefs, but its evaluation as a scientific hypothesis does not depend on acceptance of those beliefs. Thus, Act 590 is consistent with Constitutional guarantees that government will not "establish" sectarian religion. (d) Act 590 promotes freedom of religious choice. If creation-science is coincident with certain Christian beliefs, so too is evolution-science coincident with other religions such as secular humanism or agnosticism. If creation-science is excluded because its teaching would involve excessive entanglement of church and state, logic requires that evolution-science be excluded as well. (e) The State of Arkansas has ultimate authority to determine curricula in its public schools.

The Plaintiffs were represented by a team of lawyers organized by the ACLU, including several attorneys working *pro bono publico* from a large New York firm (cf. Kerr, 1983). The Plaintiff's case emphasized six points (cf. Cracraft, 1983; Crawford, 1983; Holtzman and Klasfeld, 1983; LaFollette, 1983a; excerpts from the Plaintiff's Pre-Trial Brief are in LaFollette, 1983c:59-67): (a) The creationist model of origins does not meet conventional criteria of a scientific theory: it cannot be tested with empirical evidence; it goes beyond natural law to ascribe cause to a supernatural being; it neither explains nor predicts biological and geological facts; it is not falsifiable (cf. Ruse, 1983). (b) There is no scientific evidence for a creationist model. For example, belief in a young earth (thousands of years old) is contradicted by abundant empirical evidence that the age of the earth must be measured in millions of years. (c) Creation-science is inseparable from religious faith. The creationist model is derived explicitly from Genesis read literally, and makes little sense when removed from this Biblical context. Creation-science is religious apologetics, and there is no secular value in teaching it to public school children. Act 590 thus violates the Establishment Clause of the First Amendment. (d) Act 590 is so vaguely worded that enforcement would jeopardize rights guaranteed by the Due Process clause of the Fourteenth Amendment. For example, Arkansas teachers are nowhere told the meaning of "balanced-treatment": is it enough to give equal time to creation and evolution, or (quite different) must each be presented in an unbiased way as equally valid? (e) Annulment of Act 590 would not involve censorship: Christians are free to discuss creation in religious settings. (f) Act 590 infringes

on academic freedom. It forces a state-sponsored theory into public schools, overriding professional judgments by scientists that creationism is not a plausible scientific hypothesis.

Judge Overton's decision is "sharply worded and unambiguous" (Nelkin, 1983:81): creation-science is not science because it is not falsifiable and not confined to natural law; creation-science depends on a literal reading of Genesis and so—both in intent and consequence—it is an advancement of religious education; thus, Act 590 creates excessive entanglement of the State with sectarian religion. In contrast to Judge Raulston's exclusion of expert witnesses from *Scopes*, Judge Overton not only allowed expert witnesses in *McLean* but—according to a member of the Plaintiffs' legal team—they were "the critical element of the constitutional challenge to Act 590" (Herlihy, 1983:99). Overton's long opinion (the full text is in LaFollette, 1983c:45–73) relied heavily upon testimony provided by the Plaintiff's expert scientists, theologians and educators. Philosopher of science Michael Ruse (1983:158–59), a Plaintiff witness, admitted that his definition of a scientific theory was "accepted by the court virtually verbatim." But the Defense—hoping to save Act 590—brought its own experts to the trial, offering alternative descriptions of science, evolution and creation. To understand how Overton was persuaded by experts from the Plaintiffs' side requires closer examination of the images of science and scientists created in the court by these witnesses and their attorneys.

### *Boundary-Work at McLean*

The Plaintiffs' case against Act 590 centered on the argument that creation-science is not "real" science, and that creation-scientists do not have the authority of "real" scientists (cf. Holtzman and Klasfeld, 1983:86; LaFollette, 1983:10; Lewin, 1982). Success was achieved, in part, through effective boundary-work: an image of science was constructed at the trial that placed a boundary *between* science and creation-science, one that excluded creation-science as pseudoscientific religious apologetics.<sup>7</sup> Boundary-work by "professional" scientists at *McLean* emphasized four distinctive features of science.

(1) Science is the domain of experts, whose specialized training and accomplishments en-

able them *alone* to decide the validity of knowledge about nature. Creation-scientists lack professional credentials and so they are denied the authority to speak as "genuine" scientists. Langdon Gilkey, theologian at the University of Chicago, testified at the trial that "the general association of biologists . . . would be the final authority as to whether something is a biological theory or not" (Trial, 215).<sup>8</sup> The unique legitimacy granted to theories offered by certified scientists, Gilkey suggested, is an "earned authority. It is not granted by some other power. It is earned by expertise, by training, by excellence at work." Cornell's Dorothy Nelkin, testifying as an expert in the sociology of science and in the history of science-textbook controversies, noted that "science is not a democracy. It is a meritocracy. Achievements, bodies of knowledge, and acceptable sets of procedures; these are the things that define science, not democracy, not audience applause" (Trial, 143).

Boundary-work here assumed a gatekeeping function (cf. Merton and Zuckerman, [1942] 1973:521–22): cross-examination of scientists testifying for the Defense—generally supportive of creationism as a legitimate scientific hypothesis—suggested that they are not "members in good standing" of the professional scientific community, and thus their claims about science, evolution and creation should be discredited. For example, supporters of creation-science are infrequent contributors to the professional scientific literature. Under cross-examination, geologist Harold Coffin of the Geoscience Research Institute at Loma Linda University (affiliated with the Institute for Creation Research) admitted that "he had only two articles in standard scientific journals since getting his Ph.D. in 1955." Second, scientists who support creationism are not generally employed at universities within the mainstream of American scientific research. Harold Morowitz, geologist at Yale, told the Court that he could not name one Ivy League University that had a creation-scientist on its faculty (in Lyons, 1982:76). Nelkin testified that "most of the documents, most of the lectures, most of the activities of people in ICR, which is now the most active organization [promoting creationist models] are . . . published primarily through religious sources." Third, creation-scientists lack up-to-date training in techniques essential for evaluating evolutionary theory.

<sup>7</sup> Sociological studies of pseudoscience include: Collins and Pinch, 1982; Hanen et al., 1980; Mausekopf, 1979; Wallis, 1979.

<sup>8</sup> Primary materials on *McLean* are taken from typescripts of depositions or from the trial transcripts. We have also examined a typescript of the Plaintiffs' Pre-Trial Brief. Page numbers refer to these typescripts.

Donald Chittick, a physical chemist from Oregon and a member of the Creation Research Society, agreed under cross-examination that he had attended "no formal course in radiometric dating for 20 years" and had "never published an article on radiometric dating." Robert Gentry, guest scientist for a time at Oak Ridge National Laboratory, agreed under cross-examination that his grant proposal to the National Science Foundation had been turned down because he was "faulted for using a technique that was known to give false results."

"Science" emerged as a game that not just anyone can play. Only credentialed scientists can decide the validity of a scientific theory or method. "Professional" scientists have passed various gatekeepers at the boundaries of science by publishing in technical journals, by gaining employment at mainstream colleges and universities, by learning specialized research techniques, and by having their work favorably reviewed by peers at (for example) the National Science Foundation. Expert witnesses for the Plaintiffs provided *vitae* demonstrating these credentials; experts for the Defense were shown to lack them. Thus, claims by professional scientists provided by the Plaintiffs took on greater authority when compared to claims by creation-scientists working for the Defense. Creation-scientists are pictured as parvenus, falsely speaking with the credibility of scientists. As Harvard evolutionary theorist Stephen Jay Gould puts it in his deposition (p. 65): "Professional boundaries are very guarded in academia, and it is not regarded happily when people make pronouncements in areas where they really don't understand."

(2) Genuine scientists are skeptical, tentative and cautious about claims to knowledge, in contrast to the dogmatic faith in Biblical inerrancy attributed to creation-scientists. Francisco Ayala, geneticist from the University of California, noted that "scientists take great pride in showing evidence that goes against prevailing theory because it is one way of getting attention" (Deposition, 106). Gould asserted that "science is always tentative" (Deposition, 56), and Nelkin concurred: "[science] is not trying to prove anything; it is trying to test . . . to look skeptically at data and to understand" (Trial, 156).

Creation-scientists are unscientific because they refuse to doubt the validity of Biblical accounts of origins. Plaintiffs' attorneys summarized their experts' testimony in the Pre-Trial Brief (p. 27): "Evolution, like all science, is necessarily tentative. 'Creation-science' does not have this tentativeness, this uncertainty, for it both starts and ends with immutable *a priori* assumptions. Defense witness after

defense witness testified to his belief that the Bible is inerrant and is historically and scientifically true." Michael Ruse testified: "There's basically nothing one can think of that creation scientists couldn't fit in . . . They say time and again that 'Look, folks, we start with the Bible, this is the framework. If it doesn't fit in, we aren't going to accept it'" (Trial, 294).

(3) Scientists reach consensus over facts or theories that are accorded at least the provisional status of "truth." Despite scientists' willingness to challenge and even to reject current wisdom, some knowledge-claims achieve a measure of certainty and finality. Creation-scientists' unwillingness to conform to prevailing scientific opinion on even uncontroversial knowledge-claims is presented as further evidence that they are outside the boundaries of "real" science. Gould suggested that "the fact that science is always tentative does not mean that there is entirely subjective knowledge of the world. I think science does obtain answers. They can never be absolutely certain, but I would be very surprised if the earth did turn out to be flat after all" (Deposition, 117). Science has reached consensus on the facticity of evolution, as Ayala suggested under cross-examination:

A: . . . the evidence today is unambiguous as to the fact that evolution has taken place, and that is very definitely established.

Q: . . . are you talking about all scientific evidence or . . . evidence in the area of biology . . .

A: All.

Q: All evidence? Is there any evidence against evolution?

A: No, not that I know of . . . no scientific evidence.

Experts testifying in support of creation-science suggested that the *fact* of evolution has not yet been proved, and that it remains a hunch at best. They presented Genesis as an alternative to evolutionary theory, and offered empirical evidence and logical arguments for, say, a relatively recent creation of earth. Yet, geologist Brent Dalrymple contended that professional scientists have found little reason even to consider the creationist alternative:

Q: In your professional opinion, have the creation-scientists' assertions of a young earth been falsified?

D: Absolutely, I'd put them in the same category as the flat earth hypothesis and the hypothesis that the sun goes around the earth. I think those are all absurd, completely disproven hypotheses.

Q: In your professional opinion, in light of all the scientific evidence, is the continued

assertion by creation-scientists that the earth is relatively young consistent with the scientific method?

D: No, it is not consistent with the scientific method to hold onto a hypothesis that has been completely disproven to the extent that it is now absurd.

(4) Science is the disinterested search for knowledge. Whatever personal interests may motivate individual scientists—fame, fortune or politics—these are filtered out by institutionalized procedures for guaranteeing an objective, unbiased evaluation of the validity of a knowledge-claim. Creation-science, by contrast, has a hidden agenda: its ulterior motive is to advance religious teaching in public schools under the guise of scientific objectivity. Biologist William V. Mayer of the University of Colorado, observed that “[creationists] are blatantly religious and they are poor science. They deliberately misrepresent. I used to think this was a lack of knowledge . . . but I find [that] they make these statements even if they know better” (Deposition, 127). Ruse elaborated on the biased research of creationists: “they play all sorts of sleights of hand; they quote all sorts of eminent evolutionists out of context, implying that evolutionists are not quite saying what they are saying” (Trial, 296–97). Father Bruce Vawter, Plaintiff witness and chairman of religious studies at DePaul University, traced the bias to creationists’ commitment to the advance of Biblical theories of origins: “I can’t but believe that [creation-science] is a reading of the first eleven chapters of Genesis, and . . . the thesis is now being proposed that science will confirm all of this. But those first eleven chapters of Genesis are religious doctrine. That is why I feel that it is the hidden agenda of creationism” (Deposition, 37). “Professional” scientists do not allow nonscientific agendas to affect their research. Gould explained:

Q: Would it be fair to say that since you have something of a vested interest in seeing that evolution—

G: Only in the sense that everybody has a stake in what they believe—no more, no less. Every human being does. That doesn’t constitute bias. Bias or prejudice is unreasonable personal investment in a theory. (Deposition, 115)

### *The Professional Stake at McLean*

These descriptions of science offered by Plaintiffs’ witnesses will seem familiar to sociologists of science. Characteristics here attributed to science—disinterested, skeptical, meritocratic—overlap with the “normative

structure of science” identified by Merton ([1942] 1973: Ch. 13) as functional for the extension of certified knowledge. For our analysis, these attributions are not assessed for their *accuracy* in describing how scientists do or should behave. They are examined as ideological statements (cf. Gieryn, 1983:782–83; Mulkay, 1976; Fries, 1984) used in *public* science to advance narrow legal goals and broader professional goals at stake in *McLean*.

Attribution of these selected characteristics to science was effective for excluding creation-science from “professional” science: creationists testifying for the defense of Act 590 lack the credentials that certify success in passing by the gatekeepers at the boundaries of “professional” science; they are dogmatic rather than skeptical; they refuse to admit the validity of universally obvious scientific facts; their conclusions are biased by a greater interest in advancing religion than in discovering truth. As one attorney for the Plaintiffs summarized: “the greatest success of the *McLean* opinion was . . . its implicit reliance upon the efficacy and integrity of specialized communities—such as the scientific and educational communities—to be the proper arbiters of claims of legitimacy made within their proper sphere” (Herlihy, 1983:102). Boundary-work at *McLean* successfully excluded creationists as pseudo-scientists, and achieved legal vindication of professional scientists’ monopoly over the market for “scientific” knowledge in Arkansas schoolrooms.

The ideology of science at *McLean* was also designed to minimize a deeper threat to the professional authority and resources of scientists. Gary Crawford (1983:112), a member of the Plaintiffs’ team of attorneys, observed after the trial that “the American public respects science greatly, even if it does not always understand exactly what science is or how it operates. Any claim that an idea is ‘scientific’ appears to enhance its persuasive power and its public appeal.” Because the American public is largely illiterate about science (LaFollette, 1983a:4), scientists are vulnerable to unwarranted use of their authority—in legal or political contexts—by those they have not admitted to the profession. *McLean* highlights the danger: the authority of science can be used in public settings to challenge monopolistic control by the dominant scientific community. Creation-scientists try to use the authority of science to pursue intellectual, political or religious agendas that do not coincide with agendas pursued by the professional scientific community.

One part of the creation-scientists’ agenda challenges the essence of scientists’ claim to

public, governmental support: the perceived *neutrality* of scientific truth and its assumed irrelevance for sectarian religious beliefs. The First Amendment forbids government agencies from "establishing" sectarian religion. At first glance, the Establishment Clause has little relevance for government funding of scientific research and education: it forbids (in tax-supported institutions) the presentation of sectarian religious beliefs, not universal scientific truths. But creation-science blurs the demarcation between science and religion by asserting continuities between scientific knowledge and religious values, in order to challenge government's *selective* support of the evolutionary perspective. Nelkin's (1983:68) description of fundamentalist science-textbook watchers is accurate for creation-scientists: "Their vision of science is strangely skewed with religious and personal values . . . Scientific understanding requires a religious perspective." Gilkey (1983:130) suggests that for creationists, a "scientific theory that leaves out God—as the scientific theory of evolution surely does—is clearly false and so cannot *really* be 'science.'"

On the agenda of creation-scientists, religious and scientific goals are inseparable; for the scientific community, their separation is professionally essential. Creation-scientists' redefinition of science could encourage reassessments of the Constitutionality of government "establishment" of scientific research and education. That reassessment has begun, in small steps (cf. Nelkin, 1982:129–33): in 1972, William Willoughby (religion editor at the *Washington Evening Star*) responded to the tax-supported BSCS textbook revisions by filing suit against the NSF and the University of Colorado on grounds that "citizens are coerced to pay taxes to support educational activities that offend their religious beliefs . . . The government is establishing, as the official religion of the U.S., secular humanism" (the case was dismissed in 1975; Nelkin, 1983:79). In 1981, William E. Dannemeyer of California introduced a bill into the House that would "limit congressional funding to the Smithsonian Institution if its museum of natural history continued to ignore alternatives to evolutionary theory." According to Dannemeyer, such legislation would "ensure that Federal dollars are not being used to promote one religious theory exclusively" (Lewin, 1981a:638). The next steps could be larger: creationists' argument that evolutionary theory is inherently linked to religious values of atheism or secular humanism is sometimes used by political conservatives to justify reductions in the federal science budget. Brush (1983:184 note 19) reports that the "Conservative Caucus and the

National Conservative Political Action Committee . . . propose to cut the budget of the National Institutes of Health by 50% and eliminate the National Science Foundation entirely."

The professional stake at *McLean* is now more clear. In a time of Big Science (Price, 1963), government support for scientific research and teaching at all levels is merely essential. The Plaintiffs persuaded Judge Overton that creation-scientists are not "real" scientists. Because of that successful boundary-work, creationists' definitions of science—emphasizing religious values inherent in evolutionary theory—were not heard with the authority of testimony by "professional" scientists working for the Plaintiffs. The decision at *McLean* protected the "neutrality" of science; its *irrelevance* to the Establishment Clause of the First Amendment was sustained. At stake was not just a theory of origins, but (potentially) the continued public patronage of American science.

Thus, *McLean* not only raised constitutional questions about religious freedoms or local control of public schools; it also raised issues concretely affecting the professional health of science. Still, the professional stake in *McLean* was not, at first, widely recognized by the scientific community. Organized efforts by professional associations were slow to coalesce, perhaps because many scientists saw creationists as crackpots whose theories were too absurd to warrant serious scientific refutation. As the trial approached, cavalier dismissal of creationists gave way to organized resistance taking several forms. A call to arms was heralded by the *Chronicle of Higher Education* on 15 December 1982: "increasingly, some scientists, philosophers and historians of science are beginning to say that creationism poses a threat not just to evolutionary theory, but to all science as well—and they are taking up the fight" (Winkler, 1982). Professional associations (e.g., National Academy of Sciences, National Science Teachers Association, American Association for the Advancement of Science) issued resolutions condemning the teaching of creationism in public school science classes. The AAAS resolution emerged from a January 1982 symposium on "Science and Belief," which also gave rise to a network of anti-creationism citizens' lobbies, operating in 42 states (Saladin, 1982:59). Also, the AAAS has agreed to be listed as co-plaintiff in pending legislation against a balanced-treatment act recently passed in Louisiana. The NAS lent its prestige to publication of a "handy creationism refuter" that presented the simple facts of evolution, intended for citizens battling balanced-treatment legislation (Lewin,

1981b:635). Other scientists and scholars have written "popular" books elucidating evolution while denouncing creationism (e.g., Kitcher, 1982; Ruse, 1982; Newell, 1982; Eldredge, 1982; Futuyma, 1983; Godfrey, 1983; Wilson, 1983), and these books (unlike many such popularizations of science) have generally been praised as authoritative and accurate by professional scientists (cf. Winkler, 1982). Finally, although some scientists and scholars refused to testify at *McLean*, the ACLU was able to draw on "the overwhelming support of the scientific community—approximately 100 scientists advised (also on a *pro bono* basis) the litigation team" (Kerr, 1983:118).

These diverse efforts—a mobilization of professional solidarity in face of possible threats to professional advantages—no doubt contributed to the legal success at *McLean*. But success was not complete, and the creationist cause may have gained as much from the trial as did the professional scientific community. Press coverage was substantial: "75 publications or news organizations registered more than 100 journalists or production-crew members" (LaFollette, 1983b:191). That publicity alone was cause for celebration by Senator Holsted, sponsor of Act 590: "I feel like we really won because people are talking about it, kids will be asking about it. Teachers will have to talk about creation-science . . . All the hoopla, the publicity—that's just what I wanted" (in LaFollette, 1983b:199).

The public image of science created by media coverage of *McLean* was not fully flattering. Science sometimes emerged as the "autocratic arbiter of its own rules," while creationists sometimes emerged as a beleaguered minority seeking fair play, only to be wrongfully excluded from the country club of elite scientists interested in protecting their turf (LaFollette, 1983b:194; Nelkin, 1982:18). Also, the *McLean* decision cannot insure that evolution will be taught in public school science classes; it may have the opposite effect. A consultant on the teaching of school science told *Time*: "teachers in Iowa are being intimidated by the controversy. Rather than teach both creation and evolution, they teach neither one" (Pierce, 1981:80). Brush (1983:177) suggests that *McLean* may do no more than *Scopes* to enlarge treatment of evolutionary theory in science textbooks, so long as book publishers believe that their profits are more secure if the "origins" controversy is avoided.

## THE TRIALS COMPARED

Two similarities between *Scopes* and *McLean* should not be overlooked. First, in both cases, we observe a "closing of the ranks," scientists

coming together to battle for common professional interests. Rank-closing is evidenced by scientists' willingness to set aside arguments over the *details* of evolutionary theory, and instead to present the facts of evolution with a certainty and unanimity that risks appearance of dogma. Second, the rhetorical structure of ideological presentations of science took the common form of boundary-work. Scientists and their attorneys engaged in a public and practical demarcation of science from religion, by attributing a unique set of characteristics to scientists, scientific methods and scientific knowledge that differentiated these from practitioners and products of other knowledge-producing institutions.

However, the *content* of public science at the two trials is—on some points—different. At *Scopes*, the ideology of science sought to establish the uniqueness of its commodity: truthful and useful knowledge about nature. Scientific knowledge was differentiated from religious knowledge, and they were presented as distinctive but complementary realms of culture. This served the narrow, legal goal of justifying the inclusion of science teaching in public schools in a way that did not appear to threaten traditional religious values. Differentiation of science from religion also served the broader, professional goal of segmenting the "market" for distinctive kinds of truth: science does not replace religion but augments it by using different methods (e.g., empirical discovery) to create knowledge with different practical utilities (e.g., technological progress).

At *McLean*, the ideology of science sought to establish a professional monopoly over the market for scientific knowledge. Only credentialed professional scientists have the expertise and authority to define science, to evaluate the validity of a scientific theory and to prescribe curricula for public school science classes. Scientists at the trial erected a boundary between their science and the pseudoscientific religion of creationism. This boundary-work served the narrow, legal goal of removing creation science from biology classrooms in Arkansas public schools. It also served the broader, professional goal of excluding competitive but illegitimate providers of "scientific" knowledge whose interests and objectives are not consistent with those of the scientific community. Because of their lack of credentials, and because of their reliance on faulty methods and logic, creation-scientists were denied the authority to speak as professional scientists.

The *relationship* of science to religion is differently described at the two trials. At *Scopes*, science and religion are complementary; they

are said to work side by side to create a cultural whole. At *McLean*, science and religion (in the specific form of creation-science) are competitive; religion-as-creation-science is an illegitimate intruder poaching on the professional authority that is said to be scientists' alone. At *Scopes*, scientists and their attorneys argued against the fundamentalists' zero-sum logic by suggesting that inclusion of evolution in public schools did nothing to threaten the authority of religious belief. At *McLean*, scientists themselves exploited the zero-sum logic by suggesting that the inclusion of creation-science in public schools threatened the effectiveness of science education by teaching error as truth.

Thus, ideological demarcations of science from religion in *public* science are contextually and historically contingent. The choice to present the relationship of science to religion as either complementary or competitive may be explained by differences in scientists' narrow legal goals in each trial and by historical changes in their broader professional goals. Ideological differences result in part from responses by scientists to a legal setting specific to each trial. The Tennessee statute removed evolution from public schools, while the Arkansas statute forced inclusion of creationism along side evolution; *Scopes* was decided by a jury, *McLean* by a judge. To convince the jury at *Scopes* (one that was assumed to have deep religious convictions) that evolution belonged in the schools, it was useful to argue that scientific knowledge is a distinctively valuable contribution to cultural progress and that it does not threaten traditional religious beliefs. However, to convince the judge at *McLean* (one who was presumed to have his own commitment to the professional authority of "experts" over a different cultural domain: the law) that creationism did not belong in public schools, it was useful to argue that religion was incompatible with—and even threatening to—the effectiveness of scientific education, and that scientific knowledge was beyond the grasp of the uncredentialed laity, and thus decisions about the scientific legitimacy of creationism must be left to professional scientists.

Ideological differences also result from historical improvements for American scientists from 1925 to 1982, improvements that changed the collective goals of the profession. The rhetoric at *Scopes* was well suited to making the case for greater public financing of scientific research and education. Scientists in 1925 sought to establish and expand the market for their kind of knowledge by creating public demand for its distinctive utilities. Arguments for the *complementarity* of science and religion were useful in two ways: first, scientists were able to advertise the practically valuable tech-

nological fruits grown only by scientific research; second, they tried to dissipate religious opposition to increased public support for science by presenting the two cultures as mutually exclusive.

By 1982, public support for scientific research and teaching had become a fixture in the federal budget. The enlarged cognitive authority of science is evidenced best by fundamentalists' choice to "become scientific" in their efforts to reform public education. A different professional goal emerged: to protect and to monopolize control over this cultural authority and government financing (in part) by preventing its misuse by nonprofessionals for their own political or religious purposes. It is no longer enough to present science and religion as complementary: creation-science must be seen as a *competitor* working against the effective realization of public investments in science. The rhetorical exclusion of creation-science at *McLean* served these new professional goals in two ways. First, public tax dollars and public education systems would not be used to perpetuate "scientific" beliefs that had not been authorized by the professional scientific community. Second, creationists' alternative definition of "science" (as intimately linked to sectarian religious values) would not be accepted as an official, insiders' opinion. Thus, the value neutrality of science—and its perceived irrelevance to the Establishment Clause of the First Amendment—would be protected. Public patronage for science would, by implication, be preserved. Both steps reinforce a professional monopoly over the market for knowledge about nature.

## CONCLUSION

Ideological flexibility in public science may be important for the successful professionalization of American scientists. Distinctive images of the relationship between science and religion were used on different historical occasions to advance two separate professional goals: to justify enlarged investments in scientific research and education, and to monopolize professional authority over a sphere of knowledge in order to protect collective resources of scientists. Ideologies found in public science are not sufficient to explain the growing authority and resources of the profession of science: one must also consider how scientific knowledge is put to use, say, by the State or by private industry. Yet decisions by government or industry to invest in scientific education and research are sometimes based on crude images of *what science is* and what it might accomplish in the future. Scientists have a professional interest in diffusing images or



ideologies of science that encourage these public or private investments. A fuller understanding of the "rise" of scientists in American society will emerge from further sociological studies of public science—occasions like *Scopes* and *McLean*—where the boundaries of science are negotiated and where the allocation of cognitive authority and professional resources is at stake.

## REFERENCES

- Anonymous  
1925 "The John T. Scopes Scholarship Fund." *Science* 105.
- Barber, Bernard  
1983 *The Logic and Limits of Trust*. New Brunswick: Rutgers University Press.
- Bates, Vernon L.  
1976 "Christian fundamentalism and the theory of evolution in public school education: a study of the creation science movement." Ph.D. Thesis, University of California at Davis.
- Beer, John J. and W. Daniel Lewis  
1974 "Aspects of the professionalization of science." Pp. 197–216 in Sal Restivo and Christopher Vanderpool (eds.), *Comparative Studies in Science and Society*. Columbus, OH: Merrill.
- Ben-David, Joseph  
1971 *The Scientist's Role in Society*. Englewood Cliffs, NJ: Prentice-Hall.
- Berlant, Jeffrey L.  
1975 *Profession and Monopoly*. Berkeley: University of California Press.
- Brickman, Jane Pacht  
1983 "Public health, midwives and nurses: 1880–1930." Pp. 65–88 in Ellen Condliffe Lagemann (ed.), *Nursing History: New Perspectives, New Possibilities*. New York: Teachers College Press.
- Brush, Stephen G.  
1983 "Creationism and education in the physical sciences." Pp. 174–84 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Cavanaugh, Michael A.  
1982 "Science, true science, pseudoscience: the one-eyed religious movement for scientific creationism." *Association for the Sociology of Religion*, Providence, October 22–24.
- Cole, Leonard A.  
1983 *Politics and the Restraint of Science*. Towata: Rowman & Allenheld.
- Cole, Stewart G.  
1931 *The History of Fundamentalism*. New York: Harper & Row.
- Collins, Harry M. and Trevor Pinch  
1982 *Frames of Meaning*. London: Routledge.
- Collins, Randall  
1979 *The Credential Society*. New York: Academic.
- Cracraft, Joel  
1983 "The scientific response to creationism." Pp. 138–49 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Crawford, Gary E.  
1983 "Science as an apologetic tool for biblical literalists." Pp. 104–113 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Daniels, George M.  
1967 "The process of professionalization in American science: the emergent period, 1820–1960." *ISIS* 58:151–66.
- de Camp, L. Sprague  
1968 *The Great Monkey Trial*. Garden City, NY: Doubleday.
- Eldredge, Niles  
1982 *The Monkey Business*. New York: Washington Square Press.
- Elias, Norbert  
1982 "Scientific establishments." Pp. 3–69 Richard Whitley (ed.), *Scientific Establishments and Hierarchies*. Dordrecht: D. Reidel.
- Freidson, Eliot  
1970 *Profession of Medicine*. New York: Dodd, Mead.
- Fries, Sylvia D.  
1984 "The ideology of science during the Nixon years: 1970–76." *Social Studies of Science* 14:323–41.
- Furniss, Norman F.  
1954 *The Fundamentalism Controversy, 1918–1931*. New Haven: Yale University Press.
- Futuyma, Douglas J.  
1983 *Science on Trial: The Case for Evolution*. New York: Random House.
- Gieryn, Thomas F.  
1983 "Boundary-work and the demarcation of science from non-science: strains and interests in professional ideologies of scientists." *American Sociological Review* 48:781–95.
- Gilkey, Langdon  
1983 "The creationist controversy: the interrelation of inquiry and belief." Pp. 129–37 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Ginger, Ray  
1958 *Six Days or Forever? Tennessee v. John Thomas Scopes*. Boston: Beacon.
- Godfrey, Laurie R. (ed.)  
1983 *Scientists Confront Creationism*. New York: Norton.
- Gould, Stephen Jay  
1983 *Hen's Teeth and Horses' Toes*. New York: Norton.
- Grabner, Judith V. and Peter D. Miller  
1974 "Effects of the Scopes trial." *Science* 185:832–37.
- Greenberg, Daniel S.  
1967 *The Politics of Pure Science*. New York: New American Library.
- Grossbach, Barry L.  
1964 "The Scopes trial: a turning point in American thought?" Unpublished Ph.D. dissertation, Department of History, Indiana University.

- Haller, John S., Jr.  
1981 *American Medicine in Transition, 1840–1910*. Urbana: University of Illinois Press.
- Hanen, Marsha P., Margaret J. Osler and Robert G. Weyant (eds.)  
1980 *Science, Pseudo-Science and Society*. Waterloo, Ontario: Wilfrid Laurier University Press.
- Hays, Arthur Garfield  
1925 "The strategy of the Scopes defense." *The Nation* 121:157–58.
- Herlihy, Mark E.  
1983 "Trying creation: scientific disputes and legal strategies." Pp. 97–103 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Hofstadter, Richard  
1963 *Anti-Intellectualism in American Life*. New York: Knopf.
- Holtzman, Eric and David Klasfeld  
1983 "The Arkansas creationism trial: an overview of the legal and scientific issues." Pp. 86–96 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Kerr, Peggy L.  
1983 "The creation-science case and pro bono publico." Pp. 114–124 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Kevles, Daniel J.  
1979 *The Physicists*. New York: Random House.
- King, M. D.  
1971 "Reason, tradition and the progressiveness of science." *History and Theory* 10:3–32.
- Kitcher, Philip  
1982 *Abusing Science*. Cambridge: MIT Press.
- Klegon, D.  
1978 "The sociology of professions: an emerging perspective." *Sociology of Work and Occupations* 5:259–83.
- Kuklick, Henrika  
1980 "Boundary maintenance in American sociology: limitations to academic professionalization." *Journal of the History of the Behavioral Sciences* 16:201–19.
- LaFollette, Marcel C. (ed)  
1983a "Introduction." Pp. 1–14 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.  
1983b "Creationism in the news: mass media coverage of the Arkansas case." Pp. 189–207 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- LaFollette, Marcel C. (ed)  
1983c *Creationism, Science and the Law: The Arkansas Case*. Cambridge, MA: MIT Press.
- Larson, Magali Sarfatti  
1977 *The Rise of Professionalism*. Berkeley: University of California Press.
- Lewin, Roger  
1981a "A response to creationism evolves." *Science* 214:635–38.  
1981b "Creationism goes on trial in Arkansas." *Science* 214:1101–1104.  
1982 "Where is the science in creation science?" *Science* 215:142–46.
- Lyons, Gene  
1982 "Repealing the Enlightenment." *Harper's* 264:38–40, 73–80.
- Marsden, George M.  
1980 *Fundamentalism and American Culture*. New York: Oxford University Press.
- Mauskopf, Seymour  
1979 *The Reception of Unconventional Science*. Boulder, CO: Westview.
- Merton, Robert K.  
[1942] "The normative structure of science." Pp. 267–78 in Robert K. Merton (ed.), *The Sociology of Science: Theoretical and Empirical Investigations*. Chicago: University of Chicago Press.
- Merton, Robert K. and Harriet Zuckerman  
1973 "Age, aging and age-structure in science." Pp. 497–559 in Robert K. Merton (ed.), *The Sociology of Science*. Chicago: University of Chicago Press.
- Meyer, John W.  
1977 "The effects of education as an institution." *American Journal of Sociology* 83:55–77.
- Mulkay, Michael J.  
1976 "Norms and ideology in science." *Social Science Information* 15:637–56.
- National Science Board  
1983 *Science Indicators 1982*. Washington: U.S. Government Printing Office.
- Nelkin, Dorothy  
1982 *The Creation Controversy: Science or Scripture in the Schools*. New York: Norton.  
1983 "From Dayton to Little Rock: creationism evolves." Pp. 74–85 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Newell, N. D.  
1982 *Creation and Evolution: Myth or Reality?* New York: Columbia University Press.
- Numbers, Ronald L.  
1982 "Creationism in 20th-century America." *Science* 218:538–44.
- Parry, Noel and Jose Parry  
1976 *The Rise of the Medical Profession*. London: Croom Helm.
- Pierce, Kenneth M.  
1981 "Putting Darwin back in the rock." *Time* 117:80–82.
- Price, Derek J. de Solla  
1963 *Little Science, Big Science*. New York: Columbia University Press.
- Ruse, Michael  
1982 *Darwinism Defended*. Reading, MA: Addison-Wesley.  
1983 "Creation-science is not science." Pp. 150–60 in Marcel C. LaFollette (ed.), *Creationism, Science and the Law*. Cambridge: MIT Press.
- Saks, Mike  
1983 "Removing the blinkers?: a critique of recent contributions to the sociology of professions." *The Sociological Review* 31:1–21.
- Saladin, Kenneth S.  
1982 "Opposing creationism: scientists organize." *The Humanist* 59,61.

- Shipley, Maynard  
1927 *The War on Modern Science*. New York: Knopf.
- Starr, Paul  
1982 *The Social Transformation of American Medicine*. New York: Basic.
- Tobey, Ronald C.  
1971 *The American Ideology of National Science*. Pittsburgh: University of Pittsburgh Press.
- Tompkins, Jerry R.  
1965 *D-Days at Dayton*. Baton Rouge: Louisiana University Press.
- Turner, Frank M.  
1980 "Public science in Britain, 1880–1919." *Isis* 71:589–608.
- Useem, Michael  
1976 "State production of social knowledge: patterns in government financing of academic social research." *American Sociological Review* 41:613–29.
- Wallis, Roy (ed.)  
1979 *On the Margins of Science*. Sociological Review Monograph No. 27.
- Weber, Max  
[1925] *Economy and Society*. Berkeley: University of California Press.
- Wilson, David B. (ed.)  
1983 *Did the Devil Make Darwin Do It?: Modern Perspectives on the Creation-Evolution Controversy*. Ames: Iowa State University Press.
- Winkler, Karen J.  
1982 "Concerned over scientific illiteracy, scholars enter creationist debate." *Chronicle of Higher Education* 25(Dec. 15):33–34.

## FOR WHOM THE SCHOOL BELL TOLLS: THE IMPACT OF DROPPING OUT ON COGNITIVE PERFORMANCE\*

KARL L. ALEXANDER  
*Johns Hopkins University*

GARY NATRIELLO  
*Teachers College  
Columbia University*

AARON M. PALLAS  
*Johns Hopkins University*

*Although much has been written about the ineffectiveness of schools in imparting cognitive skills, there is little reliable knowledge by which to judge such claims. While the typical school-effectiveness study focuses on variation in educational outcomes between organizational units, there have been few studies which compared "school" and "non-school" populations. The purpose of this paper is to assess the contribution of formal schooling to cognitive development. Using data from the sophomore cohort of the High School and Beyond project, we compare patterns of cognitive development for graduates and dropouts over a two-year interval. With the effects of social background, sophomore test performance, and prior academic adjustment controlled, the average difference in cognitive test performance that may be attributed to the effect of staying in school is about one-tenth of a standard deviation. Moreover, dropping out of school has its most severe negative effects on disadvantaged students.*

After a period of relative neglect, education again has assumed a prominent position in the forefront of the public-policy agenda. Blue-ribbon reports on the crisis in education have been offered in abundance (National Commission on Excellence, 1983; Task Force on Education for Economic Growth, 1983; Twentieth Century Fund, 1983; National Science Board Commission, 1983), proposals for school reform have either been passed or are under de-

velopment in most state legislatures (Walton, 1983; Fiske, 1984), and the rhetoric from Washington made education policy a major issue in the recent election. In stark contrast to the education agenda of just a few years ago, however, today's central concerns have little to do with equity issues and the failures of our educational system vis-a-vis minorities. Rather, they involve largely matters of school quality, and in particular, the supposed failure of our schools to produce graduates who can cope with the occupational requirements and the exigencies of everyday life in a world of high technology. Declining test scores, watered-down mathematics and science curricula, and disturbingly high levels of both

\* Direct all correspondence to: Gary Natriello, Teachers College, Columbia University, New York, NY 10027.

The authors contributed jointly and equally to this paper; the order of listing is alphabetical.