

Still creationism after all these years: understanding and counteracting intelligent design

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Synopsis Despite denials by proponents of intelligent design (ID) that ID is creationism, critical analysis by scientists and scholars, as well as statements by the proponents of ID themselves, has established beyond any doubt ID's true identity as neo-creationism. Despite de-emphasizing elements of earlier creationism such as belief in a young earth and "flood geology," ID bears marks of its descent from "creation science" and is defined by its leading proponents in overtly religious, and specifically Christian, terms. These facts enabled the plaintiffs in the first ID legal case, *Kitzmiller et al. v. Dover Area School District* (2005), to win a decisive victory over the Dover, PA, school board, which had required that a pro-ID statement be read to biology students at Dover High School. *Kitzmiller* was also a defeat for ID proponents at the Discovery Institute's Center for Science and Culture (CSC). Yet, although the CSC continues efforts to undermine the teaching of evolution even in the wake of this defeat, their tactics are increasingly stale and transparent. Their current strategy, disguising pro-ID policy proposals with code language to avoid using the term "intelligent design," is yet another tactic used by earlier creationists after consistent legal defeats. Moreover, the ID movement's continued execution of their agenda has enabled ID critics to compile an ever-lengthening list of further congruencies between ID and creation science. Such powerful evidence of ID's identity as neo-creationism, combined with modest but promising demographic changes in the United States, suggest that increased public support for teaching evolution is possible through effective outreach to the relevant demographic groups. Scientists must take advantage of this opportunity to cultivate such support and to counteract ID by engaging in pro-science activism, making use of the many resources available to support their efforts.

Introduction

In an interview in December 2007 with a religious organization, William Dembski, the intelligent design (ID) creationist movement's leading intellectual, candidly summarized not only ID's present status but, in reality, the status it has had since its inception:

Citizenlink: "Does your research conclude that God is the Intelligent Designer?"

William Dembski: "I believe God created the world for a purpose. The Designer of intelligent design is, ultimately, the Christian God."

The focus of my writings is not to try to understand the Christian doctrine of creation; it's to try to develop intelligent design as a scientific program.

There's a big question within the intelligent design community: 'How did the design get in there?' We're very early in this game in terms of understanding the history of how the design got implemented... evolutionary theory has so misled us that we have to rethink things from the

ground up. That's where we are. There are lots and lots of questions that are now open to re-examination in light of this new paradigm" (Williams 2007).

Dembski's statements here should be compared with his assertions of a decade earlier: "In the last five years [1993–1998] design has witnessed an explosive resurgence.... Scientists are beginning to realize that design can be rigorously formulated as a scientific theory.... What has emerged is a new program for scientific research known as Intelligent Design" (Dembski 1998b).

Dembski's confirmation that ID's designer is the Christian God is an admission that the true status of ID, as its critics have repeatedly stressed, is beyond dispute: ID is not only creationism but an overtly sectarian religious belief. Proponents of ID have bluffed their way into the American cultural and media mainstream as the prelude to their long-sought *entrée* into science classrooms. In 2008—twelve years after the Discovery Institute established

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the Center for the Renewal of Science and Culture (now Center for Science and Culture—CSC) as its ID headquarters in 1996; fifteen years after its first ID conference at Southern Methodist University in 1992 (Forrest and Gross 2007a); sixteen years after its “Wedge Strategy” began with publication of *Darwin on Trial* (Johnson 1991); and twenty-four years after publication of *The Mystery of Life’s Origin* (Thaxton et al. 1984), with which Dembski says the ID movement began (Dembski 1998b)—the ID movement has never left the ground scientifically. According to Dembski, evolution is to blame; its influence has led everyone down a blind alley, necessitating a “new paradigm.” However, ID’s true identity is as clear today, in 2008, as it was a decade ago: it is the hybrid offspring of “creation science” and the 1987 U. S. Supreme Court ruling, *Edwards v. Aguillard*, which outlawed teaching creationism in public schools (U. S. Supreme Court 1987). Pre-*Edwards* “creation science” evolved into post-*Edwards* “intelligent design.” After all these years, ID is what it has always been—the late 20th and now 21st-century continuation of the fundamentalist rebellion against modern science and secular society (Forrest and Gross 2005).

The movement has even less credibility since ID was legally recognized as creationism and declared unconstitutional in public schools by Judge John E. Jones III in *Kitzmiller et al. v. Dover Area School District* (Jones 2005), the “Dover trial.” A decade of critical analysis by scientists and other scholars has exposed ID as merely neo-creationism; much of this work was used in court (Forrest and Gross 2007a). However, because the CSC continues to push its agenda as though the trial had never occurred, the scientific community must become more involved in protecting their collective disciplines. Fortunately, scientists can do much to help.

Summary of evidence for ID as neo-creationism

From its Seattle headquarters, the CSC has executed the phases—minus the production of scientific data—of its “Wedge Strategy,” outlined in a 1998 document detailing its twenty-year strategy. The first paragraph reveals the creationist theme: “The proposition that human beings are created in the image of God is one of the bedrock principles on which Western civilization was built.... Yet a little over a century ago, this cardinal idea came under wholesale attack by intellectuals drawing on the discoveries of modern science” (DI 1998). Yet in pronouncements to mainstream audiences, proponents of ID

flatly deny that ID is creationism. According to CSC associate director John West, “‘Intelligent Design Creationism’ is a pejorative term coined by some Darwinists to attack intelligent design” (West 2002). CSC director Stephen C. Meyer denies that ID is grounded in religion: “ID is not based on religion, but on scientific discoveries and our experience of cause and effect, the basis of all scientific reasoning about the past. Unlike creationism, ID is an inference from biological data” (Meyer 2006).

West’s and Meyer’s denials, disingenuous stock quotations prepared for the mainstream media, are contradicted by candid admissions made by their ID colleagues Dembski and Phillip Johnson to “our natural constituency, namely, Christians” (DI 1998). Dembski and Johnson, the movement’s intellectual and tactical leaders, respectively, quite literally define ID in religious—in Dembski’s case, overtly Christian—terms. Dembski defines ID as “the Logos theology of John’s Gospel restated in the idiom of information theory” (Dembski 1999). The “defining concept” of ID, says Johnson, is “theistic realism,” meaning that “we affirm that God is objectively real as Creator, and that the reality of God is tangibly recorded in evidence accessible to science, particularly in biology” (Johnson 1996).

Striking evidence of ID’s direct ancestry in the “creation science” of earlier decades comes in the person of Dean H. Kenyon, a biologist who, with young-earth creationist Percival Davis, co-authored *Of Pandas and People* (Kenyon and Davis 1993), the creationist textbook that was among the *Kitzmiller* plaintiffs’ central items of evidence. In 1984, Kenyon filed a sworn affidavit in *Edwards* as a creation scientist: “It is my professional opinion, based on my original research, study, and teaching, that creation-science is as scientific as evolution” (Kenyon 1984). He also worked on *Pandas* while involved in that case (Forrest and Gross 2007a). By 1997 (after the creationists’ defeat in *Edwards*), he had transformed himself into an ID proponent, becoming one of the first CSC fellows (DI 1997). In 2000, he openly admitted that “Scientific creationism, which in its modern phase began in the early 1960s, is actually one of the intellectual antecedents of the Intelligent Design movement” (Wiker 2000).

Pandas’ centrality to *Kitzmiller* lay in the direct evidence it yielded of ID proponents’ opportunistic transformation of creationism into “intelligent design” after the *Edwards* defeat. At issue in *Kitzmiller* was a 2004 policy statement that was adopted by the Dover, PA, school board and read aloud by school administrators to Dover High School students. The statement presented ID as an alternative to evolution

and informed students of *Pandas'* availability in the school library (Jones 2005). As an expert witness for the plaintiffs, I examined early drafts of the book, subpoenaed by plaintiffs' attorneys, for evidence that *Pandas* had been written as a creationist textbook (Forrest 2006).

There were reams of such evidence. Among more than 7000 documents, I found five early drafts of *Pandas* (bearing overtly creationist titles until 1987, when the title was changed to *Pandas*). The pre-*Edwards* drafts were written in explicit creationist language, which was later expunged and replaced with design terminology in the post-*Edwards* draft, first published in 1989. The best example is the definition of "creation" used in every draft, including the 1987 pre-*Edwards* version: "Creation means that various forms of life began abruptly through the agency of an intelligent Creator with their distinctive features already intact—fish with fins and scales, birds with feathers, beaks, and wings, etc." (Forrest 2005b). In the 1987 post-*Edwards* draft, that definition is identical except for the replacement of the now legally hazardous "Creation" and "intelligent Creator," respectively, with "Intelligent design" and "intelligent agency." Such examples were so abundant that the most blatant one was not even used in court: in an obviously hurried "search and replace" in one 1987 draft, someone had only partially replaced "creationists," producing instead a "transitional" term—"cdesign proponentsists" (Forrest and Gross 2007a).

On December 20, 2005, Judge Jones ruled that "ID cannot uncouple itself from its creationist, and thus religious, antecedents" and that the school board's pro-ID policy "violates the Establishment Clause of the First Amendment of the Constitution of the United States" (Jones 2005).

Yet the wedge strategy continues

The school board's defeat in *Kitzmiller* was also a defeat for the Discovery Institute, although proponents of ID there had not initiated the Dover policy and tried unsuccessfully to persuade the board either to eliminate references to ID or to withdraw the policy (Forrest and Gross 2007a). Yet, despite this legal setback, the Wedge Strategy remains operative. In 2007, biochemist and ID proponent Michael Behe, a defense witness in *Kitzmiller*, published *The Edge of Evolution* (Behe 2007) which, like his earlier *Darwin's Black Box* (Behe 1996), received devastating reviews from mainstream scientists (NCSE 2007). More worrisome, however, is the new ID textbook, *Explore Evolution* (Meyer et al. 2007), in which the

old creationist trick of using sanitized terminology is the most glaring characteristic. Patterned after ID creationist Jonathan Wells's book, *Icons of Evolution*, the authors—three high-profile CSC creationists and two lesser-known supporters—lodge shopworn criticisms against evolution, avoiding overt endorsement of ID. The book, however, is clearly an ID text. The inclusion of "irreducible complexity," Behe's signature contribution to ID but also an identifiably creationist concept that predates his use of it (see below), is a dead giveaway. Whereas the main title, *Explore Evolution*, may mislead teachers and students about the content, the subtitle, *The Arguments For and Against Neo-Darwinism*, sends a loud signal to creationist teachers and school boards who want to slip the book past the bureaucratic radar.

The tactic of trying to make the book's ID content legally unactionable by sanitizing the terminology marks a phase in the CSC's evolving strategy that began even before *Kitzmiller* (Forrest and Gross 2004). This tactic is further evidence of ID's direct lineal descent from creation science, whose proponents also tried to conceal its true nature from federal courts. Forty years ago, after a U. S. Supreme Court ruling against creationism (U. S. Supreme Court 1968), young-earth creationists similarly refashioned "flood geology" into "creation science": "The...key events, such as a recent special creation and...worldwide Flood, remained the same, but all direct references to biblical characters and places, such as Adam and Eve...disappeared from the stripped-down narrative" (Numbers 2007).

The CSC's use of this tactic is not only evidence that they feel the pressure of consistent, effective opposition but also constitutes their tacit recognition of the thin legal ice on which they tread. Denying (falsely) ever having endorsed teaching ID in public schools (DI 1998), they now couch policy proposals in code terms: they favor teaching "strengths and weaknesses" of evolution, so that students may engage in "critical analysis" of evolution. "Teaching the controversy," they contend, makes science interesting and preserves students' "academic freedom" (Forrest 2007).

Encouraging signs for pro-science activists

Paradoxically, the CSC's post-*Kitzmiller* promotion of ID has generated developments that should encourage pro-science activists: as the execution of the Wedge Strategy continues, so does the unearthing of more damaging evidence of ID's creationist identity, and so, too, do ID creationists' use of

increasingly stale and unsavory tactics to salvage their program. Ongoing research into ID's origins yields even more connections to creation science: "[W]hen it comes to design, creation science and ID speak in one language... Like the irreducible complexity argument, the other prominent claims made by the ID movement, and often the specific terminology, trace back to creation science" (Scott and Matzke 2007; see also Forrest 2005a). Pro-science advocates should make aggressive use of such genealogical evidence, especially, for instance, two sterling examples involving ID's central concepts.

In testifying for the defense in *McLean v. Arkansas Board of Education* (Overton 1982), creationist Ariel Roth used a version of what Behe now calls "irreducible complexity." As well-known creationist Norman Geisler recounts, "Roth mentioned a number of 'serious problems' with the evolution model... [such as] difficulty of evolving complex integrated structures since each part of the integrated structure alone would be useless to the organism... and therefore would be weeded out by natural selection.... Of the respiratory system, [Roth] said, 'This system would not be functional until all the parts were there'" (Geisler 1982). Fourteen years later, Behe elevated "complex integrated structures" to a starring role as "irreducible complexity" in *Darwin's Black Box* (Behe 1996). He used it in slightly altered but recognizable form, updated for ID's post-*Edwards* context and designed to exploit developments in molecular biology:

By *irreducibly complex* I mean a single system composed of several well-matched, interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning.... An irreducibly complex system... would be a powerful challenge to Darwinian evolution... if a biological system cannot be produced gradually [by natural selection] it would have to arise as an integrated unit... for natural selection to have anything to act on (Behe 1996).

Yet Behe's attempt to rehabilitate this old creationist concept is as sterile scientifically as when his creationist predecessors used it (Forrest and Gross 2007b).

In addition to Behe's co-option of a creationist concept, Dembski's "complex specified information" exhibits an exact congruity, with barely altered terminology, with the one that Geisler himself used in "Miracles and Primary Causality," an appendix to *Origin Science: A Proposal for the Creation-Evolution Controversy*: "[I]f a single event conveys specifically

complex information, then it may be assumed to have a primary (intelligent) [i.e., supernatural] cause" (Geisler and Anderson 1987). Eleven years later, Dembski employed the same concept—with the same supernaturalist stipulation—in the context of ID: "[I]ntelligent causation, or equivalently design, accounts for the origin of complex specified information.... CSI demands an intelligent cause. Natural causes will not do" (Dembski 1998a).

In addition to ID's substantive continuity with creation science, there is a tactical similarity. Like proponents of creation science who unsuccessfully tried to maintain their momentum after consistent legal defeats, proponents of ID have virtually exhausted their strategic arsenal. Their rhetorical tricks are routine and predictable. They recycle stale sound bites and resort to ridiculous hyperbole—and sometimes devious maneuvering—to market their books, their only tangible product. The website for Dembski and Wells's *The Design of Life* (Dembski and Wells 2007), planned as a new edition of *Pandas* (Matzke 2005), bears no original endorsements; all are from earlier publications (Design of Life [date unknown]). Behe, however, endorsed the book enthusiastically: "When future intellectual historians list the books that toppled Darwin's theory, *The Design of Life* will be at the top" (Design of Life [date unknown]). Moreover, Dembski and his ID associates apparently manipulated publicity for the book by orchestrating positive reviews at Amazon.com and trying to suppress negative ones. This scheme and other unflattering behavior have been well documented and publicized by scientists (Perakh 2006, 2007; Elsberry 2007).

Another tactical similarity between creation science and ID is the establishment of a "research" institute (Biever 2006; Forrest 2007). In August 2005, fourteen years after the Wedge Strategy began in 1991, but only one month before the Dover trial, ID proponent and molecular biologist Douglas Axe told the *New York Times* that he had established the "Biologic Institute" (BI) with "significant" Discovery Institute funding (Chang 2005). The Wedge Strategy document names Axe as the scientist in charge of ID's molecular biology research (DI 1998). With software developer Brendan Dixon and zoologist Ann Gauger, neither of whom has any significant scientific record (Forrest 2007), Axe supposedly conducts scientific research to support ID: "[C]an the theory of intelligent design... lead to good science...? Researchers at the Biologic Institute are convinced that it can" (Axe et al. 2007).

To date, no research data that support ID have been forthcoming. Almost three years after BI's

incorporation, the website offers only a “coming soon” announcement, an address, and a phone number (although for a long period, there was not even a phone listing) (BI [date unknown]; Forrest 2007). In BI’s 2006 IRS 990 (which Axe signed in August 2007), Axe is the only fulltime, paid employee (with three unpaid officers) (BI 2006). Neither Dixon nor Gauger is listed. BI’s self-description in the 990 does not even mention ID: “To conduct basic scientific research on topics relating to the origin, organization, and operation of living things and their parts, and to the nature of ecosystems and environments conducive to life” (BI 2006). (In 2006, Dixon made charitable donations totaling \$980 000, of which \$700 000 went to the Center for Science and Culture) (Lifeworks 2006). Nonetheless, BI scientists have enlisted in the Discovery Institute’s effort to extend the lifespan of the Wedge Strategy through the use of shopworn creationist tactics. Axe and Gauger recently attended an ID conference purporting to present new scientific research to support ID. Yet, according to a report by a scientist who attended, neither of their presentations accomplished this aim; and the venue through which they offered their research was not typical of the way genuine scientific meetings are conducted.

In June 2007, Axe and Gauger participated in a Discovery Institute conference entitled “Emergence vs. design,” which was described to prospective presenters as a “Wistar Retrospective Symposium” that would reprise a 1966 Wistar Institute conference, “Mathematical challenges to the neo-Darwinian interpretation of evolution” (Brooks 2006, 2008; Weber 2006; see also Moorhead 1967). Although the 1966 conference had been a legitimate scientific meeting, creationists have persistently but wrongly claimed that it was the scene of the successful undermining of evolutionary theory (Gish 1973). ID proponent Bruce Gordon, CSC Research Director and conference organizer, informed participants that the 2007 event would be a “closed research conference, so neither the media nor members of the public will be present” and that “polished versions of the papers presented . . . and verbatim transcripts of the ensuing discussions, will be published with an academic press in the following year” (Brooks 2007).

Biologist Daniel R. Brooks, who attended despite misgivings, published a report about the conference based on his notes (Brooks 2008). According to Brooks, several days after the conference, attendees received an e-mail “stating that the ID people considered the conference a private meeting, and did not want any of us to discuss it, blog it, or publish

anything about it” until the presentations were published (Brooks 2008). Criticisms by attending scientists of Axe’s and Gauger’s presentations no doubt help explain the Discovery Institute’s concern about pre-publication discussion of the proceedings.

Brooks reported that any connection between Axe’s presentation, “The Language of Proteins—Revisiting a Classic Metaphor with the Benefit of New Technology,” and ID was difficult to discern. Axe offered statements to the effect that “because lots of mutations do not destroy whole genomes, genomes have been designed to withstand mutations” and that “[i]f you look at molecular functions outside of their organic context, they appear so improbable that they must have been designed” (Brooks 2008). However, according to Brooks, he focused “primarily on a computer program for proteomics that his company has produced, and presumably is trying to market” (Brooks 2008).

Proteomics researchers mimic the macro-mutational process of protein evolution in the lab at an accelerated rate, produce novel proteins, and search for functional differences that have some economic value. Axe’s company has an online program producing analogies with primary and secondary structure and super-secondary structure, trying to link primary structure-based sequences to structural components of Chinese characters, using some sort of numerical assessment of the geometric correctness of the gene for the best-fitting Han character, then assessing the extent to which this points to novel functional proteins. This is based on the notion that similarity in structure means similarity in function

One questioner pointed out that character *order* in Chinese is very important, so there is more redundancy and hierarchical structure in Chinese than in English. Axe responded by denouncing [Chairman] Mao [Zedong’s] efforts to simplify Chinese rather than answering the real question about redundancy. Another questioner asked about the possibility that his models are not independent of his assumptions. Axe responded by denouncing unnamed people who get the right answers before they produce their model and says he has no results because he did not do what these unnamed others do; he built his model before he had any results.

Privately, some of us wondered who was the target marketing audience for a proteomics computer program based on Han ideographs. Some felt it was simply good capitalism, going after a large market. Others, noting Axe’s attack on Mao, wondered if there was [an] evangelical agenda hidden in the marketing (Brooks 2008).

Brooks's assessment of Axe's presentation is consistent with earlier critiques of his work by other scientists: Axe's research as a molecular biologist in no way supports ID (Forrest and Gross 2007a; Hunt 2007).

Following other pro-ID presentations by figures such as Michael Behe and William Dembski, Gauger delivered her presentation, "Assessing the difficulty of pathway evolution: an experimental test," which, Brooks says, "was remarkable in part because she performed experiments and reported original data" (Brooks 2008). Yet, her interpretation of her data, namely, according to Brooks, "that the current complexity of metabolic pathways within cells could not have been created by gene duplication or gene recruitment...and therefore they were designed" (Brooks 2008), was clearly crafted to reflect her pro-ID stance. When Gauger's argument failed to withstand criticisms from attending scientists, an ID colleague urged her to report some of her newer discoveries. She did so, but with even less success.

She gave what amounted to a second presentation, during which she discussed 'leaky growth,' in microbial colonies at high densities, leading to horizontal transfer of genetic information, and announced that under such conditions she had actually found a novel variant that seemed to lead to enhanced colony growth. [Evolutionary biologist] Gunther Wagner said, 'So, a beneficial mutation happened right in your lab?' at which point the moderator halted questioning. We shuffled off for a coffee break with the admission hanging in the air that natural processes could not only produce new information, they could produce beneficial new information (Brooks 2008).

Brooks's report indicates that ID proponents' purported efforts to bolster ID scientifically are merely a continuation of the traditional creationist rhetorical tactic of trying to reinterpret scientific data to derive the preconstructed conclusion that biological structures and processes had to be designed. Consequently, their "research" remains as scientifically sterile and their tactics are just as scientifically unorthodox as those of their creation science predecessors.

However, despite the congruence of creation science and ID in tactics, substance, and scientific sterility, there is a significant difference: ID proponents have much more political influence, including at the national level (Forrest and Gross 2007a). At this writing, developments in Texas are a prominent example of ID's political reach. In July 2007, Gov. Rick Perry appointed an avowed creationist,

dentist Don McLeroy, to chair the Texas Board of Education (TFN 2007). In a 2005 pro-ID church lecture, McLeroy boasted of a working relationship with "the creationist intelligent design people" from the Discovery Institute (McLeroy 2005), some of whose leaders live in Texas. In 2003, they were his allies in an effort to influence the selection of biology textbooks in Texas. However, creationist politics in Texas may have gone too far when the Texas Education Agency (TEA) forced Christina Comer to resign from her job as state Director of Science in November 2007. The TEA charged that she violated the agency's "neutrality" on the evolution/creationism issue by forwarding an e-mail from the National Center for Science Education announcing a lecture that I was scheduled to give in Austin, Texas, on 2 November 2007 (Heinauer 2007a). The widespread media coverage was uniformly critical of the TEA, and more than 100 Texas professors sent a letter of protest to Texas Education Commissioner Robert Scott (Heinauer 2007b). Anger over Comer's firing could stiffen opposition to an expected creationist attack on the Texas science standards during the 2008 revision process.

In addition to ID creationists' self-inflicted damage, demographic changes in the United States may portend an opportunity to expand and solidify the defense of evolution. At the very least, these changes support an expectation that expanded activism by scientists and other pro-science advocates may increase public support for teaching evolution, especially when the connection is made between good science education and broader constitutional concerns such as the separation of church and state that scientists, as citizens, share with other Americans. Such changes are the subject of a March 2007 survey by the Pew Research Center for the People and the Press (Pew 2007). Although the study primarily surveyed changing political attitudes, some of the modest, but auspicious, demographic changes could translate into a more favorable attitude toward teaching evolution if a concerted effort is made to reach the relevant demographic groups. Perhaps the most intriguing example is the response to the statement, "I am worried science is going too far and hurting society" (Pew 2007). Sixty-two percent of the respondents *disagreed* and 34% agreed with that statement in 2007, compared with 54% and 42%, respectively, in 2003. Other data in the survey, such as changing attitudes on women's roles and on religious and social issues, also suggest promising opportunities to cultivate support for science education.

What can scientists do?

Scientists can counteract ID creationism through activities tailored to the levels and kinds of involvement that they are willing and able to undertake. Fortunately, some level of involvement is feasible for virtually all scientists. However, effective activism at any level, in all related scientific disciplines, requires understanding the creationism issue. Books, articles, and websites addressing all aspects of ID are available. For example, *Creationism's Trojan Horse: The Wedge of Intelligent Design*, used by plaintiffs' attorneys in *Kitzmiller*, describes the ID movement's execution of its Wedge Strategy and documents its religious and political agenda (Forrest and Gross 2007a). *Evolution vs. Creationism: An Introduction*, offers a comprehensive history of all variations of creationism (Scott 2005). *Not in Our Classrooms: Why Intelligent Design is Wrong for Our Schools* is useful not only for learning about almost every significant angle of the issue (historical, scientific, religious, etc.), but also especially about organizing effectively (Scott and Branch 2006). An activists' handbook is also available through the National Center for Science Education upon request (see NCSE reference). *Intelligent Design Creationism and its Critics: Philosophical, Theological, and Scientific Perspectives*, a comprehensive anthology, juxtaposes essays by ID proponents with essays by ID critics, providing an effective overview of how to rebut ID claims (Pennock 2001). In Texas, even young-earth creationism (YEC) is again growing in influence (Hacker 2007); scientists will therefore find *Scientists Confront Creationism: Intelligent Design and Beyond* useful for addressing YEC issues (Petto and Godfrey 2007). For a concise summary of legal rulings against creationism, the National Center for Science Education's "10 significant court decisions regarding evolution/creationism" is useful (Matsumura and Mead 2007). For a combined legal, philosophical, and scientific analysis of ID, scientists should consult "Is it science yet? Intelligent design creationism and the Constitution" (Brauer et al. 2005). Since ID now poses the greatest threat nationwide, the *Kitzmiller* opinion is essential reading (Jones 2005). Websites are useful for finding the most current information and critiques of ID. *Panda's Thumb*, *Talkorigins.org*, *Talkreason.org*, and *AntiEvolution.org* are excellent resources (see references); all feature contributions by scientists and other experts on the ID issue.

Addressing the unavoidable religious aspects of the ID issue often makes scientists particularly uncomfortable. However, ID is integral to the Religious Right's effort to control public—and, by extension, educational—policy. Since the Religious Right's

attacks on science and public education will ultimately contribute to the further erosion of public understanding of and support for science, knowing this context is essential. Michelle Goldberg's *Kingdom Coming: The Rise of Christian Nationalism* (Goldberg 2007) and Damon Linker's *The Theocons: Secular America Under Siege* (Linker 2007) provide this context from jointly comprehensive perspectives. (Forrest and Gross 2005; see also Ch. 9, 2007a.) (Although the Religious Right is usually understood as comprising Protestant evangelicals and fundamentalists, it includes a smaller but influential contingent of conservative Catholics; Linker addresses this part of the Religious Right demographic.) In addition to many other books explaining the Religious Right's influence and activities, scientists can consult websites such as *Talk2action.org*, co-managed by Frederick Clarkson, a veteran journalist who covers the Religious Right (*Talk2action.org* [date unknown]).

For scientists who are themselves people of faith and who wish to defend the teaching of good science in their religious communities, excellent resources are available. *Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution* is the response of cell biologist Kenneth Miller as a scientist and a Christian to ID creationist Michael Behe (Miller 1999). *Perspectives on an Evolving Creation*, an anthology compiled by geologist and evangelical Christian Keith B. Miller, is a collection of essays written by evangelicals for other evangelicals (Miller 2003). The contributors, mostly scientists, explain frankly and forthrightly their own challenges in both maintaining their scientific integrity and making meaningful religious commitments. *God After Darwin: A Theology of Evolution*, is Catholic theologian John Haught's view of evolutionary processes as offering Christians an opportunity to reflect in a mature, thoughtful way on the idea of God (Haught 2000). Resource persons are also available. Scientists can contact the National Center for Science Education's Faith Project Director for assistance in making contacts in the religious community (see reference). Moreover, scientists can not only contact specific clergy for assistance but may also themselves volunteer to serve as science resource persons through the Clergy Letter Project (see reference).

The above resources are only a partial listing of what is available to scientists. However, as important as defending the teaching of evolution is, evolutionary biology is not the only area of science that requires defending. Since other, related sciences are frequently targeted by creationists, scientists in those fields must know how to rebut discipline-specific creationist arguments and develop the

requisite defenses. *Why Intelligent Design Fails: A Scientific Critique of the New Creationism* (Young and Edis 2004) offers purely scientific critiques of ID not only as it pertains to biology but also to physics and cosmology, mathematics, and computer science. “The Battle over Evolution: how geoscientists can help” (Branch 2005) is a short but detailed article detailing the creationism problem, both historically and in recent years, and aimed specifically at the geoscience community. It offers not only the rationale for activism by geoscientists, but also a list of specific measures that can be taken by scientists in any discipline:

It is, after all, the geosciences that vouch for the great age of the earth, that uncover the forces responsible for geological changes through deep time, and that discover the history of life as preserved in the fossil record. Who, if not geoscientists, will testify about the need for students to understand what the geosciences have revealed about the earth and the history of life on it?...
 [I]f a controversy over evolution education arises locally, become active. Work to resolve the controversy amicably but without compromising on the quality of science education. Write letters and op-eds; attend and speak at meetings of the board of education; organize in support of evolution education with your neighbors and friends and colleagues; turn out the vote on election day. Explain the consensus of the scientific community on such issues as the age of the earth, the fossil record, and evolution, and emphasize the scientific methodology on which the consensus is founded. Emphasize the economic importance of a scientifically literate workforce....

...Donate books and videos about evolution and related concepts to both school and public libraries; offer to speak on such topics to school classes, civic groups, and church groups. Urge educators and educational policymakers (administrators in the local school district and the state department of education, members of the local and state school boards, legislators) to retain and expand the coverage of evolution and related concepts in state standards, textbooks, and local curricula. Encourage and support science education in informal learning environments, such as museums, parks, and zoos, and in the media....(Branch 2005)

Some scientists have already become integrally involved in such undertakings at local, state, and national levels. Their most fruitful involvement, however, has been through pro-science citizen-activist groups that now exist in roughly a dozen

states; all were established in response to creationist efforts such as attempting to delete evolution from and insert ID into state science standards. Kansas, Ohio, New Mexico, and most recently Florida, have been among the most successful at beating back such efforts.

Kansas Citizens for Science (KCFS) was first established in 1999 in response to the nationally publicized deletion of both evolution and Big Bang Theory from state science standards (KCFS [date unknown]; see also Ch. 8, Forrest and Gross 2007a). The organization is a cross-section of the Kansas pro-science community: parents, teachers, clergy, scientists, and business people. Among other activities, KCFS members publish an electronic newsletter; prepare educational literature about ID for distribution to the public and the press (the latter being especially important); organize public meetings to inform citizens about the ID issue; host nationally prominent speakers at public lectures; speak at state board of education meetings; participate in public panel discussions; and make recommendations to the state board of education regarding state science standards. They have even offered a short course, “Evolution 101: Understanding Evolution for the Layperson,” to educate the public about evolution. (See “About us” at KCFS [date unknown].) Retired biology teacher and KCFS member Harry McDonald ran for a seat on the state board of education in November 2006 (Blumenthal 2006). Although he was unsuccessful, the pro-science community’s efforts paid off when a moderate majority was restored to the board and evolution was reinserted—once again—in the standards (Davey and Blumenthal 2006; see also Ch. 10, Forrest and Gross 2007a). As a 501(c)3 nonpartisan, nonprofit organization, KCFS can neither field nor endorse political candidates. However, addressing the creationism problem through the political process by supporting pro-science candidates in local and state school board elections is crucial. Pro-science moderates in Kansas organized the Kansas Alliance for Education for this purpose (KAE 2008).

Since the 2001 passage of the No Child Left Behind Act, requiring mandatory science testing in public schools, creationists are attacking the process of science standards revision that many states have subsequently undertaken. The selection of biology textbooks has also been targeted, as in 2003 when the Discovery Institute and their Texas supporters tried to persuade the Texas Board of Education to support ID-friendly changes in the content of new biology textbooks. Their failure highlighted the importance of involvement by scientists, a number of whom

made high-profile, public presentations to the Texas Board of Education opposing the Discovery Institute's efforts (AIP 2003; TCS [date unknown]). State-level politics surrounding the teaching of evolution and other related sciences has now become much more important.

Ohio Citizens for Science (OCS) was formed to fight off an attack on Ohio state science standards that began in 2001 (OCS [date unknown]). Discovery Institute creationists and their Ohio supporters mounted a concerted effort to insert ID into the revised standards. OCS's hard-fought but ultimately successful campaign to prevent this continued for five years. In February 2006, fearing a lawsuit similar to *Kitzmiller*, the Ohio Board of Education rescinded both a creationist benchmark that they had inserted into the standards and the lesson plan that would have implemented it. However, OCS's efforts had laid essential groundwork for this rescission. During the thick of the fight, OCS members had provided the Ohio Board of Education with a wealth of information, including written critiques of the benchmark and the lesson plan. Most important, they cultivated direct contact with pro-science board members, giving them the information they needed to understand the nature of the attack on the science standards, especially the identity and tactics of the Discovery Institute creationists and their Ohio supporters (who included two members of the board itself) (see Chs. 8 and 10, Forrest and Gross 2007a). Since then, OCS continues to conduct outreach activities such as Darwin Day events. As in Kansas, evolution advocates in Ohio also realized the necessity of electing pro-science moderates to the state board of education. They formed a separate organization, Help Ohio Public Education (HOPE) for this purpose. In October 2006, prior to the November board election, HOPE enlisted well-known ID critic and scientist Kenneth Miller to campaign for pro-science candidates [Ohio Hope (date unknown)]. The group helped to unseat Deborah Owens-Fink from the state board, where she had been one of the two chief ID advocates (Khamsi 2006).

New Mexico has perhaps the longest history of organized activism by scientists against ID and other forms of creationism. The Coalition for Excellence in Science Education (CESE) (now Coalition for Excellence in Science and Math Education) was established in 1996 after two creationist members of the New Mexico Board of Education succeeded in replacing evolution and the age of the earth with "various theories of origin" in the state science standards [CESE (date unknown)]; Boslough (date unknown). The scientists in this group are "citizen scientists" in the

fullest sense. Along with teachers and other citizens, they assumed a leading role in the restoration of New Mexico's science standards. One of them, physicist Marshall Berman, won a seat on the New Mexico Board of Education in 1998, defeating one of the creationist board members. In 1999, Berman persuaded the board to restore evolution and related scientific concepts to the science standards [Thomas (date unknown)]. Another group that had formed in 1990, New Mexicans for Science and Reason, assisted in CESE's efforts [NMSR (date unknown)]. More than a decade after their first successful anti-creationist effort, both NMSR and CESE continue to conduct pro-science outreach activities. For example, physicists Dave Thomas and Kim Johnson, members of both NMSR and CESE, host *Science Watch*, a weekly pro-science radio program that broadcasts to the Albuquerque area [NMSR Science Watch (date unknown)]. This program is an example of the value of cultivating contacts with local media by providing them with information during flareups.

Florida Citizens for Science (FCS) is one of the newer groups in which scientists have played a major and vital role in responding to a creationist attack on state science standards. Scientists and science teachers are represented among the officers, board members, and media contacts [FCS (date unknown)]. In April 2007, two years after the group's formation in 2005 (correctly anticipating an attack on the standards revision process), FCS produced a set of recommended science standards to serve as "a starting point for discussion about both the impending revision process and the continuing evolution of the Florida Sunshine State Science Education Standards as we proceed in the 21st Century" (FCS 2007). FCS maintains a blog, a resources page, and monitors antievolution bills in the Florida legislature. Its members played an important role in the writing and adoption of science standards in which evolution is central to instruction in biology in Florida public schools (NCSE 2008a, 2008b). FCS also set up an online petition and conducted other activities to solicit public support for "revised standards [that] address the scientific theory of evolution without equivocation or the introduction of nonscientific notions" (FCS 2008). Like KCFS in Kansas, OCS in Ohio, and CESE and NMSR in New Mexico, FCS's efforts have been critical to the protection of science education in Florida.

An extremely important feature of all of these groups is that their efforts have continued even after winning their battles. They have not succumbed to the post-victory lethargy and nonchalance that often beset activist groups. All continue their community education outreach activities. All maintain

informative websites, which are especially vital to getting their message out and making resources available to the public and the press. The activities that they undertake during periods of relative quiet serve as a cohesive force. This cohesion is necessary because creationism never completely goes away; members may have to spring back into action quickly, as CESE and NMSR did for a 2005 flareup in Rio Rancho, NM, when the local school board adopted a policy, couched in Discovery Institute code terms, that would permit the teaching of ID. Again, scientists played an integral role in the effort that Berman, Thomas, and Johnson recounted at the end of a successful two-year campaign to reverse the policy:

After producing division and confusion for more than two years in Rio Rancho (New Mexico) science classes, the Rio Rancho School Board formally terminated the ill-fated experiment known as ‘Policy 401.’ First passed in August of 2005, the policy did not mention ‘Intelligent Design’ (ID) by name, but was perceived by the community and press as favorable to ID and creationism arguments, and as encouraging discussion of these ‘alternatives’ to evolution (Berman et al. 2007).

As the Rio Rancho incident shows, scientists who join such groups should view their involvement as a long-term commitment. They can serve as valuable resource persons during such creationist flare-ups. However, they can also help advance the missions of pro-science and civil liberties groups, respectively—improving the teaching of science and educating the public about the separation of church and state (the latter being integrally related to the creationism issue)—in areas fortunate enough not to be plagued by such problems. Scientists may initially have to exert concerted efforts to cultivate opportunities for involvement. Overcoming difficulties in making connections into the broader community requires working with a cross-section of citizens who have a stake in public education, civil liberties, religious freedom, and the advancement of science. At some point, the opportunities that scientists create in their communities will yield other, perhaps more extensive, opportunities as word spreads of their availability and willingness to work with others who need help.

Not all scientists can commit to this kind of involvement. Yet, those for whom this is not feasible can make valuable contributions even in their more limited academic settings. Science departments can host annual Darwin Day programs [Darwin Day (date unknown)]. Evolution workshops for high school biology teachers are being offered by scientists at campuses around the country. Scientists can also

organize symposia at meetings of their professional societies, such as the one for which this article was written, in order to inform other scientists about antievolutionism. Finally, scientists whose schedules prohibit active involvement can support with their membership and financial contributions the various organizations working on the front lines to defend science education, such as the NCSE, the American Civil Liberties Union, and Americans United for Separation of Church and State (see references), all of which provided crucial assistance in the *Kitzmiller* case.

Scientists’ contributions as parents and citizens to counteracting ID are as vital to their disciplines as their professional activities. The success of the citizens for science groups shows that, while input from a cross-section of the community is important, the input of scientists is indispensable. Only they have the expertise needed to address the scientific aspects of the creationism issue that their lay colleagues are usually not equipped to handle. By performing the civic duty of defending their disciplines and public schools against creationism, they help protect the most vulnerable beneficiaries of both: children—the nation’s future scientists. The eleven parents who served as plaintiffs in the *Kitzmiller* case and the Dover High School science teachers who refused to be intimidated by a creationist school board have set a very high standard to uphold.

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