

EFFORTS TO UNDERMINE EVOLUTION EDUCATION—MOST RECENTLY IN THE FORM OF A CONCEPT CALLED "INTELLIGENT DESIGN"—HAVE EVOLVED INTO A 21ST-CENTURY MARKETING CAMPAIGN THAT RELIES ON LEGAL ACUMEN, MANIPULATION OF SCIENTIFIC LITERATURE AND GRASSROOTS TACTICS.

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The Evolutionary War

THE OHIO BOARD OF EDUCATION HAD A BIG PROBLEM.

Two years ago, a Fordham Foundation study had slapped the state with an "F" for the way it taught evolution in the classroom. In fact, state standards lacked any mention of evolution in the science lessons for Ohio students, kindergarten through high school. Embarrassed, the state legislature mandated that the board revise the standards by the end of 2002.

In the course of adopting new standards, however, the board ran smack into the latest anti-evolution concept: intelligent design. The philosophy purports that life is too complex to have evolved by chance and therefore must have been the product of a divine (in the supernatural sense—perhaps a biblical God or an extra-terrestrial force) designer.

In a push that sparked a fierce row between parents, teachers, legislators and board members, proponents of intelligent design were trying to insert the idea into the Ohio science standards as an "alternative to evolution." Advocates of intelligent design, led by the Discovery Institute, a conservative think tank and activist organization in Seattle, insist that their concept is a valid scientific theory and that it deserves a place in the K–12 curricula alongside evolution.

At Cloverleaf Middle School, a public school in Westfield Center, Ohio, Kira Nance and her classmates have not been taught about evolution. The 14-year-old recalls her 8th-grade science teacher talking last fall about adding discussions of evolution to the curriculum. "Nobody really cared," says Nance. "Only a few students had an opinion, and they didn't voice it clearly." She says she believes in God and doesn't believe in evolution, but she wouldn't mind learning about it. She'd like to hear about intelligent design as well. "Hearing both sides would be a good thing."

Adults in Ohio appear to agree. According to a public poll commissioned by *The Cleveland Plain Dealer* and published in June, 59 percent of respondents favored including both evolution and intelligent design in the state's academic standards for science; only 8 per-

cent thought science curricula should be limited to evolution alone.

"What's at stake," says Kenneth R. Miller, professor of biology at Brown University in Providence, Rhode Island, "is that a major, highly industrialized U.S. state is on the verge of writing intelligent design into its school curriculum, with the complete absence of any scientific support."

Ohio's education standards are expected to be finalized by December. According to Board of Education member Marlene Jennings, "some sort of compromise" is expected, but details are unclear.

Sound familiar? It should. The Kansas Board of Education went through a similar battle four years ago when evolution faced off against creation science, which focuses on biblical origins of the universe and looks for "evidence" against evolution. In August 1999, the board voted to drop evolution entirely from its newly revised standards. Amid the public outcry, one year later, voters ousted the two anti-evolutionist board members; a third member resigned. The new board reinserted evolution into the state science standards.

In the United Kingdom, meanwhile, scientists have been enraged over reports that Emmanuel College in Gateshead—a prestigious Christian-run college near Newcastle upon Tyne that has been praised by Prime Minister Tony Blair—is teaching creationist ideas as science. At the same time, Japanese education officials are cutting evolution from the middle school curriculum and mak-



ing it optional for high school students. The move is meant to ease pressure on the country's children, according to a report in the April 25, 2002, *Nature*, but scientists are concerned about the impact on students' understanding of biology.

PLANTING THE SEED

The hullabaloo about intelligent design, says evolutionary biologist David R. Lindberg, director of the Museum of Paleontology at the University of California, Berkeley, "is all really a smokescreen to get back to basic 'creation science'."

This self-styled science sprung from creationism, which became a legal reality when John T. Scopes was convicted by the state of Tennessee in 1925 of the crime of teaching evolution. It wasn't until 1957 that evolution made a classroom comeback, spurred in large part by Sputnik, which generated a competitive zest in Americans to be scientifically literate. Law solidified the turnaround in 1968 when, in *Epperson v. Arkansas*, the Supreme Court ruled that states cannot ban the teaching of evolution on religious grounds.

In response, creationists reframed their doctrine as creation science. During the 1970s, 22 states proposed that creation science and evolution be given equal time in classrooms, and two states—Arkansas and Louisiana—adopted the idea. Then in 1987, the U.S. Supreme Court struck anti-evolutionists down again, reaffirming a federal district court decision that creation science was, in fact, religion and therefore couldn't be taught in schools.

While the decision appeared to be a victory for science, Justice Antonin Scalia left a loophole. Teachers could still teach "evidence against evolution," he wrote. That tiny phrase, part of a larger opinion, became a seed that anti-evolutionists readily planted. They scoured the scientific literature and attended scientific meetings, with the purpose of finding and pointing out evolutionary "controversy," as if the practice of science proceeds any other way.

Scientists do of course disagree on some of the specifics of evolution. For example, they argue about the exact positions that whales and hippos occupy on the tree of life and about the exact sequence of genetic changes that cause tumor cells to develop resistance to chemotherapy. Darwin's theory hasn't explained all these details—at least not yet, say scientists. But the devil is in the details.

Meanwhile, anti-evolutionists claim that these disagreements cast doubt on whether evolution ever happened at all—"a completely willful misinterpre-

Jonathan Wells from the Discovery Institute promoted intelligent design at a March Ohio Board of Education meeting in Columbus.



Evolution Online

Meanwhile, adults and children can turn to the Web to learn about Darwinian evolution.

The Museum of Paleontology at the University of California, Berkeley, is developing a Web site that features interactive laboratories. Targeting primary, middle and high school students, the site, supported by a grant from HHMI, will show how evolution affects people's daily lives. Examples such as the human-microbe "arms race" of antibiotic resistance form the basis of the lessons.

Evolutionary biologist David R. Lindberg, the museum's director, calls the Web site's approach "less esoteric than exploring evolution by discussing why Darwin's finches all have different beak sizes." He recalls hearing a public service announcement last fall that reminded people to get their flu shots because "last year's shot won't protect you from this year's influenza strain." Why doesn't last year's vaccine work this year? The answer is evolution, Lindberg points out. Because viruses and infectious microbes have short life cycles, the rapid development of new strains of flu is really an evolutionary event.

People don't commonly think about evolution in the context of one year, nor is evolution part of their picture of disease and medical treatment. Yet such examples can bring difficult concepts home for students and adults alike. "Knowing that some people cannot simply get a penicillin shot to fight an infection because the bacterial strain they carry has evolved to resist the drug," Lindberg says, "gives evolution real meaning."

David Lindberg's museum Web site teaches about evolution, with no apologies.

—BETH SCHACHTER

FOR MORE INFORMATION: www.ucmp.berkeley.edu/history/evolution.html

tation of the level of disagreement between scientists," says Jack W. Szostak, HHMI investigator at Massachusetts General Hospital in Boston, who studies the principles of Darwinian evolution on populations of DNA molecules in the laboratory.

In some communities, these "misinterpretations" have had an impact. In 1996, biology textbooks in Alabama began carrying evolution disclaimers. The practice still continues today. That same year, Governor Fob James used state discretionary funds to send every high school teacher in Alabama a copy of the anti-evolutionary book *Darwin on Trial*, by Phillip E. Johnson, a now-retired criminal-law professor at the University of California, Berkeley. The author invokes the legal argument of "reasonable doubt": Because you can't prove that evolution created human beings, he maintains, you must allow for alternatives to it.

"Evolution is not ad hoc theorizing," counters molecular biologist Sean B. Carroll. "Evolution is a large body of scientific fact that is supported by a large body of theory," says the HHMI investigator at the University of Wisconsin–Madison. Medical experience with antibiotic resistance, fossil evidence and comparative studies with animals all bolster the case for evolution.

THE EVOLUTION OF INTELLIGENT DESIGN

The intelligent-design concept stems from the work of English theologian William Paley, who in 1802 developed the idea in his book *Natural Theology*. He compared particular biological structures, such as the eye, to a watch. Just as this timepiece does not self-assemble, Paley wrote, the intricate designs of living things implicitly argue for the hand of a "watchmaker."

In 1989, Percival Davis at the Hillsborough Community College in Tampa and Dean Kenyon at San Francisco State University resurrected the 200-year-old watchmaker argument. In their book *Of Pandas and People*, they maintain that classic Darwinism—which states that organisms evolve over long periods of time as a result of random change and mutation—cannot explain the structural complexity of life. Therefore, they conclude, life had to be created by an intelligent designer.



FRED MERTZ

By the mid-1990s, the “scientific” component of intelligent design began to form. In 1996, for example, Michael J. Behe, a biochemist at Lehigh University, in Bethlehem, Pennsylvania, laid out his theory of “irreducible complexity.” In his book *Darwin’s Black Box: The Biochemical Challenge to Evolution*, Behe argues that systems like the bacterial flagellum—a whip-like appendage that propels the creature through biological fluids—has several parts that are necessary for its function. In the absence of any of those parts, the flagellum doesn’t work. If evolution moves stepwise from first conception to today’s version, intermediate forms should be able to function. Because they don’t, Behe argues, the fully made structure must be designed.

Not surprisingly, the intelligent-design concept has met with criticisms—the main one being, according to molecular geneticist Bruce T. Lahn, that “there is no evidence for it.” Lahn, an HHMI investigator at The University of Chicago, says that intelligent design, by scientific definition, cannot be a theory because it cannot be tested, only believed. What’s more, he notes, no account of intelligent design or its conceptual siblings has ever appeared in any peer-reviewed scientific journal.

The Discovery Institute’s Stephen C. Meyer says that intelligent design proponents haven’t published articles in peer-reviewed journals because the scientific community is “biased” against intelligent design and therefore won’t accept it. “They are excluding publication of a viable hypothesis,” Meyer asserts.

Amid the debates, intelligent-design proponents are making their mark, as evidenced by that *Cleveland Plain Dealer* poll. With its convoluted arguments and lack of evidence, how is intelligent design gaining such support?

“We’re dealing with emotional issues,” says board member Joseph D. Roman, who cochairs the subcommittee that will decide the

issue in Ohio. There may be other factors as well, including the way intelligent design is being presented. One argument states that evolution is just a theory, intelligent design is also a theory; therefore, the two deserve the same time in classrooms. They “are exploiting Americans’ sense of fairness,” says Wisconsin’s Carroll.

The anti-evolution approach is being considered on the local level simply because that is where many educational decisions are made in this country, notes Lindberg. Board members are accountable to state legislators as well as to the community members who elect them. This produces incredible disparities between science curricula district-by-district and even school-by-school.

If intelligent design or some other “alternative” to evolution makes it into the state curriculum standards, it will likely dictate the content of textbooks, statewide proficiency exams and teacher certification. “Teachers are very much aware that they have to teach to tests,” says molecular biologist Joan L. Slonczewski at Kenyon College in Ohio, who runs an HHMI-funded outreach program for science teachers. They must also satisfy parents. If parents object to the teaching of evolution, for example, and teachers refuse to comply, their jobs are on the line, says Slonczewski. To skirt the problem, many teachers avoid evolution altogether—or wait until the last week of school, when no one has time to voice an objection.

This flight (as opposed to fight) approach is having an effect. Slonczewski and Carroll, both of whom teach biology, say that some students are arriving at college knowing little or nothing about evolution.

TREADING LIGHTLY

Teachers aren’t the only ones grappling with wide-ranging views about evolution. Similar disparity is playing out in zoos, museums and community programs, partly as a result of teacher actions (or inactions).

“I have been here for over eight years and I have not had one teacher ask us to cover evolution,” says Brad Batdorf, curator of education at the Sedgwick County Zoo in Wichita, Kansas. On the other hand, he reports, some teachers, parents and other visitors have asked not to be taught anything about evolution.

That puts Batdorf in a quandary. The zoo is receiving an HHMI grant to develop activities that boost scientific literacy. At the same time, community groups also provide funding to the zoo. His strategy is to tread lightly around the issue. Descriptive signs at the zoo often have subtle references to evolution, but Batdorf says he stresses respect for the creatures and their ecological relationships, rather than how they came to be.

Slonczewski is also trying to be sensitive. She is structuring her outreach to include evolution not as a separate lecture for teachers but intricately woven into all of biology as an explanation for change—in everything from viral mutation to wing development in fruit flies to immunity in human beings.

Lindberg at the Museum of Paleontology, who last July received a grant from HHMI to develop an interactive Web site on evolution (see sidebar), is promoting evolution with no apologies. “K–12 science classes should reflect what scientists call science,” he explains.

Carroll agrees: “Love your religion, but don’t try to wrap it up and tell me it’s science. For the United States to remain a technological leader, we have to understand what science is—and teach it.” **H**

FOR MORE INFORMATION:

UC Museum of Paleontology:
www.ucmp.berkeley.edu/historyoflife/histoflife.html

Discovery Institute: www.discovery.org

National Center for Science Education—an organization that defends the teaching of evolution in public schools:
www.ncseweb.org

WGBH Boston Evolution project—a PBS miniseries with online teaching tools: www.pbs.org/wgbh/evolution

What do you think? Send us your comments:
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