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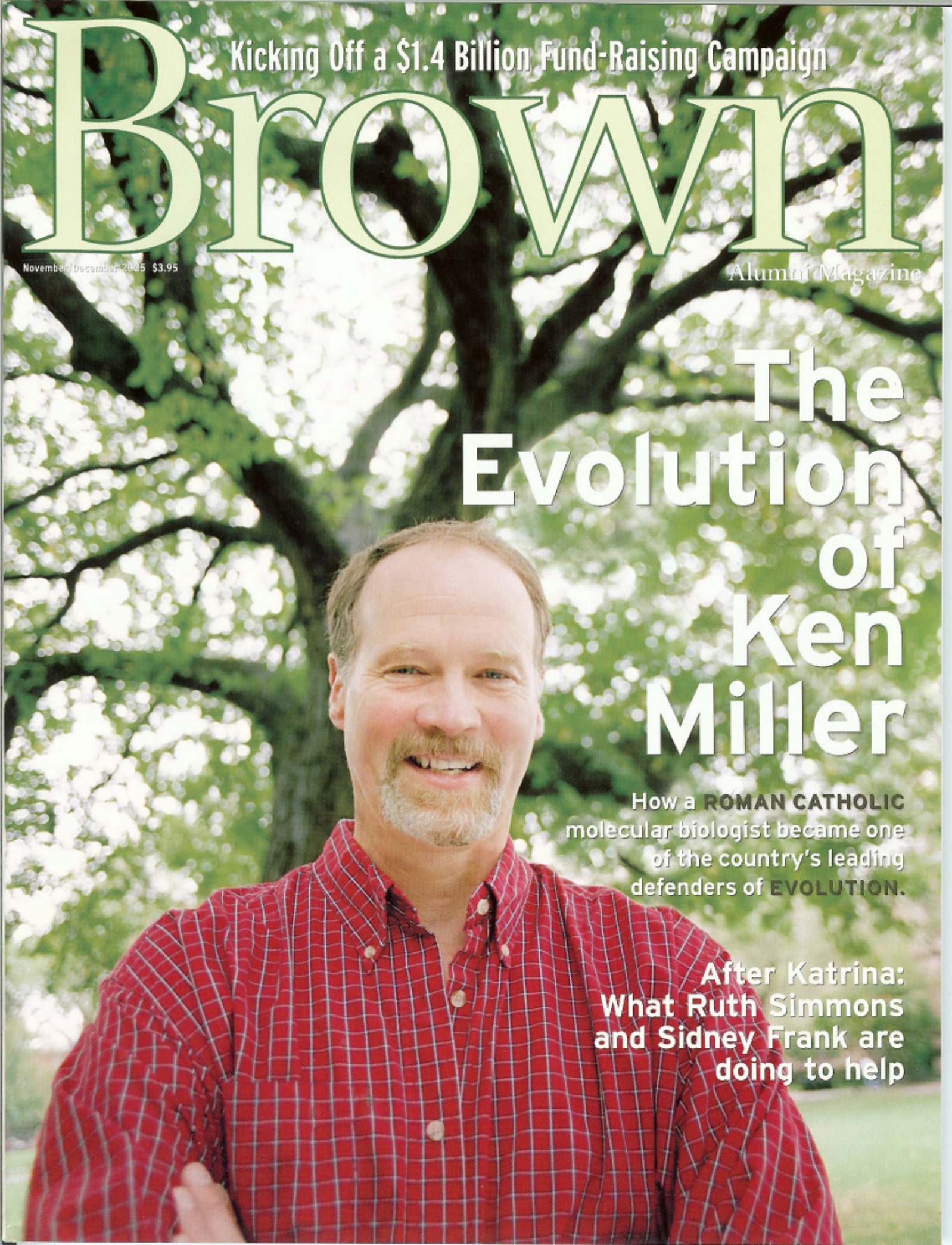
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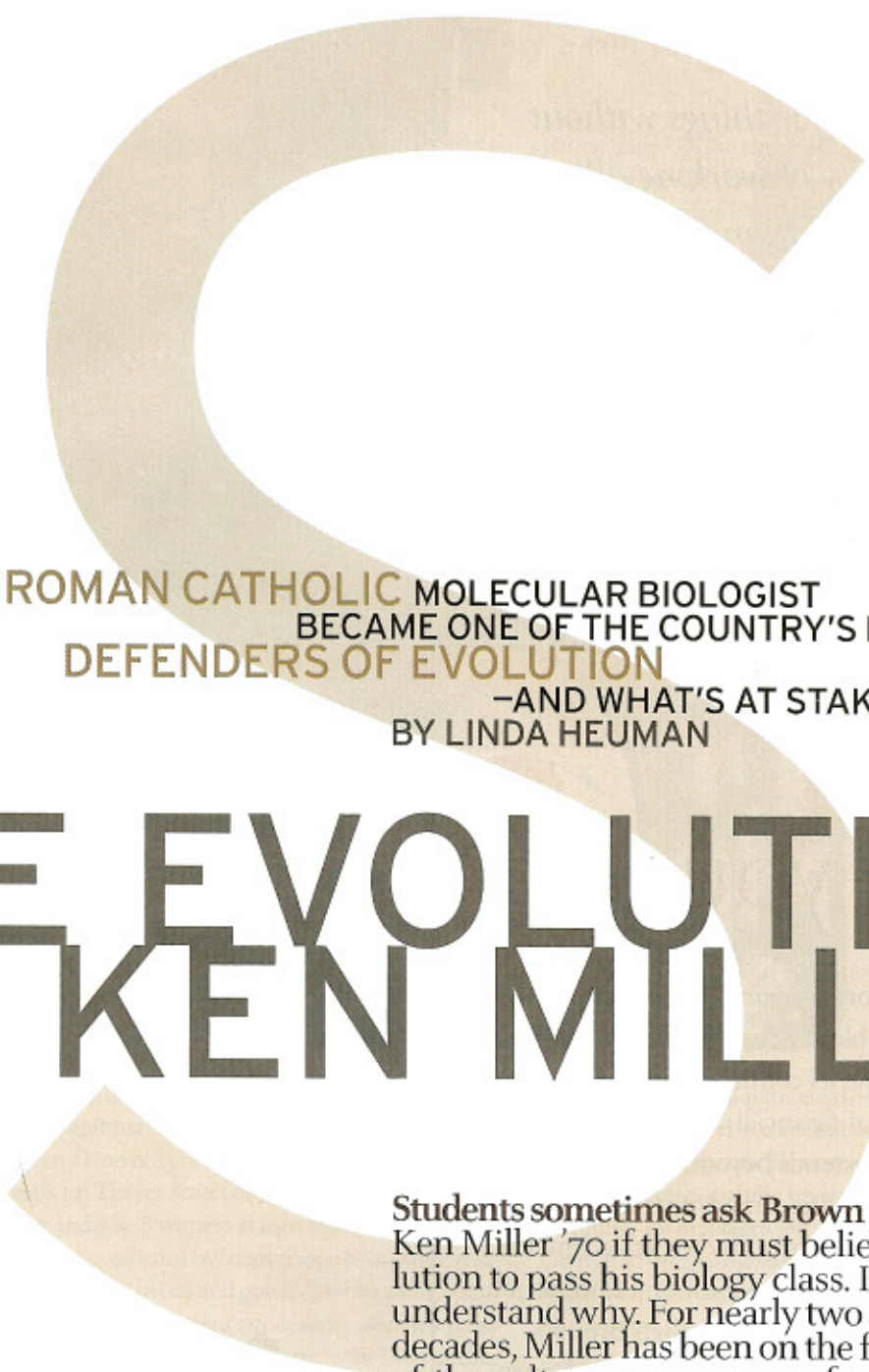
Alumni Magazine

The Evolution of Ken Miller

How a **ROMAN CATHOLIC** molecular biologist became one of the country's leading defenders of **EVOLUTION**.

After Katrina:
What Ruth Simmons
and Sidney Frank are
doing to help



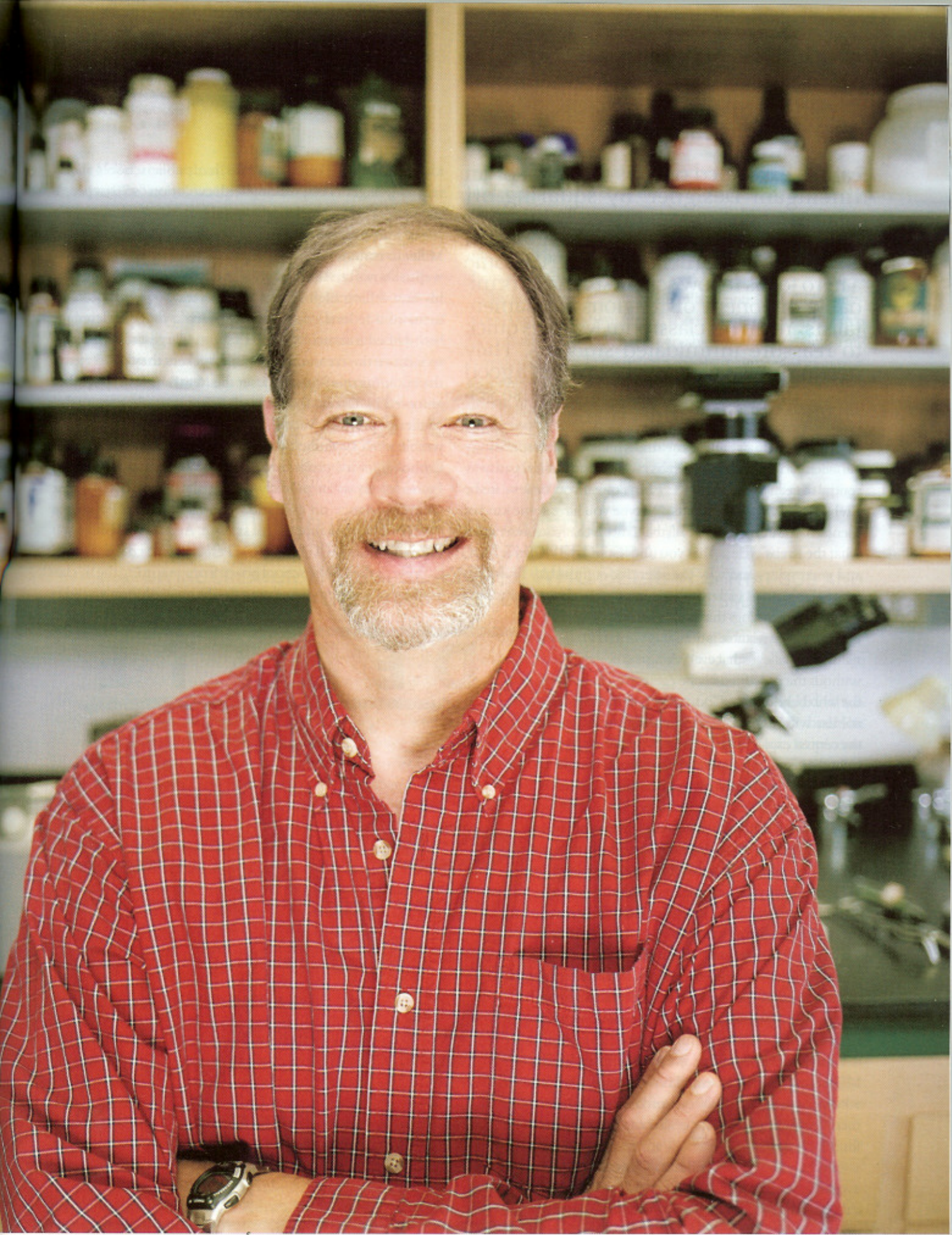


HOW A ROMAN CATHOLIC MOLECULAR BIOLOGIST
BECAME ONE OF THE COUNTRY'S LEADING
DEFENDERS OF EVOLUTION
—AND WHAT'S AT STAKE.
BY LINDA HEUMAN

THE EVOLUTION OF KEN MILLER

Students sometimes ask Brown professor Ken Miller '70 if they must believe in evolution to pass his biology class. It's easy to understand why. For nearly two and a half decades, Miller has been on the front lines of the culture wars as one of evolution's most visible public defenders. He has waged a kind of holy war against claims that the world and all the species in it were literally created in the seven days described in Genesis and against the notion that some biological phenomena

PHOTOGRAPHS
BY JOSHUA DALSIMER



Miller was drawn into the evolution fight when he reluctantly agreed to debate a prominent creationist in April 1981.

can be explained only as the work of an Intelligent Designer. By squaring off against such opponents as William F. Buckley Jr. and leading intelligent-design advocate Michael Behe, Miller has become a hero to his fellow scientists and a formidable opponent of religious fundamentalists. Yet in his classroom Miller is quick to reassure intimidated students. They needn't "believe" in anything to get a good grade in his course, he says, because science isn't in the business of belief.

To illustrate what he means, Miller draws an analogy between evolution and the Krebs cycle, a biochemical pathway central to cellular metabolism. "I don't care if you 'believe' in the Krebs cycle," he tells students. "Maybe you have some kind of mental reservation about it. All that I care is that you understand what the Krebs cycle is, that you understand the evidence for it, and you understand why the scientific community finds it so compelling. And I feel exactly the same way about evolution."

One of the things that makes Miller's defense of Darwin's ideas notable is that he is not a strict materialist who believes that everything can be explained without the need for a divine creator. He is a scientist who believes that God and prayer can logically coexist with Darwinism. Accepting evolution as the central explanation for how living things physically change over long stretches of time, he argues, should hinder no one from worshipping the creator of that world.

Although Miller, a molecular biologist, has been defending evolution in public forums for most of his adult life, in 1997 he became a national figure. That year he appeared with three other evolutionists on *Firing Line* to debate Buckley and three anti-evolutionists. His host sensed Miller was something special. "Young man," Buckley told a startled Miller after the show, "that was the most astonishing performance I've ever seen. That was absolutely remarkable." The admiration was mutual. "I would place him as one of the four or five smartest people I've ever met in my life," Miller says. "But he doesn't know science. That's why he was completely out of his depth. Like many brilliant people, he is also capable of profound self-delusion."

In the years since, Miller has become one of evolution's most visible defenders. Newsrooms call him up whenever a school board tries to undermine the teaching of evolution. When Pres-

ident Bush remarked in August that public schools should teach intelligent design along with evolution "so that people can understand what the debate is about," within hours *News-Night with Aaron Brown* and *The O'Reilly Factor* had asked Miller to comment live on the president's statement. *Today*, as well as shows on ABC and NPR, were next in line. In addition, his best-selling high school biology textbook has been the focus of a federal court case in which a judge ordered the board of education of Georgia's second-largest school district to remove the creationist-inspired stickers they'd inserted in the book. Six months later, after the *New York Times* published an op-ed by Cardinal Christoph Schönborn that seemed to challenge previous Vatican statements that evolution is compatible with Catholic doctrine, Miller, a practicing Roman Catholic, joined prominent scientists Lawrence Krauss and Francisco Ayala in publicly asking the Pope to clarify the Church's stance on evolution and to continue Pope John Paul II's legacy of support for science. And this fall Miller was the first witness in a high-profile Pennsylvania court case filed to prevent the Dover school board from requiring the in-class reading of a statement casting doubt on evolution's validity.

DEBATE

"EVOLUTION vs CREATION"

EVOLUTION & the SCIENTIFIC EVIDENCE

CREATION & the SCIENTIFIC EVIDENCE

PROPOSITION

"The Theory of Evolution is superior to the Theory of Special Creation as an explanation of the scientific evidence related to origins."

Dr. KENNETH MILLER
(Affirmative)
Asst. Prof. of Biology
Brown University
Providence, R. I.

Dr. HENRY MORRIS
(Negative)
Director, Institute for
Creation Research
San Diego, Calif.

Meehan Auditorium

**Meehan Auditorium
BROWN U. Campus
Providence**

Admission - \$ 1.00

APRIL 10th - 7^{pm}

To Miller, the battle against evolution is an attack on science itself. Evolution, he explains, means the ongoing change that gives rise to all living species, including humans. It occurs through the process of natural selection, a term Darwin coined after observing that nature tends to favor certain characteristics that individuals of a species inherit from their parents, much as a plant or livestock breeder selectively breeds the individuals that display the most desirable traits. Members of a species whose traits help them better survive within their environment are more likely to pass these characteristics on to their offspring. Gradually, over many generations of natural selection, some individuals are altered enough to form new species, adding to the diversity of life.

Opponents of evolution—from “creationists,” who believe the story of creation described in Genesis is literal truth, to advocates of intelligent design (ID), who believe that some biologi-

tends, and on the basis of the theory of evolution scientists have made predictions later confirmed and upheld, for example, by findings of the fossil record, radiometric dating, and, most recently, genomic studies. Evolution is the foundation of biology, and to biologists it is no more controversial than atomic theory is to physicists.

By emphasizing a more generalized notion of theory, evolution's opponents have turned science—the systematic search for explanations for how the observable world works—into a relativistic quagmire. In the process they have succeeded in spreading doubt among the unscientific public. In September, in anticipation of the Dover, Pennsylvania, school board case in which Miller was a star witness, the Pew Research Center for the People and the Press released an analysis of various recent polls about evolution and creationism. It concluded that although Americans are now nearly evenly split between those who accept “a biblical

MILLER IS NO STRICT MATERIALIST WHO BELIEVES THAT EVERYTHING CAN BE EXPLAINED WITHOUT THE NEED FOR A DIVINE CREATOR. HE IS A SCIENTIST WHO BELIEVES THAT GOD AND PRAYER CAN LOGICALLY COEXIST WITH DARWINISM.

cal complexity is evidence of a designer at work—are not convinced. They argue that the evidence is insufficient to prove that this is how species—including homo sapiens—came to be. Many view evolution as a godless theory that takes away the special status of humans in creation. This summer, Pennsylvania senator Rick Santorum spoke for many anti-evolutionists when he said that evolution “has huge consequences for society. It's where we come from: Does man have a purpose? Is there a purpose for our lives? Or are we just simply the result of chance? If we are the result of chance, if we are simply a mistake of nature, then that puts a different moral demand on us—in fact, it doesn't put a moral demand on us—than if in fact we are a creation of a being that has moral demands.”

Miller argues that the position of most anti-evolutionists is really scientific illiteracy. Everything in science—from gravity to relativity—is “just a theory,” he points out. If an explanation comes along that more successfully accounts for the observations and evidence, science adopts it, replacing the earlier “truth” with the newer, more complete one. If someone, for example, can come up with a better explanation than gravity for why your spilled coffee falls on the floor instead of the ceiling, science will happily give up the “theory” of gravity. Science is always provisional, Miller explains, but that does not mean that it is controversial, or a matter of opinion, faith, or personal preference. Similarly, evolution via natural selection is a “theory” only in this provisional, scientific sense.

Darwin's theory of evolution by natural selection is supported by the facts of natural history, genetics, and molecular biology. It is testable by observation and experiment, Miller con-

creationist account of the origins of life” and those who “accept the idea that humans evolved over time,” most also want to see more than one explanation taught in schools.

In August, for example, when a Gallup poll asked which explanation about the origin and development of life should be taught, many respondents chose more than one: 61 percent picked evolution, while 54 percent chose creationism and 43 percent selected intelligent design. Similarly, the Pew report noted, although only a minority of the public favors teaching creationism *instead* of evolution, the results of earlier polls demonstrate that about two-thirds favor teaching both creationism and evolution in the school curriculum.

ALTHOUGH MILLER JOKES THAT HE'S NEVER BEEN SPOKEN to by a burning bush, he is no stranger to the religious impulses that prompt so many to distrust evolution. A cradle Catholic who has “had personal experiences of God,” he is also a Darwinian for whom the world unfolds “enormously rich with life and with evolutionary possibilities,” he says. “To me the idea of God, the idea of a supreme being, is the intellectual peg that holds everything else together. That enables my existence, the world, the diversity of life, the magnificence of the universe to be put into a context in which they make sense.”

Miller has considered the Catholic Church his spiritual home ever since boyhood. “There is,” he says, “a deep emotional connection in the Church: the liturgy, the incense, the Mass, the way a church feels, the sacraments. I really got that.” As a child he even considered becoming a priest. But by his freshman year

at Brown in 1966, his interest in Catholicism was waning. Sunday morning became a time to sleep late: "Increasingly religion seemed out of touch with a lot of stuff that was going on in the world. It was the civil rights era, the beginning of the Vietnam War, student protests were just beginning, and I was much more interested in those things. But I retained this sense that there is some deeper meaning to life. And I didn't know quite how to put that into words."

During Miller's junior year a curious figure appeared on campus, a Franciscan monk who wandered among the hippies on the Green in his robes and sandals: Brown's first full-time Catholic chaplain, Howard O'Shea. "He was the right person for the times," Miller says. "He made everyone who went to Mass at Manning feel welcome, feel that the Church had something to offer, and feel that the Church was not a nasty mother who wanted to scold us for our sins but a place where we could be understood and where we could be forgiven and where we could be given the emotional and spiritual support that everybody needs in one sense or another." Miller started attending Mass again, but it was an awkward

Darwin's God was a muddle. In the *New York Review of Books*, Frederick C. Crews called it a "most startling disjunction of sensibility ... a Jekyll-Hyde metamorphosis between the covers of one book." While praising the first half as "the most trenchant refutation of the newer creationism to be found anywhere," Crews found that "when Miller then tries to drag God and Darwin to the bargaining table, his sense of proportion and probability abandons him.... *Finding Darwin's God* appears to offer the strongest corroboration yet of William Provine's infamous rule: if you want to marry Christian doctrine with modern evolutionary biology, 'you have to check your brains at the church-house door.'"

Yet the book was a popular success. Letters poured in from readers who said *Finding Darwin's God* provided a helpful perspective from which to view their own struggles to reconcile science and belief. To Miller's amusement, the book reached number eighteen on the Amazon.com best-seller list for a brief few hours in August 2000, in between books by John Grisham and Tom Clancy.

"Darwin's God," Miller believes, presides over a world in which things are exactly as scientists observe them to be:

"BY BEING ALWAYS IN CONTROL, THE CREATOR WOULD DENY HIS CREATURES ANY REAL OPPORTUNITY TO KNOW AND WORSHIP HIM. AUTHENTIC LOVE REQUIRES FREEDOM, NOT MANIPULATION."

and tentative return. He said his prayers while sitting in the back of the chapel, received communion, and left.

Then, in a poetry class, Miller came across the writing of Thomas Merton, the memoirist, poet, essayist, and Trappist monk. Merton's poems resonated with Miller, introducing him to the mystical side of religion. In *The Seven Storey Mountain*, Merton's autobiographical account of his conversion, Miller found a mirror for his own experience. "Merton talks about his alienation during his college years in a way that made perfect sense to me," he says. "And then he talks about how he found his way back, first into religion and later so much into religion that he decided to go to the seminary and become a priest." Before reading Merton's book, Miller says, he had always thought of religion as "revelations and rules." Merton convinced him "you don't have to be stupid to be religious. And being religious doesn't mean you abdicate creativity, or that you simply give yourself over to a set of arbitrary rules. But what it really means is that you accept a deeper truth and a deeper reality. And that has always had a great appeal to me."

In 1999 Miller published *Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution*, an attempt at fighting closed-mindedness on two fronts: the first part of the book attacks anti-evolutionism and the belief that religion trumps science, while the second part takes on scientism and the claim that science trumps religion. Some critics thought *Finding*

"dynamic, flexible, and logically complete." It is a world of free will and possibility, in which evolution is one of the mechanisms of realizing that possibility. Alluding to creationists, Miller writes, "Certainty of outcome means that control and predictability come at the price of independence. By being always in control, the Creator would deny His creatures any real opportunity to know and worship Him. Authentic love requires freedom, not manipulation." That freedom, Miller concludes, "is best supplied by the open contingency of evolution, and not by strings of divine direction attached to every living creature."

AFTER GRADUATING FROM BROWN IN 1970, MILLER HEADED to the University of Colorado for graduate study in biology. There he discovered his talent as a science communicator while working for Pink Elephant Notes, a company that hired note takers for popular classes and sold their write-ups to students for \$16.95 a semester. Miller took notes on the three weekly lectures of a huge introductory biology class, earning five dollars a lecture. "The marketing of these notes was aided by the fact that the professor was fundamentally incomprehensible," he recalls. "He confused the living daylight out of students." Every few lectures, Miller also submitted "What Professor Albersheim Really Meant," in which he translated the professor's lecture into easy-



to-understand English. The column was enormously popular.

One day during a particularly confusing lecture, Miller was scribbling furiously when the student in the next seat elbowed him.

"What are you doing?" the student whispered.

"I'm taking notes."

"Get them from the Pink Elephant."

"I am the Pink Elephant!"

"WHAT?" the student responded loudly, turning heads.

The next day, that student and several of his friends sought out Miller and asked him to tutor them. For two semesters Miller met with the group regularly. Each student chipped in a couple of dollars, and Miller in turn demystified Biology 001. "That's how I discovered that I loved teaching," he says.

It was during one of these tutoring sessions that he first encountered animosity toward evolution. A student handed him a pamphlet written by a fundamentalist Christian creationist and asked him what he thought. "I felt right away that it was propaganda," Miller says. "You could see that this pamphlet was predicated on the idea that all scientists are somehow engaged in a grand conspiracy to keep the truth from people. The reality is that the best way to make your reputation as a young scientist is to upset the apple cart. If I or any other scientist thought that we really could upset the ideas of Charles Darwin and replace them with a new or superior the-

ory, boy, there would be no better way to make your reputation, to ensure scientific immortality, and to get the best possible grant funding. It is that very sort of self-promotion that makes science work."

He took the pamphlet and researched some of the arguments in it. Then he handed it back to the student. "These are all distortions," he said. "What you are being told in the classroom is essentially correct. Don't worry about it."

But he was bothered.

In 1974, PhD in hand, Miller accepted a position as a lecturer (later promoted to assistant professor) and head of the electron lab at Harvard. In addition to teaching a lab course in electron microscopy, he taught introductory biology for a professor on sabbatical. "I discovered I liked teaching in the lecture format," he recalls, "that I was good at it, that I could make students laugh, that I could make them pay attention, and that I had a knack for getting things across."

When Brown lured Miller away from Harvard in 1980, Dean of Biology Richard Goss asked him to teach an upper-level course in cell biology and another course of his choosing. Goss clearly expected him to pick a graduate seminar or another upper-level class. When Miller said he would like to teach the introductory biology sequence, Goss looked at him dumbfounded and said, "You're kidding!" Miller today is one of the most popular teachers on campus.

AS A CELL BIOLOGIST WHO SPENDS MUCH OF HIS TIME using electron microscopy to study membranes in cells, Miller never intended to embark on a second career as a stand-in for Charles Darwin. But in 1981, during Miller's first spring teaching at Brown, a student Christian group arranged to bring the creationist Henry Morris, of San Diego's Institute for Creation Research (ICR), to campus. Morris challenged any Brown biology or geology professor to a debate on evolution. Students asked one professor after another to participate, but none accepted, including Miller.

"No. Get lost," he told them.

The students wanted to know why.

"Because I don't know anything about evolution," Miller replied.

"Does this mean that Morris is right?"

"No! It doesn't mean that he is right." Miller let slip that he had done some debating in high school, and after that, the students wouldn't take no for an answer.

"Okay, fine," he relented. "But under one condition. I don't know where these guys are coming from. I know what evolution is, but I don't know what their ideas are. You've got to get me some information, so I know what I'm facing."

The students brought him Morris's book *The Genesis Flood* and an audiotape of a debate in which the creationist Duane Gish took on Professor Ashley Montagu. Miller remembers: "In the sixties and seventies, Ashley Montagu was probably the most famous anthropologist in the United States. The guy must have written 300 books. He's one of the most brilliant men I've ever seen. And I figured, 'This is going to be great because Montagu is going to kill this guy.' So I popped the tape into my cassette player and listened to it." What he heard surprised him. "Gish wiped the floor with Montagu. He *destroyed* him. I was absolutely terrified." Miller set to work furiously to prepare his case.

Sixteen hundred people turned out for the three-hour debate, which was held at Mechan Auditorium. Morris argued that God created the earth and all its species in one biblical

in a single cataclysmic flood. Fossils of primitive organisms are found deeper in the rock layers than fossils of more complex organisms, he explained, because more complex organisms were able to seek higher ground during the deluge. Citing the second law of thermodynamics, he argued that in nature all processes move from greater to lesser complexity, making it irreconcilable with evolution, which suggests that complexity increases over time. Finally, he recommended that because neither special creation nor evolution can be proven, the audience should consider both theories as equal.

Miller fought back, point by point. He insisted that methods used to determine the age of the earth are now reliable and chided Morris for citing out-of-date research. Miller noted that if the earth is only 10,000 years old, light from distant stars wouldn't have had the time to reach us. The fact that we can see these stars means that, if Morris's young-earth claims are true, God would've had to create the light beams in midstream to fool us. How then would we explain God's duplicity? Also, if all species were created at once by God, he reasoned, why do older rocks show fewer animals than younger ones? Miller denied Morris's claim that there are mysterious "gaps" between species in the fossil record; evolutionary change is so gradual, he explained, that biologists have a hard time identifying from fossils where one species ends and other begins. Shortly after the debate, the ICR's publication *Acts & Facts* declared Miller to be "the most effective evolutionist debater Dr. Morris has encountered to date."

"I had no problems with any of Morris's distortions or misdirected arguments," Miller wrote in a letter to fellow scientist Carl Sagan a few days later, "and the overwhelming opinion afterwards was that evolution had won the debate cleanly. Morris was so hapless that many people told me that they had sympathy for his plight. Reporters for the [Boston] *Globe* and the [Providence] *Journal* told me that they had never seen a creationist trounced so badly. I have no illusions about why that was the case. It was a simple matter of anticipating their arguments and finding the facts to demolish them." He further confided: "I had a marvelous time."

"IF I OR ANY OTHER SCIENTIST THOUGHT THAT WE REALLY COULD REPLACE DARWIN'S IDEAS WITH A NEW OR SUPERIOR THEORY, BOY, THERE WOULD BE NO BETTER WAY TO MAKE YOUR REPUTATION, TO ENSURE SCIENTIFIC IMMORTALITY."

stroke between 6,000 and 10,000 years ago. He attacked the fossil record and dismissed radioactive dating as unreliable. Although Morris allowed that the fossil record does show changes within species, he maintained it provided no evidence that one species had ever evolved into another.

Disputing the prevailing scientific belief that the layering of the fossil record shows that animals have been dying for millions of years, Morris suggested that the animals had all died at once

Later that year a large Baptist church in Tampa, Florida, invited Miller to debate Morris again. Local officials had just instructed the school department to set up a creation-science curriculum for the fall of 1981 and teachers were up in arms. Before accepting the invitation, Miller called Nancy Marsh, the chairwoman of the Tampa schools' science department. According to Miller, Marsh said, "Help us! We're just desperate. We need anybody who can possibly come. If you've had any

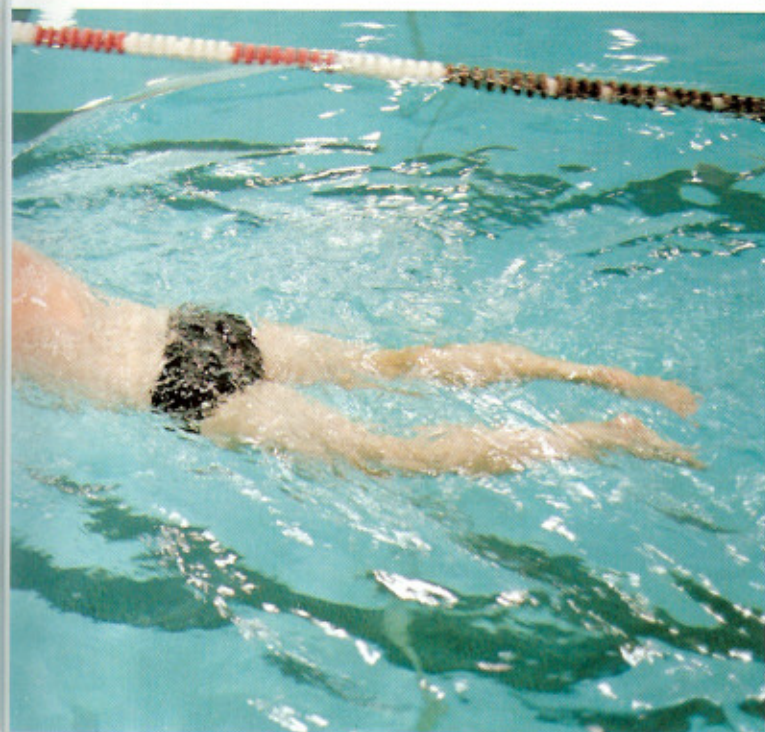


success against this Morris guy, you come down here and you tar and feather him for us, please!"

The debate packed the largest high school auditorium in Tampa, which seats 1,500 people. Another 600 in the cafeteria listened in on closed-circuit audio. Six television channels and seven radio stations covered the event, and one radio station broadcast it live. By the end of the summer, Tampa officials had reversed their decision to force a creation-science curriculum.

Although Miller says this was largely the result of hard work by the affected teachers, in Tampa he first sensed his ability to sway public opinion and help influence public policy.

After the Tampa victory, Miller figured the issue had been settled. In 1982, in the landmark court case *McLean v. Arkansas Board of Education*, a U.S. district judge overturned an Arkansas law that required public schools to present both creationism and evolution when teaching either. Miller watched the trial from



the sidelines as scientific heavyweights such as Stephen J. Gould took the stand. Six years later (in *Edwards v. Aguillard*) the Supreme Court struck down a similar Louisiana law, ruling that God did not belong in the science classroom. Miller figured, "The good guys have won. I'll dust this off, it'll be part of my résumé, and I'll go back to teaching and doing research."

BUT THEN MILLER HIMSELF CAME UNDER ATTACK. DURING the 1980s he teamed up with science writer Joseph S. Levine to write books for introductory biology classes. Over a decade and a half, they published four enormously successful college and high school textbooks.

One of Miller's high school textbooks was instantly controversial. Its publisher, Prentice-Hall, sent Miller to Austin, Texas, where a state selection committee was considering adopting it. As he wrote in an op-ed article published shortly afterward, "When the books were first presented to the committee, I sat quietly and watched as one citizen after another rose in protest, demanding that 'scientific creationism' be taught alongside evolution." Many of the objections were old and familiar. As a result, Miller and his coauthor met the public school science teachers who were fighting in the trenches. They welcomed him with "rock-star treatment," a celebrity that Miller clearly enjoys. "It's really cool!" he says. "In fact, my wife always figures she has to take me down a notch: 'People have been standing in line for your autograph and telling you how great you are. I want you to take out the trash, would you fix the fence. Would you clean up the house?'"

In 1995 the American Scientific Affiliation (ASA), an organization of evangelical Christian scientists, invited Miller to debate a new textbook called *Pandas and People*, an early intelligent-design book that was being promoted as a supplement to standard high school texts. This time Miller's opponent was Michael J. Behe, a biochemist from Lehigh University. When Miller confronted the still-unknown Behe in the ASA debate, he was meeting a fellow Roman Catholic who within a decade would become the best-known proponent of intelligent design, as well as a formidable Miller adversary.

Unlike earlier creationists, Behe accepts evolution as a valid biological process. But he believes it is incomplete. He acknowledges that evolution can account for small changes, but argues that it can't explain changes that would produce an organism different enough from its ancestor to be classified as a new species. "That has not yet been demonstrated," he insists.

Behe finds support for his argument in the cell. "The bottom line," he once wrote in the *New York Times*, "is that the cell—the very basis of life—is staggeringly complex. We know of no other mechanism, including Darwin's, which produces such complexity. Only intelligence does." Just as Mt. Rushmore bears the unmistakable signs of having been created by intelligent, nonrandom creators, complex cellular systems exhibit the characteristics of intelligent design.

Behe points to such specific biomolecular phenomena as blood clotting, ciliary motion, and intracellular protein transport as examples of "irreducible" complexity. A system is irreducible if it requires each of its parts and if removing any of its parts would cause the system to stop functioning. Behe argues that "an irreducibly complex system cannot be produced directly ... by slight, successive modifications of a precursor system, because any precursor to an irreducibly complex system that is missing a part is by definition nonfunctional."

To illustrate irreducible complexity, Behe uses the metaphor of a mousetrap, which has five parts: a platform, a metal hammer, a spring, a catch, and a metal bar that holds the hammer back when the trap is charged. This is an irreducibly complex

system, he argues, because all its parts are needed to accomplish its function; if any part were missing, "the mouse could dance all night on the platform." In his 1996 book, *Darwin's Black Box*, Behe claims that the intelligent-design argument is "so unambiguous and so significant that it must be ranked as one of the greatest achievements in the history of science."

Miller, like most scientists, rejects Behe's postulation of irreducible complexity. Something is irreducibly complex, he says, when your understanding of how it developed or how it works is incomplete. He refutes Behe's mousetrap analogy by showing that removing one part may alter the mechanism by which a mousetrap kills mice, but it by no means renders the trap impotent. In one debate, Miller removed one of a trap's five parts, bent

people who are looking for validation for their faith."

Most disturbing to scientists like Miller is the way savvy marketing and careful language have led people—even those who should know better—to view intelligent design and evolution as two equally valid and competing theories. Miller suggests that the media have unwittingly played into the hands of the anti-evolutionists by promoting a false impression in the interest of "fair" reporting. When *The Charlie Rose Show* contacted Miller recently, they asked him to appear opposite a representative from the Discovery Institute, which is the leading promoter of intelligent design. Miller objected.

"When [the news media] pick a scientist from anywhere," he says, "they feel obliged to balance the scientist's comment with

"[THE MEDIA] FEEL OBLIGED TO BALANCE ANY SCIENTIST'S COMMENT WITH SOMEONE FROM 'THE OTHER SIDE.' SO THE ENTIRE SCIENTIFIC COMMUNITY IS BEING BALANCED AGAINST SEVEN OR EIGHT LOUDMOUTHS. IT GIVES PEOPLE A VERY FALSE IMPRESSION."

another with his fingers, and triumphantly snapped a pencil in half with the resulting four-part device. Labeling an object or process irreducibly complex, he suggests, may say more about the observer's limitations than about any ultimate irreducibility.

Miller is confident that, given time, scientists will be able to account for the evolution of complex cellular systems, and he cites recent studies that are accomplishing just that. By contrast, intelligent design makes no predictions and has no testable hypotheses, so how can it be subject to scientific scrutiny? Besides, Miller adds, intelligent design is actually not such a new idea. The Rev. William Paley articulated a well-known version of it in his *Natural Theology* more than half a century before Darwin published *Origin of Species*. Early in his career, even Darwin found the argument convincing, but he rejected it after his observations of the natural world convinced him that natural selection provided an adequate explanation of the origin of species. Miller insists that Behe has essentially "dusted off the argument, spiffed it up with the terminology of modern biochemistry, and then applied it to the proteins and macromolecular machines that run the living cell."

Whatever its limitations to most scientists, intelligent design is enormously comforting to many religious nonscientists. "There is a reason we call [religious belief] faith and we don't call it certainty or proof," Miller says. "Religion is something that people always doubt, but science seems to be in the business of certainty. If you hear that science can prove the existence of God—although you veil that language by saying science can show the existence of a designer—that seems to confirm faith, that seems to remove doubt. What intelligent design does is say, 'Hey, we've got the proof. We can prove that this God that you keep struggling with really existed because we got his fingerprints, we can show his handiwork.' That has tremendous emotional appeal for

someone from 'the other side.' And the 'other side' is one group of about eight people at the Discovery Institute. So you have this very curious thing where the entire scientific community is being balanced against seven or eight loudmouths at the Discovery Institute. It gives people a very false impression."

STUDENTS ARRIVING IN MILLER'S CLASS MIGHT BE SURPRISED that on the first day he reads them poetry. Science is about understanding the world around you in a particular way, he seems to be saying, but it should never take away your ability to see the wonder in it. The poem he reads is Walt Whitman's "When I Heard the Learn'd Astronomer." In it, the narrator listens to an astronomer describe the heavens and becomes, unaccountably, "tired and sick, / Till rising and gliding out I wander'd off by myself, / In the mystical moist night-air, and from time to time, / Look'd up in perfect silence at the stars."

"If you really understand science in the most profound sense," Miller tells his students, "when you look at a flower, you appreciate it as Whitman does, for what it is. But then, I could take you into my laboratory and say, 'Let's see where the green color comes from,' and you see that deep within the flower there is a detailed and intricate structure. Then I could take you downstairs to my electron microscope, and I can show you what is *really* going on there. I can appreciate this at a level that Whitman could never have approached. Whitman never saw a plant the way that I—or you, for that matter—am able to see a plant right now. That means that our experience becomes deeper and it becomes more profound. Even something like a biochemical pathway can be understood as a thing of beauty." **B**

LINDA HEUMAN wrote about cheating in the May/June BAM.