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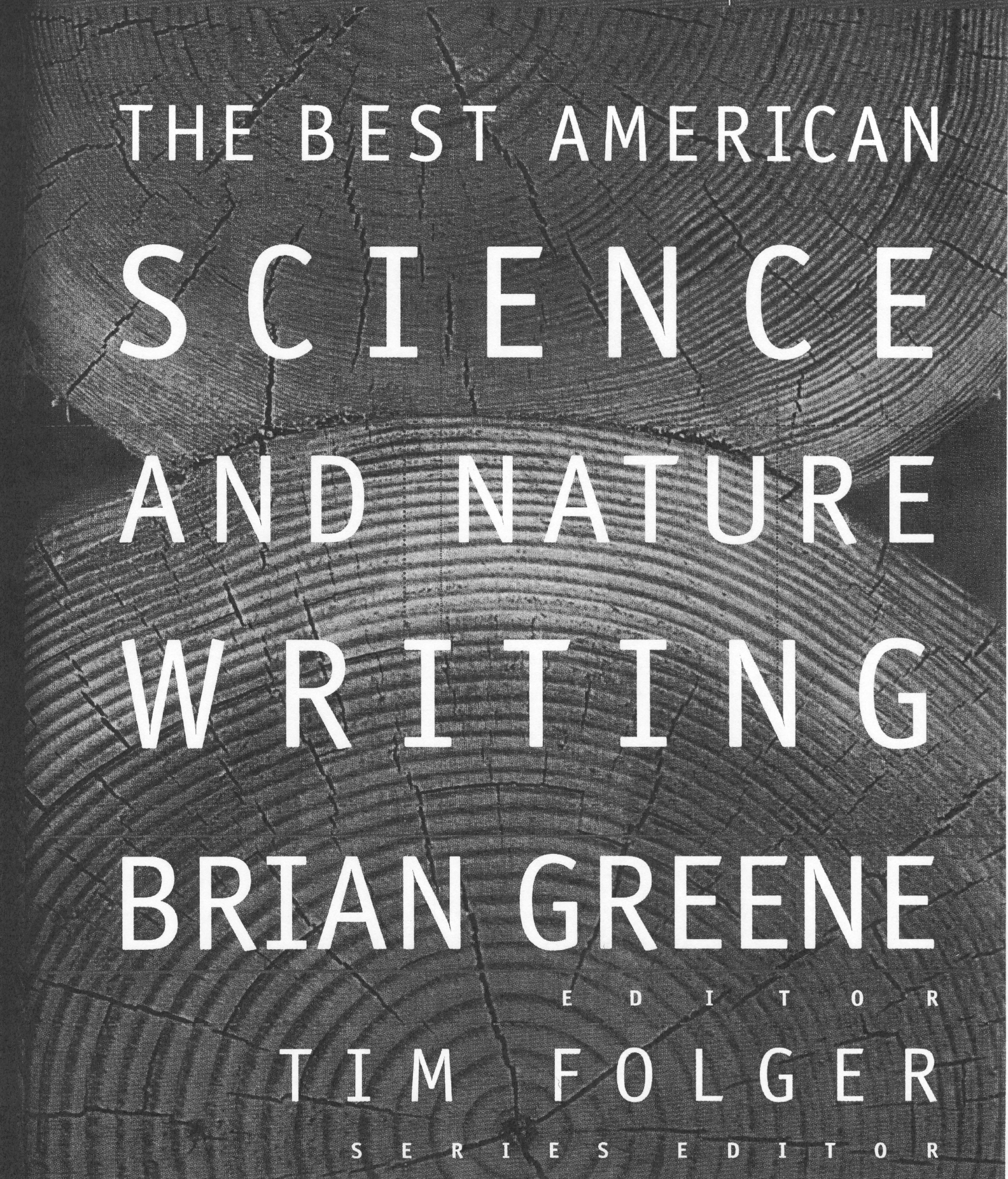

# THE BEST AMERICAN SCIENCE AND NATURE WRITING

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# *The Best American Science and Nature Writing 2006*

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*Edited and with an Introduction by* Brian Greene

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DANIEL C. DENNETT

# *Show Me the Science*

FROM *The New York Times*

PRESIDENT BUSH, announcing this month that he was in favor of teaching about "intelligent design" in the schools, said, "I think that part of education is to expose people to different schools of thought." A couple of weeks later, Senator Bill Frist of Tennessee, the Republican leader, made the same point. Teaching both intelligent design and evolution "doesn't force any particular theory on anyone," Frist said. "I think in a pluralistic society that is the fairest way to go about education and training people for the future."

Is "intelligent design" a legitimate school of scientific thought? Is there something to it, or have these people been taken in by one of the most ingenious hoaxes in the history of science? Wouldn't such a hoax be impossible? No. Here's how it has been done.

First, imagine how easy it would be for a determined band of naysayers to shake the world's confidence in quantum physics — how weird it is! — or Einsteinian relativity. In spite of a century of instruction and popularization by physicists, few people ever really get their heads around the concepts involved. Most people eventually cobble together a justification for accepting the assurances of the experts: "Well, they pretty much agree with one another, and they claim that it is their understanding of these strange topics that allows them to harness atomic energy, and to make transistors and lasers, which certainly do work . . ."

Fortunately for physicists, there is no powerful motivation for such a band of mischief-makers to form. They don't have to spend much time persuading people that quantum physics and Einsteinian relativity really have been established beyond all reasonable doubt.

With evolution, however, it is different. The fundamental scientific idea of evolution by natural selection is not just mind-boggling; natural selection, by executing God's traditional task of designing and creating all creatures great and small, also seems to deny one of the best reasons we have for believing in God. So there is plenty of motivation for resisting the assurances of the biologists. Nobody is immune to wishful thinking. It takes scientific discipline to protect ourselves from our own credulity, but we've also found ingenious ways to fool ourselves and others. Some of the methods used to exploit these urges are easy to analyze; others take a little more unpacking.

A creationist pamphlet sent to me some years ago had an amusing page in it, purporting to be part of a simple questionnaire:

> Test Two
> Do you know of any building that didn't have a builder? [YES] [NO]
> Do you know of any painting that didn't have a painter? [YES] [NO]
> Do you know of any car that didn't have a maker? [YES] [NO]
> If you answered YES for any of the above, give details.

Take that, you Darwinians! The presumed embarrassment of the test-taker when faced with this task perfectly expresses the incredulity many people feel when they confront Darwin's great idea. It seems obvious, doesn't it, that there couldn't be any designs without designers, any such creations without a creator.

Well, yes — until you look at what contemporary biology has demonstrated beyond all reasonable doubt: that natural selection — the process in which reproducing entities must compete for finite resources and thereby engage in a tournament of blind trial and error from which improvements automatically emerge — has the power to generate breathtakingly ingenious designs.

Take the development of the eye, which has been one of the favorite challenges of creationists. How on earth, they ask, could that engineering marvel be produced by a series of small, unplanned steps? Only an intelligent designer could have created such a brilliant arrangement of a shape-shifting lens, an aperture-adjusting iris, a light-sensitive image surface of exquisite sensitivity, all housed in a sphere that can shift its aim in a hundredth of a second and send megabytes of information to the visual cortex every second for years on end.

But as we learn more and more about the history of the genes in-

volved, and how they work — all the way back to their predecessor genes in the sightless bacteria from which multicelled animals evolved more than a half-billion years ago — we can begin to tell the story of how photosensitive spots gradually turned into light-sensitive craters that could detect the direction from which light came and then gradually acquired their lenses, improving their information-gathering capacities all the while.

We can't yet say what all the details of this process were, but real eyes representative of all the intermediate stages can be found, dotted around the animal kingdom, and we have detailed computer models to demonstrate that the creative process works just as the theory says.

All it takes is a rare accident that gives one lucky animal a mutation that improves its vision over that of its siblings; if this helps it have more offspring than its rivals, this gives evolution an opportunity to raise the bar and ratchet up the design of the eye by one mindless step. And since these lucky improvements accumulate — this was Darwin's insight — eyes can automatically get better and better and better, without any intelligent designer.

Brilliant as the design of the eye is, it betrays its origin with a telltale flaw: the retina is inside out. The nerve fibers that carry the signals from the eye's rods and cones (which sense light and color) lie on top of them and have to plunge through a large hole in the retina to get to the brain, creating the blind spot. No intelligent designer would put such a clumsy arrangement in a camcorder, and this is just one of hundreds of accidents frozen in evolutionary history that confirm the mindlessness of the historical process.

If you still find Test Two compelling, a sort of cognitive illusion that you can feel even as you discount it, you are like just about everybody else in the world; the idea that natural selection has the power to generate such sophisticated designs is deeply counterintuitive. Francis Crick, one of the discoverers of DNA, once jokingly credited his colleague Leslie Orgel with "Orgel's Second Rule": evolution is cleverer than you are. Evolutionary biologists are often startled by the power of natural selection to "discover" an "ingenious" solution to a design problem posed in the lab.

This observation lets us address a slightly more sophisticated version of the cognitive illusion presented by Test Two. When evolutionists like Crick marvel at the cleverness of the process of natural selection, they are not acknowledging intelligent design. The de-

signs found in nature are nothing short of brilliant, but the process of design that generates them is utterly lacking in intelligence of its own.

Intelligent-design advocates, however, exploit the ambiguity between process and product that is built into the word "design." For them the presence of a finished product (a fully evolved eye, for instance) is evidence of an intelligent design process. But this tempting conclusion is just what evolutionary biology has shown to be mistaken.

Yes, eyes are for seeing, but these and all the other purposes in the natural world can be generated by processes that are themselves without purposes and without intelligence. This is hard to understand, but so is the idea that colored objects in the world are composed of atoms that are not themselves colored and that heat is not made of tiny hot things.

The focus on intelligent design has, paradoxically, obscured something else: that genuine scientific controversies about evolution abound. In just about every field there are challenges to one established theory or another. The legitimate way to stir up such a storm is to come up with an alternative theory that makes a prediction that is crisply denied by the reigning theory — but that turns out to be true, or that explains something that has been baffling defenders of the status quo, or that unifies two distant theories at the cost of some element of the currently accepted view.

To date, the proponents of intelligent design have not produced anything like that. No experiments with results that challenge any mainstream biological understanding. No observations from the fossil record or genomics or biogeography or comparative anatomy that undermine standard evolutionary thinking.

Instead, the proponents of intelligent design use a ploy that works something like this. First you misuse or misdescribe some scientist's work. Then you get an angry rebuttal. Then, instead of dealing forthrightly with the charges leveled, you cite the rebuttal as evidence that there is a "controversy" to teach.

Note that the trick is content-free. You can use it on any topic. "Smith's work in geology supports my argument that the earth is flat," you say, misrepresenting Smith's work. When Smith responds with a denunciation of your misuse of her work, you respond, saying something like: "See what a controversy we have here? Profes-

sor Smith and I are locked in a titanic scientific debate. We should teach the controversy in the classrooms." And here is the delicious part: you can often exploit the very technicality of the issues to your own advantage, counting on most of us to miss the point in all the difficult details.

William Dembski, one of the most vocal supporters of intelligent design, notes that he provoked Thomas Schneider, a biologist, into a response that Dembski characterizes as "some hairsplitting that could only look ridiculous to outsider observers." What looks to scientists — and is — a knockout objection by Schneider is portrayed to most everyone else as ridiculous hairsplitting.

In short, no science. Indeed, no intelligent-design hypothesis has even been ventured as a rival explanation of any biological phenomenon. This might seem surprising to people who think that intelligent design competes directly with the hypothesis of nonintelligent design by natural selection. But saying, as intelligent-design proponents do, "You haven't explained everything yet" is not a competing hypothesis. Evolutionary biology certainly hasn't explained everything that perplexes biologists. But intelligent design hasn't yet tried to explain anything.

To formulate a competing hypothesis, you have to get down in the trenches and offer details that have testable implications. So far, intelligent-design proponents have conveniently sidestepped that requirement, claiming that they have no specifics in mind about who or what the intelligent designer might be.

To see this shortcoming in relief, consider an imaginary hypothesis of intelligent design that could explain the emergence of human beings on this planet:

> About six million years ago, intelligent genetic engineers from another galaxy visited Earth and decided that it would be a more interesting planet if there was a language-using, religion-forming species on it, so they sequestered some primates and genetically reengineered them to give them the language instinct and enlarged frontal lobes for planning and reflection. It worked.

If some version of this hypothesis were true, it could explain how and why human beings differ from their nearest relatives, and it would disconfirm the competing evolutionary hypotheses that are being pursued. We'd still have the problem of how these intelligent

genetic engineers came to exist on their home planet, but we can safely ignore that complication for the time being, since there is not the slightest shred of evidence in favor of this hypothesis.

But here is something the intelligent-design community is reluctant to discuss: no other intelligent-design hypothesis has anything more going for it. In fact, my farfetched hypothesis has the advantage of being testable in principle: we could compare the human and chimpanzee genomes, looking for unmistakable signs of tampering by those genetic engineers from another galaxy. Finding some sort of user's manual neatly embedded in the apparently functionless "junk DNA" that makes up most of the human genome would be a Nobel Prize–winning coup for the intelligent-design gang, but if they are looking at all, they haven't come up with anything to report.

It's worth pointing out that there are plenty of substantive scientific controversies in biology that are not yet in the textbooks or the classrooms. The scientific participants in these arguments vie for acceptance among the relevant expert communities in peer-reviewed journals, and the writers and editors of textbooks grapple with judgments about which findings have risen to the level of acceptance — not yet truth — to make them worth serious consideration by undergraduates and high school students.

So get in line, intelligent designers. Get in line behind the hypothesis that life started on Mars and was blown here by a cosmic impact. Get in line behind the aquatic ape hypothesis, the gestural origin of language hypothesis, and the theory that singing came before language, to mention just a few of the enticing hypotheses that are actively defended but still insufficiently supported by hard facts.

The Discovery Institute, the conservative organization that has helped to put intelligent design on the map, complains that its members face hostility from the established scientific journals. But establishment hostility is not the real hurdle to intelligent design. If intelligent design were a scientific idea whose time had come, young scientists would be dashing around their labs, vying to win the Nobel Prizes that surely are in store for anybody who can overturn any significant proposition of contemporary evolutionary biology.

Remember cold fusion? The establishment was incredibly hostile to that hypothesis, but scientists around the world rushed to their labs in the effort to explore the idea, in hopes of sharing in the glory if it turned out to be true.

Instead of spending more than one million dollars a year on publishing books and articles for nonscientists and on other public relations efforts, the Discovery Institute should finance its own peer-reviewed electronic journal. That way the organization could live up to its self-professed image: the doughty defenders of brave iconoclasts bucking the establishment.

For now, though, the theory they are promoting is exactly what George Gilder, a long-time affiliate of the Discovery Institute, has said it is: "Intelligent design itself does not have any content."

Since there is no content, there is no "controversy" to teach about in biology class. But here is a good topic for a high school course on current events and politics: Is intelligent design a hoax? And if so, how was it perpetrated?