

Letters to the Editor

Many of our readers responded to the article, “Intelligent Design and that Vast Right-Wing Conspiracy,” by Paul R. Gross, published in Volume 7, Issue 4 of *Science Insights*, September 2003. We have provided below all responses, followed by Dr. Gross’s reply.

Contributors (in order of appearance):

David Berlinski
Phillip E. Johnson
Jonathan Wells
Michael J. Behe
William A. Dembski
John G. West
James Downard
Robert C. Koons
Roland F. Hirsch
Jason Rosenhouse
Jeffrey Shallit
Matt Young
Andrea Bottaro
Pete Dunkelberg
Paul R. Gross

From David Berlinski:

I make it a habit to respond to critics only when I am assured of having either the last word or the last laugh. Mr. Gross has generously afforded me the opportunity to have both -- not once, but many times over. The Discovery Institute has placed almost all of my essays on-line; and the full text of both my articles on Darwinism and my various responses to Mr. Gross are on-line at www.CommentaryMagazine.com. There is a modest purchase price. I encourage Mr. Gross to keep scribbling. I need the laughs, God knows, and I can use the money.

David Berlinski

From Phillip E. Johnson:

In response to the bluff and bluster from Paul Gross, I refer readers to my review of Daniel Dennett’s book *Darwin’s Dangerous Idea*, which appeared in *The New Criterion* for October, 1995, and is on line at <http://www.arn.org/docs/johnson/dennett.htm>.

This book review pleased the editors of *The New Criterion*, but not Paul Gross, whose Darwinian fundamentalism is similar to that of Dennett.

Gross referred dismissively to the “creationist” Santorum Amendment, which is preserved in the Conference Committee Report accompanying the “Leave No Child Behind” federal Education Act, but he did not explain what the amendment actually says.

Senator Santorum proposed the amendment as a resolution, Senators Kennedy, Brownback, and Byrd endorsed it, and the following language passed the Senate by a vote of 91-8:

“It is the sense of the Senate that (1) good science education should prepare students to distinguish the data or testable theories of science from philosophical or religious claims that are made in the name of science; and (2) where biological evolution is taught, the curriculum should help students to understand why this subject generates so much continuing controversy and should prepare the students to be informed participants in public discussions regarding the subject.”

I surmise that Gross did not tell his readers what the amendment provides because he knew that to do so would spoil his appeal to prejudice. If the language of the Santorum Amendment were put to a vote of members of the National Association of Scholars, I expect it would be approved by them just as it was approved by a huge bipartisan majority of the United States Senate.

Does the National Association of Scholars really wish to follow the lead of Paul Gross and declare war against the millions of Americans who have serious doubts about Darwinism, and the many scholars who share those doubts? It seems an unpromising strategy.

Phillip E. Johnson
Professor emeritus (Law)
University of California, Berkeley

From Jonathan Wells:

Although I allowed my membership in NAS to expire several years ago because I was inundated with too many other publications, I continue to affirm the organization’s goals of preserving academic freedom and the free exchange of ideas, and creating professional forums in which issues can be discussed in a responsible and sophisticated way. I am especially encouraged to see the NAS pursuing these goals by permitting me and other advocates of intelligent design to respond to Paul Gross’s mean-spirited and misleading essay, “Intelligent Design and that Vast Right-Wing Conspiracy” in the September, 2003, issue of *Science Insights*.

Gross misrepresented many aspects of the current controversy over Darwinian evolution and intelligent design, but I will limit myself to responding to his remarks about my book, *Icons of Evolution* (Washington, D.C.: Regnery Publishing, 2000). Since my book did not deal with intelligent design theory, but only with the science behind some common textbook evidences for Darwinism, and since Gross himself is a biologist, I would have expected his criticisms to address scientific matters. Instead, he began by calling me the “chief conspiracy theorist” of the intelligent design movement (perhaps I should be flattered!), and by attacking a distorted version of my personal religious background. Since *ad hominem*s serve only to derail the discussion, however, I will let these pass and move directly to the central issue: the evidence for Darwinian evolution.

As a Berkeley Ph.D. student in molecular and cell biology in the 1990s, I discovered that most biology textbooks were systematically exaggerating, distorting, or even faking the best-known evidences for Darwin’s theory. For example, many of them contained drawings purporting to show that the embryos of fish, amphibians, reptiles, birds and mammals look almost identical in their earliest stages; these early similarities were then claimed to be evidence for Darwin’s theory that all animals with backbones are descendants of a common ancestor. As an embryologist myself, however, I noticed that the drawings did not resemble the real embryos, which look very different from each other.

I was not the only scientist to notice this: In 1997, an international team of embryologists published photographs in the journal *Anatomy and Embryology* showing that many early vertebrate embryos look nothing like the textbook drawings. When interviewed for the journal *Science*, the leader of the team said: “It looks like it’s turning out to be one of the most famous fakes in biology.”

In fact, the drawings had already been exposed as fakes over a hundred years ago. Yet many modern biology textbooks continue to feature them as evidence for Darwinian evolution. In 2000 the late evolutionary biologist Stephen Jay Gould wrote in *Natural History*: “We do, I think, have the right to be both astonished and ashamed by the century of mindless recycling that has led to the persistence of these drawings in a large number, if not a majority, of modern textbooks.”

After I noticed the faked embryo drawings (and published an article about them in the peer-reviewed journal *The American Biology Teacher*), I turned my attention to the peppered moth story. Before 1800 all (or almost all) peppered moths were a speckled gray. When the industrial revolution filled the air with smoke, however, the peppered moth populations became mostly dark-colored. Darwinian biologists attributed the shift to natural selection: Since dark-colored moths were better camouflaged on pollution-darkened tree trunks, they survived and reproduced while predatory birds ate the light-colored moths. In the 1950s, Bernard Kettlewell sought evidence for this explanation by releasing light and dark moths onto tree trunks in polluted and unpolluted woodlands. He watched as birds ate the more visible ones, and when he recaptured as many as he could he found that the better-camouflaged moths survived in greater numbers.

The peppered moth story and Kettlewell's experiments are still featured in most introductory biology textbooks as the classic demonstration of natural selection in action. In most cases, the story is illustrated with photographs of light and dark peppered moths resting on light and dark tree trunks, to show the striking differences in camouflage.

Yet biologists in the 1980s discovered several anomalies in the classic story, including the fact that peppered moths don't normally rest on tree trunks. The textbook photographs were staged—often by pinning or gluing dead moths in place. (This practice may have been justified when biologists thought the moths naturally rest on tree trunks, but it should have stopped once the truth was known.)

Again, I was not the only scientist to notice the problem. In 1998, University of Massachusetts biologist Theodore Sargent and two colleagues wrote in the journal *Evolutionary Biology* that although natural selection may, indeed, have caused the shift from light to dark peppered moths during the industrial revolution, “there is little persuasive evidence, in the form of rigorous and replicated observations and experiments, to support this explanation at the present time.”

The same year, University of Chicago evolutionary biologist Jerry Coyne wrote in *Nature* that the fact that peppered moths do not rest on tree trunks “alone invalidates Kettlewell's release-and-recapture experiments, as moths were released by placing them directly onto tree trunks.” Coyne concluded that this “prize horse in our stable of examples” of evolution “is in bad shape, and, while not yet ready for the glue factory, needs serious attention.”

Despite these misgivings about the classic story among professional biologists, many introductory textbooks still present the story—complete with staged photographs—without informing students about any of its problems.

The embryos and moths are only two of the ten examples I discuss in my book, but I think they make the point. How does Gross respond? (1) He calls the examples “wrong and deceitful”; (2) he points out that “not one of them is about a ‘proof’ of Darwinism”; and (3) he dismisses them as present only “in some few school science textbooks.”

I think the facts laid out above—supported by references to the peer-reviewed scientific literature (of which Gross cites none) are sufficient to refute the “wrong and deceitful” claim, at least for the two examples I describe.

As for Gross's statement that my examples are not about “proof” for Darwinism: I never claimed that they were. In science, one piece of evidence rarely, if ever, constitutes “proof” for a theory, and removing one piece of supporting evidence rarely, if ever, topples it. Nevertheless, scientific theories must ultimately be judged by the quality of the evidence for them. When some of the best-known evidence for Darwin's theory of evolution turns out to be exaggerated, distorted, or even faked, scientists have a right—if not a duty—to look skeptically at it.

Gross claims that the examples I cite are found only “in some few school science textbooks.” Yet when I surveyed ten widely used biology textbooks in 2000, I found some version of the embryo drawings in eight of them, and staged photos of peppered moths in six. This year (2003), the Texas State Board of Education is evaluating eleven new biology textbooks for possible adoption in the public schools; three of them contain the same faked embryo drawings that were discredited over a century ago, and five use staged photos to illustrate the peppered moth story but omit any mention of the story’s flaws. For details go to <http://www.discovery.org/scripts/viewDB/index.php?program=CRSC&command=view&id=1522>.

Gross lists several web sites that feature critiques of my book. I would encourage any NAS members interested in the controversy to visit them; but I would also encourage NAS members to read my response. It’s titled “Critics Rave Over *Icons of Evolution: A Response to Published Reviews*,” and it’s available at <http://www.discovery.org/scripts/viewDB/index.php?program=CRSC%20Responses&command=view&id=1180>.

Jonathan Wells
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Discovery Institute

From Michael J. Behe:

In “Intelligent Design and that Vast Right-Wing Conspiracy,” Paul Gross snickers that I compare my own work on intelligent design to “the discoveries of Copernicus and Galileo.” It goes without saying that no member of the National Association of Scholars need pay attention to such a crank. (Thank God he didn’t divulge my habit of wearing a Napoleon-hat and walking around with my hand in my coat.) Well, why don’t we just look a little closer at what Gross portrays as my claim to a place in the pantheon.

I assume Gross is referring to a passage from the opening paragraphs of the last chapter of *Darwin’s Black Box* in which I wrote the following:

Over the past four decades modern biochemistry has uncovered the secrets of the cell. The progress has been hard won. It has required tens of thousands of people to dedicate the better parts of their lives to the tedious work of the laboratory....

The result of these cumulative efforts to investigate the cell ... is a loud, clear, piercing cry of “*design!*” ... The observation of the intelligent design of life is as momentous as the observation that the earth goes around the sun or that disease is caused by bacteria or that radiation is emitted in quanta. The magnitude of the victory gained at such great cost through sustained effort over the course of decades, would be expected to send

champagne corks flying in labs around the world....

Why does the scientific community not greedily embrace its startling discovery?[1]

Let's notice a couple of things about this passage, which Gross does not actually quote. First, observe that I speak of effort over the course of decades. Does Gross really think I meant my own work? I'm not *that* old! And second, notice that the antecedent to "its" in the last sentence is "the scientific community," not "Behe." In fact, in writing this passage I intended to convey—and I think the words of the passage ("modern biochemistry," "thousands of people," "cumulative efforts," "labs around the world") clearly indicate to any fair-minded reader—that all credit is due to the community of molecular biological scientists as a whole, whose ongoing efforts have made the design of life obvious. It does not take a rocket scientist to see design in the machinery of the cell (just take a look at a drawing of the bacterial flagellum[2]); the hard work was in the day-to-day research detailing the astonishing complexities of the cell, to which I have contributed very little.

Now, with Gross's ridicule as background, I want to argue to the members of the National Association of Scholars that, whatever other admirable qualities he may have, Paul Gross is an unreliable guide on the topic of Darwinism. Rather, he is a committed Darwinist who gives a partisan's account of the subject. If you agree with me that the quoted passage does not jibe with the spin Gross puts on it, then that leaves us with several unpalatable options: 1) Gross didn't read the passage closely; or 2) he read it, but thought he could construe the words to paint an unflattering portrait of an intellectual adversary. It has always been my understanding, however, that in debate a scholar should interpret a text in the most charitable possible way. It is a serious breach of civil discourse to distort the meaning of a text to portray an intellectual opponent as somewhat unbalanced. Thus we are left with a man who either does not closely read the work he is caustically criticizing, or who strains to put an uncharitable twist on the words of those with whom he disagrees.

Either way, this is not someone from whom we should expect an impartial evaluation of either Darwinism or intelligent design. Gross's unreliability becomes much more important as he turns from discussing the mental instability of those who disagree with him to assessing the state of the evidence for Darwinian evolution. Since his article is rich in assertions but poor in reasoned argument, then a reader has only Gross's say-so on whether a review is "devastating," whether my argument contains "howlers," or whether a paper in a recent issue of the *Proceedings of the National Academy of Sciences* says anything at all relevant to the problems with Darwinism I pointed to.

In his essay Professor Gross grouches that mine "is just the old Argument from Personal Incredulity." Let me return the compliment. I must say that, when the subject is Darwinism, as a group Darwinists are the most credulous people I have ever met. Gross and like-minded folks have no trouble at all believing—in fact, they insist that everyone believe—that the most intricate and elegant biological machinery was put together in tiny

steps by random mutation and natural selection, despite an utter lack of evidence for it. Within this credulous mindset any retort to a critic of Darwinism on the order of “Yeah, says who?” strikes the faithful as “devastating.” Gross points to Ken Miller’s review of my book. Miller and I have debated a number of times, most recently at the American Museum of Natural History, and each have chapters in a forthcoming book to be published next year by Cambridge University Press. His chapter is already available on his website.[3] In the 6000-plus words of his chapter, Miller gives no further details of how an unintelligent process could produce an irreducibly complex molecular machine such as the bacterial flagellum than he gave in the brief debate. His chief strategy is rhetorical (attacking the definition of irreducible complexity I offered in *Darwin’s Black Box*) rather than scientific (offering experimental evidence that the process of random mutation and natural selection, which Darwinists assert to be so powerful, could indeed do what they claim). I will wait for the book to come out before posting the entirety of my chapter. However, to give a flavor of his criticisms and my response, in the following endnote I reproduce three paragraphs from my chapter.[4]

As a closing reason to think there may be more to the subject than Paul Gross admits, listen to Lynn Margulis, a biologist at the University of Massachusetts, member of the National Academy of Sciences, and no fan of intelligent design. In her 2001 book, *Acquiring Genomes*, she writes (p. 103): “Like a sugary snack that temporarily satisfies our appetite but deprives us of more nutritious foods, neodarwinism sates intellectual curiosity with abstractions bereft of actual details—whether metabolic, biochemical, ecological, or of natural history.” Or consider the more pointed judgment of another scientist about the state of Darwinism. In 2001 Oxford University Press published *The Way of the Cell* by Colorado State University biochemist emeritus Franklin Harold. Harold swears allegiance to materialism (“I share the commitment to a material conception of life.”[5]) but candidly observes,

We should reject, as a matter of principle, the substitution of intelligent design for the dialogue of chance and necessity (16) [*Harold’s citation is to my book, Darwin’s Black Box*]; but we must concede that there are presently no detailed Darwinian accounts of the evolution of any biochemical system, only a variety of wishful speculations.[6]

Questions that might pop into your head after reading this comment by Harold are: Exactly what “principle” forbids consideration of intelligent design? (Harold never says.) And, why is Darwinism taken to be orthodoxy if it has produced “only a variety of wishful speculations”? Neither of those interesting questions would occur to someone who read only Paul Gross’s comments.

Since responsible scholars need to read widely on a controversial topic before forming an opinion on it, I would ask interested readers to examine the replies that I have made to the many, many critics of intelligent design. Some of the replies can be found at the website of the Discovery Institute.[7] Original citations to published material include the following:

Behe, M.J. 2004. "Irreducible Complexity: Obstacle to Darwinian Evolution." In *Debating Design: from Darwin to DNA*, Ruse, M. and Dembski, W.A., eds., Cambridge University Press, in press.

Behe, M.J. 2003. "The Modern Intelligent Design Hypothesis: Breaking Rules." In *God and Design: The Teleological Argument and Modern Science*, Neil Manson, ed., Routledge, pp. 277-291.

Behe, M.J. 2001. Reply to My Critics: A Response to Reviews of Darwin's Black Box: The Biochemical Challenge to Evolution, *Biology and Philosophy* 16, 685-709.

Behe, M.J. 2000. Self-Organization and Irreducibly Complex Systems: A Reply to Shanks and Joplin. *Philosophy of Science* 67, 155-162.

Endnotes

[1] Behe MJ: *Darwin's black box: the biochemical challenge to evolution*. New York: The Free Press; 1996, pp. 232-233.

[2] A drawing of the flagellum from the biochemistry textbook by Voet & Voet is used as the frontispiece of *Darwin's black box*.

[3] <http://www.millerandlevine.com/km/evol/design2/article.html>, last accessed October 9, 2003.

[4] "Finally, rather than showing how their theory could handle the obstacle, some Darwinists are hoping to get around irreducible complexity by verbal tap dancing. At a debate between proponents and opponents of intelligent design sponsored by the American Museum of Natural History in April 2002, Kenneth Miller actually claimed (the transcript is available at the website of the National Center for Science Education) that a mousetrap isn't irreducibly complex because subsets of a mousetrap, and even each individual part, could still "function" on their own. The holding bar of a mousetrap, Miller observed, could be used as a *toothpick*, so it still had a "function" outside the mousetrap. Any of the parts of the trap could be used as a paperweight, he continued, so they all had "functions." And since any object that has mass can be a paperweight, then any part of anything has a function of its own. *Presto*, there is no such thing as irreducible complexity! Thus the acute problem for gradualism that any child can see in systems like the mousetrap is smoothly explained away.

"Of course the facile explanation rests on a transparent fallacy, a brazen equivocation. Miller uses the word "function" in two different senses. Recall that the definition of irreducible complexity notes that removal of a part "causes the *system* to effectively cease functioning." Without saying so, in his exposition Miller shifts the focus from the separate function of the intact *system* itself to the question of whether we can find a

different use (or “function”) for some of the *parts*. However, if one removes a part from the mousetrap I pictured, it can no longer catch mice. The *system* has indeed effectively ceased functioning, so the *system* is irreducibly complex, just as I had written. What’s more, the functions that Miller glibly assigns to the parts—paperweight, toothpick, key chain, etc.—have little or nothing to do with the function of the system of catching mice (unlike the mousetrap series proposed by John McDonald, discussed below), so they give us no clue as to how the system’s function could arise gradually. Miller explained precisely nothing.

“With the problem of the mousetrap behind him, Miller moved on to the bacterial flagellum—and again resorted to the same fallacy. If nothing else, one has to admire the breathtaking audacity of verbally trying to turn another severe problem for Darwinism into an advantage. In recent years it has been shown that the bacterial flagellum is an even more sophisticated system than had been thought. Not only does it act as a rotary propulsion device, it also contains within itself an elegant mechanism to transport the proteins that make up the outer portion of the machine, from the inside of the cell to the outside. (Aizawa 1996) Without blinking, Miller asserted that the flagellum is not irreducibly complex because some proteins of the flagellum could be missing and the remainder could still transport proteins, perhaps independently. (Proteins similar—but not identical—to some found in the flagellum occur in the type III secretory system of some bacteria. See Hueck 1998). Again he was equivocating, switching the focus from the function of the system to act as a rotary propulsion machine to the ability of a subset of the system to transport proteins across a membrane. However, taking away the parts of the flagellum certainly destroys the ability of the system to act as a rotary propulsion machine, as I have argued. Thus, contra Miller, the flagellum is indeed irreducibly complex. What’s more, the function of transporting proteins has as little directly to do with the function of rotary propulsion as a toothpick has to do with a mousetrap. So discovering the supportive function of transporting proteins tells us precisely nothing about how Darwinian processes might have put together a rotary propulsion machine.” (From Behe, M.J. 2004. “Irreducible Complexity: Obstacle to Darwinian Evolution.” In *Debating Design: from Darwin to DNA*, Ruse, M. and Dembski, W.A., eds., Cambridge University Press, in press.)

[5] Harold FM: *The Way of the Cell*. Oxford: Oxford University Press; 2001, p. 65.

[6] Harold, p. 205.

[7] The exact URLs for the articles are quite long. Instead of listing them, I will just tell the interested reader to go to <http://www.discovery.org/csc> and click on the “Reply to critics” link at the bottom of the page. You’ll be taken to a page with a list of articles, many by myself, which address the most prominent objections raised by ID critics.

Michael J. Behe
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From William A. Dembski:

A few years back, well-known skeptic Michael Shermer and I were in a bar in Waco having drinks. We discussed how we could generate funds for our respective causes—he to promote skepticism and debunk people like me, and me to promote intelligent design and debunk Darwinism (which underwrites Shermer’s brand of skepticism). We agreed that we should start a highly visible campaign against each other in which we argue the dangers of the other’s position. Having escalated the conflict between us, we could then go to our natural constituencies and urge them to fund each of us against the other. Of course, nothing ever came of that conversation. But we had a chuckle. And both our causes have since done quite well financially.

I tell this story because when I read Paul Gross’s savaging of intelligent design and of my work in particular in the NAS’s *Science Insights*, I couldn’t help but see it as a gift. Here he was doing everything I would have liked Michael Shermer to do for me, only I didn’t have to respond in kind. What do I mean? It’s one thing if a critic has truly substantive arguments that damage your position. But it’s another when the critic makes such transparently feeble arguments that a few simple observations demolish the criticism. Paul Gross is such a critic. And critics like this are wonderful for generating support from one’s natural constituency: “You mean you have to deal with that sort of low polemic from the high priests of modern science. How much money do you need to reform the system? Let me get my checkbook.”

What’s so obviously wrong with Gross’s article? Since others are responding to Gross’s criticism of their work, I’ll confine my remarks to Gross’s criticism of my own work. Let’s begin with Gross’s criticism of the “design inference,” which he puts in scare quotes. He cites critiques of it by Victor Stenger, Jason Rosenhouse, and Richard Wein, and then, without justification or elaboration, merely asserts that they have decisively refuted my work on this topic.

What Gross doesn’t disclose is that I have a book titled *The Design Inference*, published by Cambridge University Press. It was peer-reviewed as part of a Cambridge monograph series: *Cambridge Studies in Probability, Induction, and Decision Theory*. In that book I lay out in full technical detail a method of design detection applicable to biology. Perhaps Gross neglected to mention this because the editorial board of that series included members of the National Academy of Sciences as well as one Nobel laureate, John Harsanyi, who shared the prize in 1994 with John Nash, the protagonist in the film *A Beautiful Mind*. The editors and referees of *The Design Inference* were in each case more qualified to judge its merits than the three individuals Gross cites. (Richard Wein, for instance, holds nothing more than a bachelor’s degree in statistics).

Gross refers to “a dozen point-by-point refutations” of my work on the design inference. But if I have been refuted, why not cite my most formidable critic rather than amateurs like Stenger, Rosenhouse, and Wein. All the critics of my work, when pushed to cinch their critique, end up citing Stanford’s Elliott Sober, who critiques my work from a Bayesian perspective. Sober has now published four or so articles either exclusively

devoted to critiquing my work or devoting substantial space to it, including a long critical review of *The Design Inference* for the journal *Philosophy of Science* as well as his 1999 presidential address to the American Philosophical Association (which was subsequently reprinted).

What about Sober's criticisms? I deal with them in *No Free Lunch* and again in *The Design Revolution* (which is forthcoming). In my view, I've answered Sober's concerns successfully and completely. But suppose you think Gross is a more credible witness than I and you don't want to take my word for it. Then consider the following remark by Paul Davies, a prolific science writer, a well regarded physicist in his own right, and no proponent of intelligent design: "Dembski's attempt to quantify design, or provide mathematical criteria for design, is extremely useful. I'm concerned that the suspicion of a hidden agenda is going to prevent that sort of work from receiving the recognition it deserves. Strictly speaking, you see, science should be judged purely on the science and not on the scientist." (Quoted in L. Witham, *By Design* [San Francisco: Encounter Books, 2003], p. 149.) Note that Davies made this remark when asked about Elliott Sober's criticism of my work.

Davies is a serious physicist and regards my work on information as important (I correspond with him regularly by email, and readers can confirm Davies's view of my work for themselves). But instead of citing people of Davies's stature and caliber, Gross refers to the "experts" who "have ignored or scorned" my work on information, notably my work on the Law of Conservation of Information. Who are his experts? Right after referring to them, he cites an article with the following URL: http://talkreason.org/articles/dembski_LCI.pdf. Who wrote this article? An anonymous Internet persona named "Erik." I understand that Erik is a graduate student in mathematics in Sweden. Even though Erik, like Gross's other "experts," is an amateur, I responded at length to Erik on my website (at http://www.designinference.com/documents/2002.08.Erik_Response.htm).

What about the Law of Conservation of Information? Gross claims that it is a new law of nature, that I've introduced it, and that introducing a new law of nature is the mark of a crank science. Each of these claims is false. Certainly if the mere introduction of a new law of nature signified a crank science, then genuine scientists could never discover and introduce any new laws at all. But the more important point for this discussion is that I'm not introducing anything fundamentally new. The very phrase "Law of Conservation of Information" is due not to me but to the biologist Peter Medawar (see his *The Limits of Science*, 1984). What's more, he used it, albeit in a restricted sense, in the same way I use it.

I also identify this law with a Fourth Law of Thermodynamics. But again, I'm not claiming to introduce anything fundamentally new. If Gross had read my book *No Free Lunch*, where I give a history of this law, he would realize that it goes back at least to the mid 1970s to some speculations by Victor Weisskopf and that more recently it has received careful attention from Stuart Kauffman (see his most recent book with Oxford titled *Investigations*). Kauffman and I are conversation partners. We have debated

publicly at the University of New Mexico and spent several days together at a symposium in Santa Fe. He even graciously consented to do an online chat through a professional organization I helped found (the International Society for Complexity, Information, and Design (for the chat transcript, go to <http://www.iscid.org/stuartkauffman-chat.php>).

The Law of Conservation of Information or, equivalently, the Fourth Law of Thermodynamics attempts to understand a deep problem in thermodynamics and information theory. An intuitive way to think about the problem is in terms of two CDs, one with random bits and the other with the latest Microsoft Windows operating system. From the vantage of the Second Law of Thermodynamics, these CDs are indistinguishable. And yet informationally they are very different. The underlying problem here goes back to Maxwell and his famous demon, in which the Second Law of Thermodynamics could be reversed given an appropriate information source. The Law of Conservation of Information attempts to come to grips with such information sources.

How has the scientific community received my work? Of those who have actually read it, by and large I find scientists intrigued. I speak around the globe to science faculties (to take just one upcoming example, mathematicians at the Niels Bohr Institute in Copenhagen invited me to speak there about my work on the design inference in the spring of 2004). More significantly, given Gross's unending refrain that intelligent design is crank science, my work is favorably cited in the peer-reviewed mathematical and biological literature (for the actual references see the ID FAQ on my website: http://www.designinference.com/documents/2003.09.ID_FAQ.pdf).

Gross is playing a losing game if he wants to say that my work on intelligent design is not science. If he doesn't like the peer-reviewed scientific articles that currently cite my work - perhaps he thinks they don't make sufficiently extensive use of my work or they were not published with sufficiently prestigious journals or presses - let him consider that there is more in the pipeline and that the charade that methods of design detection are not scientific when applied to biology will grow increasingly implausible.

I want next to address Gross's reference to me as a "theologian and mathematician." I hold a Ph.D. in mathematics from the University of Chicago. I've also done postdoctoral work in mathematics at MIT, computer science at Princeton, and physics at the University of Chicago. Besides mathematics, I hold a Ph.D. in philosophy from the University of Illinois at Chicago and have done postdoctoral work in that field at Northwestern University and the University of Notre Dame. My area of specialization is the philosophy of science, and I'm currently an associate research professor in the conceptual foundations of science at Baylor University. And finally, I hold an M.Div. from Princeton Theological Seminary.

Now, I'm certainly proud of my theological background and enjoy writing on theological topics, especially on what I take to be the theological implications of my work on intelligent design. But I keep my technical work on design detection separate from its theological implications. The former I publish through standard academic outlets. The latter I publish through religious outlets. Gross, however, makes sure this distinction is

missed. Thus he quotes some of my most flamboyantly theological writings and suggests that these are representative of my work on intelligent design. Not so. As a public intellectual, I'm perfectly in my rights to explain what I take to be the broader implications of my work. But I always insist that the actual mathematical and scientific work must stand on its own merits. I'll be the first to admit that intelligent design is an ambitious program whose full implications for science are not yet clear. But it needs first to be fairly discussed. Gross, in his article for *Science Insights*, attempts to keep that discussion from ever starting.

One of my friends at Oxford, a senior scholar who works in the history of physics, has watched the vituperation and storm of controversy that surrounds my work and continually counsels me to keep my polemical streak in check. Yet when I referred him to Gross's article, here's what he wrote:

My goodness, Bill, this is loaded with extreme polemical language almost from the first sentence. I find it so biased that I simply cannot get beyond the first page. That the editor is proud to present this polemical babble is astonishing. If this is the best that the "scientific establishment" can do, then that establishment is culturally decadent. It confirms what I have worried about for a long time: that science today simply does not have the cultural depth, the conceptual and linguistic resources, to conduct civilized scholarly debate about its foundational commitments and assumptions. Thomas Huxley would be deeply embarrassed by this article. If you have to deal daily with this kind of low polemic, there is a real danger of being dragged down to their level. I am more sympathetic than ever with what you have to deal with.

Notwithstanding, I remain grateful for all of Paul Gross's efforts to unseat intelligent design and my work in particular. I want to encourage him to keep at it, especially through the NAS (provided, of course, my colleagues and I are given the opportunity, as here, to unmask his shenanigans). Indeed, I'm particularly heartened to see his forthcoming book with Barbara Forrest, tentatively titled *Creationism's Trojan Horse: The Wedge of Intelligent Design*, to be published, no less, by Oxford University Press.

Through all such efforts, Gross, however much he would like to deny it, is tacitly conceding that there are multiple millions of people who find it plausible or even self-evident that the world was designed by intelligence. These multiple millions now have a voice in the academic and scientific world, effective enough that Gross and his colleagues have to spend a lot of time writing articles and even whole books attacking intelligent design (and in some cases, like Robert Pennock, they even make an academic career attacking it).

Gross's efforts to unseat intelligent design make clear to my natural constituency that there are still lots of dogmatic scientists out there who are unwilling to consider the claims of intelligent design dispassionately. They see Gross's misrepresentations and character assassinations as a profanation of the scientific enterprise. And they are only too happy to support its reform in the name of intelligent design. So thank you Paul

Gross. And thank you Michael Shermer for clarifying, if only by counterexample, just what “Reasoned Scholarship in a Free Society” means.

William A. Dembski
Conceptual Foundations of Science
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From John G. West (for Discovery Institute):

“Darwinism... is the ‘politically correct’ of science,” observes Italian geneticist Giuseppe Sermoni. (“Darwin is a Prime Number,” *Rivista di Biologia*, 95 [2002], p. 10). Perhaps the best that can be said of Paul Gross’s “Intelligent Design and that Vast Right-Wing Conspiracy” (*Science Insights*, Sept. 2003) is that Gross succeeds rather spectacularly in proving Sermoni right.

Gross is convinced that scientific critics of neo-Darwinism must be “crackpots,” “bogus scientists,” or “scientific illiterates” who are driven by their religious fanaticism and whose ideas can be dismissed without a fair hearing. Demonizing one’s opponents in this way is standard practice in much of what passes for public life today. That doesn’t make such harangues particularly constructive, and as a member of NAS, I was surprised that an organization so devoted to defending the academic freedom of scholars would print an essay that seems directed at shutting down debate rather than encouraging it.

Nevertheless, on reflection I am thankful Gross’s piece was published, if only because it provides such a clear example of the self-righteous and dogmatic mindset exhibited by many leading Darwinists. It also exposes just how lacking in self-reflection some Darwinists are about their own beliefs.

For instance, only someone blissfully unaware of what he is saying could indict others for conspiracy-mongering while at the same time accusing them of being part of a “vast right-wing conspiracy”! Presumably that part of the title of Gross’s article was supposed to be playful, but the article itself makes clear that Gross really *does* think there is a sinister conspiracy afoot to undermine modern science by using “the power of money, public relations, and politics to convince millions of good but credulous people of the truth of what is in fact baloney.” According to Gross, this conspiracy is headquartered at the big bad Discovery Institute in Seattle, and its object is nothing less than overthrowing the separation between church and state. Prof. Gross’s effort to caricature the scientific controversy over Darwinism as a struggle between religious extremism and enlightened science is a tactic so old it has whiskers on it. I fear Prof. Gross has watched one too many re-runs of *Inherit the Wind*.

For the record, Discovery Institute is a secular think tank, and its fellows and board members represent a variety of religious traditions, including mainline Protestant, Roman Catholic, Orthodox, Jewish, and agnostic. Until recently the Chairman of Discovery’s Board of Directors was former Congressman John Miller, who is Jewish. Although it is

not a religious organization, the Institute has a long record of supporting religious liberty and democratic pluralism. In fact, it sponsored a program for several years for college students to teach them the importance of religious liberty and the separation of church and state. Our fellows and board members would be rather surprised to find out that they are at the heart of some sort of theocratic cabal. As for whether teaching intelligent design would violate the First Amendment establishment clause, interested readers might want to consult the views of legal scholars rather than Gross. Francis Beckwith, associate director of the nation's most respected university institute on church-state studies, has just published a book arguing that teaching about intelligent design is perfectly constitutional. (Beckwith, *Law, Darwinism, and Public Education: The Establishment Clause and the Challenge of Intelligent Design* [Rowman and Littlefield, 2003]; also see DeWolf, Meyer, and DeForrest, "Teaching the Origins Controversy: Science, Religion, or Speech?" *Utah Law Review* (2002), available on the web at <http://147.222.27.5/people/dewolf/utah.pdf>.)

Others are better equipped to handle the few scientific points actually raised by Gross. I would like to focus instead on what seems to be his primary argument, which is at once stunningly simple and breathtakingly unscientific: According to Gross, scientists and other scholars supporting intelligent design have religious motives. Therefore, their writings about science can be dismissed. Q.E.D.

For someone presumably devoted to the scientific method, such an argument (if I may charitably call it that) is rather astonishing. Scholars are supposed to be evaluated on the quality of their evidence and arguments, not their motives. Moreover, I expect most NAS members (as well as most Americans) are likely to find Prof. Gross's blatant religion-baiting singularly unappealing. Last time I checked, scholars who believe in God are just as entitled to a fair hearing in the public square as anyone else. Using someone's religious beliefs as a method of stigmatizing his scientific views is little more than bigotry.

If Prof. Gross genuinely believes that motives are enough to rebut someone's views about science, then he will have to be a lot more consistent if he wishes to be taken seriously. In particular, he should start applying his litmus test to fellow Darwinists, many of whom have rather strong personal motivations of their own.

For example, Darwinists Francis Crick and James Watson, co-discoverers of the structure of DNA, are outspoken atheists, and Crick has indicated that his scientific research was motivated by a desire to undermine belief in religion. (See Crick's comments in Roger Highfield, "Do our genes reveal the hand of God?" *The Daily Telegraph*, March 20, 2003.) Ditto for physicist and Nobel laureate Steven Weinberg, another champion of Darwinism, who says that he hopes the demise of religion "is something to which science can contribute and if it is, then I think it may be the most important contribution that we can make." (See, "Free People from Superstition," <http://www.ffrf.org/fttoday/april2000/weinberg.html>.)

Physicist Victor Stenger, whose critique of intelligent design Prof. Gross recommends, holds similar views. Stenger laments that "most scientists would probably classify

themselves as *agnostics* rather than *atheists*,” but adds that he hopes “some of these agnostic scientists will take a more careful look at the empirical data and realize, as I have, that these data are already sufficient to make a strong, scientific statement about the very likely nonexistence of the Judeo-Christian-Islamic God. I also hope that scientists will realize that they cannot sit back and ignore the current challenges to science being made by religious zealots who wish to suppress this fact.” (See, <http://spot.colorado.edu/~vstenger/Found/00Preface.pdf>.) Does Gross think that the aggressive atheism of these scholars is relevant to assessing the truth of their scientific views? Or is it only *religious* motives that make a scientist’s work suspect, not anti-religious motives?

Similar questions might be asked about Gross’s comrade-in-arms Barbara Forrest, who is building her career by outing and denouncing the presumed religious motives of academic critics of Darwin. Prof. Forrest serves on the board of directors of a group called the “New Orleans Secular Humanist Association,” which describes itself as “an affiliate of American Atheists, and [a] member of the Atheist Alliance International.” (See <http://nosha.secularhumanism.net>.) Do Prof. Forrest’s anti-religious beliefs disqualify her as a legitimate philosopher of science according to Prof. Gross? Applying Prof. Gross’s own motivation standard, should people dismiss his new book with Prof. Forrest as nothing more than the rant of a militant secularist?

For my part, I hope not. Professors Gross and Forrest deserve to be refuted on the demerits of their arguments, not on speculations about their motives. But the same courtesy should be extended to scholars who are challenging Darwinian theory. In any case, Prof. Gross and other Darwinists should apply a consistent standard when dealing with the questions of motives. Either motives don’t matter for any scientist, or they matter for all of them.

In addition to his preoccupation with motives, Prof. Gross criticizes proponents of intelligent design for engaging in what he calls politics and public relations to promote their cause. As a political scientist, I always find it amusing when someone accuses an opponent of engaging in “politics” while he happens to be employing tactics straight from the world of partisan campaigning himself. This is especially so in Prof. Gross’s case, because he relies heavily on such hardball political tactics as guilt by association (e.g., conflating intelligent design with creationism) and character smears (e.g., denigrating his scientific opponents as simply religious zealots). At the end of his article, he even appeals to a public relations stunt, invoking last year’s resolution condemning intelligent design by the board of the American Association for the Advancement of Science (AAAS).

The AAAS resolution is typically touted by Darwinists as some sort of authoritative determination from the “scientific community” about the scientific legitimacy of intelligent design. But was the resolution an example of science or politics? After the resolution was issued, I surveyed members of the AAAS board about what books and articles by scientists favoring intelligent design they had actually read before adopting their resolution. Alan Leshner, the Chief Executive Officer of the AAAS, declined to

specify any and replied instead that the issue had been analyzed by his group's policy staff. Two other AAAS board members similarly declined to identify anything they had read by design proponents, while yet another board member volunteered that she had perused unspecified sources on the internet. In other words, AAAS board members apparently voted to brand intelligent design as unscientific without studying for themselves the academic books and articles by scientists proposing the theory. Does Prof. Gross wish to hold this up as a model for how the "scientific community" should determine scientific truth? Does he think it is good science (or even science at all) to condemn a new scientific idea without even bothering to read those scientists who are proposing it?

Presumably even Prof. Gross won't defend such a procedure, but he may respond by reiterating his complaint that intelligent design proponents don't publish their work in peer-reviewed journals. Except that they do. Michael Behe has defended his theory of irreducible complexity in *Philosophy of Science* (published by the University of Chicago) and *Biology and Philosophy*. (See Prof. Behe's response for references.) Then there are academic books like *The Design Inference*, published as part of a peer-reviewed monograph series put out by Cambridge University Press. The fact of the matter is that design scientists are publishing in peer-reviewed venues. When critics of design are forced to admit this fact rather than ignore it, they end up drawing artificial distinctions. They may insist, for example, that *Philosophy of Science* and *Biology and Philosophy* are not "relevant," even though such theoretical journals are an appropriate place to debate a new scientific theory, and both journals are indexed in standard scientific databases such as *Biosis* and the *Science Citation Index*.

Other critics may try to claim that peer-reviewed books "don't count," despite the fact that the evaluation process for peer-reviewed academic books is for all intents and purposes the same as for peer-reviewed journals. In both cases, a manuscript is sent out to one or more anonymous experts who are expected to critique its content, judge its accuracy, and determine its contribution to the discipline. It should be noted that design scholars have published peer-reviewed work on this topic even though some Darwinists have actively sought to disqualify articles supportive of design on *a priori* grounds. The editorial board of one science journal, for example, rejected a submission by Michael Behe with the following explanation: "As you no doubt know, our journal has supported and demonstrated a strong evolutionary position from the very beginning, and believes that evolutionary explanations of all structures and phenomena of life are possible *and inevitable*." (emphasis added) Evolutionary explanations for "all structures and phenomena of life" are "inevitable"? Is this an empirical statement or an ideological one? (See Behe, "Correspondence with Science Journals: Response to critics concerning peer-review," [http://www.discovery.org/scripts/viewDB/index.php?program=CRSC %20 Responses&command=view&id=450](http://www.discovery.org/scripts/viewDB/index.php?program=CRSC%20Responses&command=view&id=450).)

Despite such efforts to stop discussion before it starts, other scientists are beginning to draw on the work of design theorists in their own articles, such as a recent article in the *Annual Review of Genetics* that favorably cites the work of both Behe and Dembski. (W.-E. Loennig & H. Saedler, "Chromosome Rearrangements and Transposable Elements,"

Annual Review of Genetics, 36 [2002]: 389–410.) The “no peer review” charge is a convenient sound bite, but it distorts reality.

Readers who want to go beyond sound bites and evaluate the strengths and weaknesses of intelligent design theory for themselves should consult *Darwinism, Design, and Public Education*, a new book just published by Michigan State University Press that includes scholarly articles from both proponents and critics of design. (See <http://msupress.msu.edu/bookTemplate.php?bookID=725>.) Readers interested in an account of the history of the modern design movement by a third party might also read *By Design* (Encounter Books, 2003) by journalist Larry Witham. Of course, those who love conspiracy theories and want to cling to the old religion vs. science stereotype may prefer to read the new book by Professors Gross and Forrest instead. I’m sure they will find it suitably reassuring.

While the effort of Darwinists to demonize their scientific critics may continue to be an effective public relations strategy for a few more years, this line of attack is going to become increasingly implausible as a new generation of biologists, biochemists, mathematicians, and physicists continue to develop the theory of intelligent design. Instead of acting like beleaguered defenders of a sacred dogma, modern Darwinists would be better advised to follow the example of the founder of their theory and respectfully engage their critics rather than demonize them. No scientific theory is so sacrosanct that it should be immune to critical questioning. When Charles Darwin faced scientific criticisms, he responded for the most part with evidence and argument rather than invective. He also acknowledged that “a fair result can be obtained only by fully stating and balancing the facts and arguments on both sides of each question.” (Darwin, *On the Origin of Species*, introduction.) Open debate is a hallmark not only of good science, but of a free society, and it ought to be welcomed rather than discouraged. Prof. Gross should heed the words of the founder of his own university, who wrote to one of his correspondents, “We both value too much the freedom of opinion... not to cherish its exercise even where in opposition to ourselves.” (Thomas Jefferson to P.H. Wendover, 1815)

John G. West

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From James Downard:

Since Paul Gross cited my Talk Reasons posting on David Berlinski (concerning his use of a ridiculously wrong article by creationist John Woodmorappe, recommended to him by Phillip Johnson), I should note that the thrust of my contribution is to focus on the methodological underpinnings that both separate and unite "pseudoscience" from regular "science."

I fear Gross perceives some vast gulf between the two, when (unfortunately) it is more of a spectrum, where pseudoscientists are employing much the same approaches as seen in various forms among conventional science. Although religious motivations and apologetic methods certainly pervade the ID movement, they are not in and of itself the core problem, which is methodological.

As a matter of record, it should be noted that Berlinski posted a most interesting set of replies to my piece at Talk Origins (which I invite Gross to explore), and Berlinski and I have been engaging in an equally provocative exchange of views (and exploring one another's mode of inquiry) ever since.

Which brings me to one area where I think Gross is indulging in a counterproductive rhetorical excess, and which serves to obscure some of the important differences among ID advocates. While the Discovery Institute set (and especially their young college-level supporters) tend to view their movement as the harbinger of a scientific revolution, and believe the evolutionary establishment fail to appreciate this out of their ideological commitment to naturalism (which Gross noted in his piece), I don't really see this as translating into a positive belief in a Vast Conspiracy.

James Downard

From Robert C. Koons:

It is ironic that leading members of the NAS, including Paul R. Gross, have joined the Inquisition against defenders of “intelligent design” and other dissenters from Darwinian orthodoxy. The motto of the NAS is “for rational scholarship in a free society,” and one might have thought that this obviously meant extending the protections of freedom of thought to those who, rightly or wrongly, offer rational objections to the Darwinian. Instead, in his recent essay in *Science Insights*, Gross employs exactly the kind of tactics of ad hominem attacks, name-calling, and guilty by association that have long been associated with the enforcers of political correctness in the academy.

Contrary to the impression left by Gross and John Wenger, the editor of *Science Insights*, members of the intelligent design movement do not call themselves “creationists”. This is a label used to demonize them by associating them with groups who attempt to impose fidelity to biblical texts upon scientific inquiry. In contrast, the intelligent design movement lies squarely within the venerable scientific tradition of Louis Agassiz, St. George Mivart, Richard Goldschmidt, Pierre Grassé, Gerald Kerkut, Hans Driesch, Marcel-Paul Schützenberger, and Michael Denton: scientists who have argued that narrowly materialistic explanations are inadequate to the task of explaining biological form and function. This tradition, an approach to biology radically different from the reductionism of Darwin, Monod, Dawkins, and others in the neo-Darwinian camp, grows daily in strength and extends far beyond the bounds of the intelligent design movement.

Consider, for example, a recent article by Michael Denton et al. in the *Journal of Theoretical Biology* (Denton, Marshall and Legge, “The Protein Folds as Platonic Forms: New Support for the Pre-Darwinian Conception of Evolution by Natural Law,” 219, 2002:325-342.)

Can Lay People have any Say?

Should what counts as sound biology be left entirely to the professional biologists? Should what counts as sound English scholarship be left entirely to the MLA? Members of the NAS know the answer to the second question, but the same principle applies to the first. Conservative iconoclast Richard M. Weaver addressed this very question in the 1960’s:

“Indeed the layman must not presume to question the facts assembled by qualified scientists (although what constitutes a fact is itself sometimes debatable)... The facts we are bound to receive if they come from sources that have given satisfactory evidence of their objectivity. But the reasoning that is done upon the basis of them is open to the inquiry of every man who has a rational faculty.

...if men are to be convinced that they are simply the products of evolution, the convincing must be done in accordance with the necessary laws of thought. This is merely saying that the layman has the right to ask about the connection between the factual evidence and the conclusion when that connection is not apparent to him. He has the right to ask philosophical questions about the way the facts have been handled and even about whether all of the relevant facts have been taken into consideration.” [*Visions of Order: The Cultural Crisis of our Time* (Louisiana State University Press, Baton Rouge, La., 1964), p. 138-9.]

Is the Darwinian Story of Evolution a Certainty?

Do we know beyond a shadow of doubt, as Gross and other defenders of the Darwinian paradigm, that random variation culled by natural selection is the one and only mechanism responsible for the thousands of complex adaptations we observe in living organisms? To meet the burden of proof, Darwinian evolutionists must fill two gaps: (1) Darwin’s sketchy schema of variation and selection must be filled out with sufficient detail in particular cases to enable us to verify that it could in fact be responsible for adaptations that bear the mark of apparent design, and (2) particular hypotheses produced in this way must be tested against the available evidence (both in the fossil record and in vestigial homologies). Note that the second task presupposes success at the first: to attempt to test a vague, schematic model of “variation with selection” or “random mutations and selection” rather than specific scenarios is to attempt the impossible. Any evidence that is found can be made to accord with schematic Darwinism, and so can be counted as evidence “for” the theory.

Take, for example, Richard Dawkins’s attempt (in *Climbing Mount Improbable*) to prove that Darwinism is able to explain the emergence of the vertebrate eye. Dawkins refers to

what he calls a "computer simulation" by Nilsson and Pelger (there was in fact no computer program, only some back of the envelope calculations), showing that one can gradually improve a light sensitive spot and reach, in 800 steps or so, a fully functional, lens-bearing eye. This might be impressive, except that the Nilsson and Pelger model (like every single model or computer simulation used by Dawkins in the book), entirely omits the two crucial details about real biology: the genotype/phenotype distinction, and the processes of embryological development. The steps in Nilsson and Pelger's model are phenotypical (i.e., changes in gross, morphological features in the fully formed adult). (Nilsson and Pelger, "A pessimistic estimate of the time required for an eye to evolve," *Proc. of the Royal Society B*, 256, 1994, pp. 53-8.) We are not given a model in which the successive forms of the eye are determined by successive trajectories of embryological development, nor are we given a model of how these successive trajectories are determined by successive, feasible mutations. Given these limitations, it is of course impossible to estimate the probabilities of the mutations required for each of the 800 steps in the creation of the vertebrate eye. The model cannot be used to generate even a single prediction about present-day residues of the actual history of the eye. A more recent paper in *Nature* by Lenski et al. is even further removed from biological reality. ("The evolutionary origin of complex features," *Nature* 523, 8 May 2003, pp. 139-144.)

How not to Detect "Bogus Science"

Gross relies heavily upon seven symptoms of "bogus science" proposed by physicist Robert L. Park. Gross's argument is a perfect example of the fallacy of accident. Instead of demonstrating that intelligent design is faulty by countering the arguments and evidence that have been garnered in favor of it, Gross instead argues that we need pay no attention to such actual reasoning: we can instead dismiss intelligent design by identifying several superficial characteristics (the so-called "symptoms") that it shares with various crackpot theories. This is of course a wholly unsound procedure: theories should be rejected because they are at variance with known facts, not because they bear a superficial resemblance to other theories we have rejected.

In fact, every one of Park's symptoms has characterized paradigmatically good scientists and research programs. The second symptom, the claim to have discovered new laws of nature, would have identified Newton, Einstein, Heisenberg and Darwin himself as crackpots. In fact, this symptom doesn't even apply to intelligent design: William Dembski does not claim to have "discovered" the law of the conservation of information. Instead, he simply brings this well-known and widely accepted result of information theory (the "no free lunch theorems") to bear on problems of the origin of biological information.

Park's first symptom is similarly flawed: saying that a powerful establishment is trying to suppress his or her work. It is, in fact, a sad but nonetheless demonstrable fact that new paradigms often encounter fierce resistance from entrenched interests in science. Consider, for example, the ridicule that Alfred Wegener, the first proponent of continental drift, encountered. It is not hard to multiply examples in all branches of

science. Some of these have been documented, ironically, by Gross himself: for example, the professional price that is often paid by global-warming skeptics and other dissenters from the establishment of ecological doomsday theorists.

Distortions of Science by Religious Dogma

Gross is rightly concerned about the danger of the restriction and censorship of free scientific inquiry motivated by religious zeal. However, he entirely overlooks the fact that such repression can as easily be motivated by religious zeal for atheism or anti-supernatural deism as by religious fundamentalism. Richard Dawkins has famously claimed that Darwinism makes it possible to be an “intellectually fulfilled atheist”. Biology textbooks clearly present Darwinian evolution as imbued with a dogmatic certainty more appropriate to creation myths than to tentative hypotheses, and they go out of their way to deny the possibility that any kind of agency or purpose may have been at work in earth’s pre-human history. As Stephen Barr observed in a recent issue of *Academic Questions*:

Both the theist and the atheist, then, have a stake in this question; but the stake of the atheist is clearly greater. Generally speaking, a religious person can accept either naturalistic or supernatural explanations of events, as the case may warrant. But, obviously, the atheist can *only* (emphasis Barr’s) accept naturalistic explanations, and thus really has no alternative but to believe that natural selection is the complete and sufficient explanation of evolution. On this issue the religious person can afford to be agnostic, whereas the atheist must be dogmatic...dogmatism of any sort has no place in scientific textbooks. And that is why I think it is an intellectual disgrace that so many textbooks treat the question of the causes of evolution as closed. [“Evolutionary Excesses: A Response to Moore,” *Academic Questions* 15 (2002): 79-84; 80.]

Behe and Irreducible Complexity

In *Darwin’s Black Box*, biochemist Michael Behe put forward two claims: (1) the literature contains no explanation (in the form of detailed pathways) of how certain complex molecular machines could have evolved from simpler forms, and (2) there are good grounds for believing that such pathways are highly unlikely. Behe introduced an expression that helps to clarify a central problem of Darwinian theory: *irreducible complexity*. A mechanism is irreducibly complex if it consists of a large number of mutually adjusted parts, it has a biological function, and it loses that function if any of these parts is removed. Behe argues that the origin of an irreducibly complex mechanism cannot be explained in neo-Darwinian terms, since it is too complex to be produced all at once by random mutations, and it cannot be built up by a series of gradual steps, since, by definition, the favored function cannot be fulfilled until all of the parts are present.

Gross rejects both of Behe’s claims. Yet, many even of Behe’s harshest critics have admitted that his first claim is true. For example, microbiologist James Shapiro of the University of Chicago declared in *National Review* that “There are no detailed Darwinian

accounts for the evolution of any fundamental biochemical or cellular system, only a variety of wishful speculations.” (“In the details...what?” 9-16-1996, 62-5) Andrew Pomiankowski agreed in *New Scientist*, “Pick up any biochemistry textbook, and you will find perhaps two or three references to evolution. Turn to one of these and you will be lucky to find anything better than ‘evolution selects the fittest molecules for their biological function.’” (“The God of the tiny gaps,” 9-14-1996)

Gross points out that the scientific literature contains many examples of “structures and processes that have clearly evolved (a) from simpler, less complex biochemical precursors that function in the same way, more or less, and (b) even from simple precursors with different functions than those of the contemporary structure...” (p. 7) This fact is irrelevant to Behe’s argument, for two reasons. First, Behe does not deny that there are cases of reducible complexity (Gross’s case (a)), such as antibiotic resistance in bacteria or antifreeze enzymes in arctic fish. Second, Behe is not denying that irreducibly complex structures have in fact evolved from simpler ones: he is simply denying that we can explain this evolution in neo-Darwinian terms.

What about the possibility that irreducibly complex mechanisms could have evolved in a step-by-step manner from reducibly complex mechanisms that serve *other* functions (Gross’s case (b))? As H. Allen Orr has pointed out, this offers no solution to the enigma for the Darwinian theorist, since it is as unlikely that a complex mechanism that evolved to serve function A could, with slight modification, become a complex mechanism that serves an entirely distinct function B as that the complex mechanism with function B should arise *de novo*. As Orr put it:

“...we might think that some of the parts of an irreducibly complex system evolved step by step for some other purpose and were then recruited wholesale to a new function. But this is also unlikely. You may as well hope that half your car's transmission will suddenly help out in the airbag department. Such things might happen very, very rarely, but they surely do not offer a general solution to irreducible complexity.” (“Darwin v. Intelligent Design (Again),” *Boston Review* 21,6, Dec./Jan. 1996/7.)

The Darwinist can “climb Mount Improbable” (to use Dawkins’s metaphor) only when the *same* function is improved in a stepwise manner, which is exactly what cannot happen when the complexity is irreducible. As Behe persuasively argues, there are many actual cases (bacterial flagella, blood clotting cascades, molecular transport systems) in which we can demonstrate irreducible complexity by an analysis of the mechanism and its function.

Gross claims that Behe’s examples have been refuted. He points the reader to the anti-Behe website, <http://world-of-dawkins.com/Catalano/box/behe.htm>. This is a useful site: I recommend that the reader visit it, as well as a site containing Behe’s replies: <http://www.discovery.org/crsc/>. In particular, I urge the reader to *look up the references* in the critiques of Behe, including Kenneth Miller’s and Russell Doolittle’s. When I began doing this myself, it was an eye-opener. I discovered that, time and time again, the papers that were cited did not support the uses to which Miller, Doolittle and other Behe

critics put them. I was forced to an inescapable conclusion: either Behe's critics are so sure that they are (intellectually) right that they engage in inexcusably sloppy, even incompetent, reading and reasoning, or they are so sure that they are (morally) right that they engage in deliberate dishonesty.

Philosopher David Ray Griffin has had a similar reaction to reading the cited sources for himself:

“The response I have received from repeating Behe's claim ... is that I obviously have not read the right books. There are, I am assured, evolutionists who have described how the transitions in question could have occurred. When I ask in which books I can find these discussions, however, I either get no answer or else some titles that, upon examination, do not in fact contain the promised accounts. That such accounts exist seems to be something that is widely known, but I have yet to encounter someone who knows where they exist.” [From *Religion and Scientific Naturalism*.]

The Relevance of Mathematics

Gross claims that mathematicians like David Berlinski and William Dembski have no business challenging the consensus of evolutionary biologists. However, at the heart of the Darwinian and neo-Darwinian project is an essentially mathematical claim: the claim that random, undirected mutations (mutations whose occurrence is probabilistically independent of any future usefulness) can lead, with a high probability, to the kind of complex adaptations we find in nature. Despite the fact that this quantitative hypothesis lies at the very foundations of modern evolutionary theory, it remains a mere conjecture, without the slightest support from mathematical theory. It is no surprise, then, that mathematicians are attracted to the problem, and, also no surprise, given the critical nature of Darwin's conjecture, that biologists react with such emotional animosity to mathematicians who, like Berlinski and Dembski, offer arguments against this foundational assumption.

It is premature to make any definitive judgment about the viability of the neo-Darwinian model as an explanation of complex adaptations. The complexity of life makes the construction of testable hypotheses about the actual evolutionary pathways taken far more difficult in the case of evolution than in comparable cases from the other sciences (e.g., the Newtonian model of the solar system or quantum models of the hydrogen atom). Our understanding of the genomic information, gene expression and developmental processes are rudimentary at best, and our powers of computation are still far too weak to enable us to reverse-engineer a hypothetical phenotype into a corresponding genotype, or vice versa.

I predict that, in our lifetime, we will be able to generate genuine hypotheses from the Darwinian template (and from various non-Darwinian alternatives) and subject them to rigorous testing. If science is to maintain its rational and self-correcting character, it is critical that we do not prejudge the results of such tests. Instead, let the chips fall as they

may and adapt our opinions to actual empirical results, not to a priori philosophical expectations.

Robert C. Koons
University of Texas at Austin

From Roland F. Hirsch:

The September 2003 issue of *Science Insights* has an article, "Intelligent Design and that Vast Right-Wing Conspiracy," by Paul R. Gross that falls far short of the standards that usually apply to this publication. As a long-term member of the National Association of Scholars (going back almost to the founding) I want to take strong exception to the tone and substance of the article.

The general approach of Dr. Gross in this article is to make ad hominem attacks on anyone with whom he disagrees and then to state that person's position incorrectly. This is obvious in the case of Jonathan Wells, whom Gross chooses to identify with the Unification Church, but chooses not to identify with the university where he received his Ph.D., which is the University of California at Berkeley, in Molecular and Cell Biology. Gross then states "His work consists not of doing biology" which is an outright falsehood, for Wells published two papers based on post-doctoral research in Berkeley after receiving the Ph.D. there, and today is an active researcher in biology. Gross brings up Wells' book *Icons of Evolution*, saying it discusses things found "in some few school science textbooks". In fact *Icons* discusses errors in the most widely used textbooks at the college as well as the high school level. The textbook errors are substantive, have in at least one case been labeled as fraud, and are being corrected in these textbooks as they go into new editions.

Gross' treatment of the work of Michael Behe is equally far off the mark. Behe does not "claim ... that the internal machinery of cells is massively complex"; that is the standard picture of living cells endorsed by every cell biologist today. Rather, he points out that certain machines in the cell cannot perform their function if any of the essential parts are removed. This raises the question of how they could have evolved, since several otherwise unusable component proteins of the machine would have had to appear simultaneously to form the machine. As we learn more about the major cellular machines we recognize the inadequacy of evolutionary theory to account for them. One obvious example is the ribosome, which makes practically all of the proteins in a cell, yet the simplest ribosome must have some 55 separate proteins and several strands of RNA to function. No scientist has the vaguest idea how this machine could have made its parts before it itself existed.

Readers should know that there are three positions today on evolutionary theory. One is that of ardent Darwinists such as Gross, who insist on its acceptance and promulgation as the essence of biology and reject any effort to lay out the flaws in the theory alongside its merits. The second is that of the creationists, who by the way are found in large numbers

outside the United States. The third is that of the vast majority of life scientists who either doubt the validity of the basic claims and concepts of Darwinian evolutionary theory and seek alternative explanations, or find evolutionary theory has no utility in their work and thus is uninteresting as a topic of scientific discussion. As Richard Lewontin aptly said "evolution explains nothing because it explains everything." [*Nature*, 236 (24 March 1972): 181-2]

I urge *Science Insights* to publish an article that accurately reflects the status of evolutionary theory and avoids the invective and name-calling used by Dr. Gross as a substitute for scientific argument.

Roland F. Hirsch

From Jason Rosenhouse:

Squeamish readers of "Science Insights" might wonder if the polemical tone of Paul Gross' editorial against Intelligent Design theory (ID) was really justified. To them I offer the following paragraph, drawn from a letter I received announcing a forthcoming ID conference:

"The American Association for the Advancement of Science believes the design that is detected by our intuition and confirmed by formal design detection methodology should be censored for a lack of evidence. Hmmm! If this doesn't seem a bit off-the-wall, they also claim that design can't be tested even though scientists are testing radio and light waves for alien intelligence everyday. Curiously, while those tests have turned up negative, the same tests run on DNA are turning up positive."

Or this quote, drawn almost at random from Jonathan Wells' "Icons of Evolution":

"As we saw in Kevin Padian's 'cracked kettle' approach to biology, dogmatic Darwinists begin by imposing a narrow interpretation on the evidence and declaring it to be the only way to do science. Critics are then labeled unscientific; their articles are rejected by mainstream journals, whose editorial boards are dominated by the dogmatists; the critics are denied funding by government agencies, who send grant proposals to the dogmatists for 'peer review'; and eventually the critics are hounded out of the scientific community altogether.

"In the process, evidence against the Darwinian view simply disappears, like witnesses against the Mob. Or the evidence is buried in specialized publications, where only a dedicated researcher can find it. Once critics have been silenced and counter-evidence has been buried, the dogmatists announce that there is no scientific debate about their theory, and no evidence against it. Using such tactics, defenders of Darwinian orthodoxy have managed to establish a near-monopoly over research grants, faculty appointments, and peer-reviewed journals in the United States."

This is how ID proponents talk when they are preaching to the choir. It is how they talk during the uncounted hours they spend lobbying sympathetic politicians to have their views presented in science classes. This is the rhetoric you will find at any of the dozens of web sites devoted to ID propaganda.

So forgive me if I find their bleats about fairness, civility and open-mindedness to be a bit rich. The fact is the scientific community has bent over backward to give the ID theorists a fair hearing. Not long ago, for example, the American Museum of Natural History invited William Dembski and Michael Behe to present their views. Numerous scientists such as Kenneth Miller of Brown and Massimo Pigliucci of the University of Tennessee have engaged in debates with ID proponents. When presenting their views to knowledgeable audiences, the ID proponents are invariably unimpressive.

The scientific claims of ID proponents are rejected because they are demonstrably false. Scientists who investigate further quickly discover that ID proponents do not behave the way scientists behave when they have a dispute over technical questions. For example, rather than present their views at academic conferences they attempt to seize the reins of public power by lobbying school boards and politicians. This makes it reasonable to wonder about their true agenda. When you subsequently discover that most of the funding for ID comes from organizations otherwise devoted to promoting a conservative social agenda, it is not difficult to connect the dots.

Scientists wading into ID literature can expect to find their words distorted, their ideas misrepresented and their integrity impugned. When they point this out, they are accused of being part of an atheist conspiracy. And after delivering their endless tirade of irrational anti-Darwinian invective, ID proponents then turn around and accuse scientists of being arrogant.

Where I come from we call that chutzpah.

Jason Rosenhouse
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From Jeffrey Shallit:

Thanks to Paul Gross for telling it like it is.

"Intelligent design" isn't good science. It isn't even good pseudoscience. It's a political and religious movement masquerading as pseudoscience. Its proponents have largely refused to submit their claims to the rigors of peer review, preferring to bypass this process by publishing books with religious and/or right-wing publishers.

Need proof? Look at Dembski's forthcoming book, *The Design Revolution*. The publisher is InterVarsity, whose website states "We are a publisher of Christian books and Bible studies" -- not the first place I'd look for a revolutionary scientific discovery.

Next, look at the endorsements for *The Design Revolution*, available on Dembski's own web site <http://www.designinference.com/>. The very first is from far-right Senator Rick Santorum; the second is from Robert George, a conservative Christian professor of politics; the third is from William Abraham, a theology professor at Southern Methodist; the fourth is from an historian; the fifth is from a philosopher; the sixth is from a theologian. (Yes, lower down there are a few scientist endorsers, but it's clear what the pecking order is.) If most of these folks have the necessary scientific and mathematical training to catch the errors in Dembski's claims, it's news to me.

And there are errors -- lots of them. Some are pure carelessness (one crucial calculation in Dembski's *No Free Lunch* is off by 65 orders of magnitude), but others are not so easy to shrug off. I have covered a number of them in my review of his book in *BioSystems* 66 (2002), 93-99. I sent Dembski a copy of this review more than a year ago, but no substantive response has been forthcoming. Although Dembski's own web site archives dozens of his papers, there is no errata page for *No Free Lunch*.

Intelligent design advocates are so desperate for praise that they grasp at nearly anything to show that they're actually doing science. Take Dembski's response to Gross that appears at http://www.designinference.com/documents/2003.09.Gross_Response.pdf. Dembski mentions two papers from the peer-reviewed literature that he claims cite his work "favorably." But if you look at the article by Chiu and Lui, you will see that (1) nothing in their article uses Dembski's methodology (2) their citation to *The Design Inference* refers to "complex specified information" -- a term that doesn't even appear in that book! This is hardly proof that Dembski's work is having scientific impact.

Maybe intelligent design will eventually become science. But the only way that's going to happen is if its proponents buckle down and do some actual science, instead of spending their time exhorting the faithful at church gatherings or legislating their way into the public-school curriculum.

Professor Jeffrey Shallit
University of Waterloo

From Matt Young:

Whenever I hear someone compare himself to Copernicus, I immediately think, "Velikovsky." Immanuel Velikovsky was a physician who apparently convinced himself that the mythology of all the peoples of the world reported real events and then set out to prove it. He argued that the planets Mars and Venus had had near collisions with Earth within historical times and made a great many predictions based on this contention.

Among them were the claim that Venus was very hot (true) and that oil would be found only at low latitudes (thought to be true but later falsified). By rewriting the archeological record, ignoring real physical problems, and focusing only on his successful predictions, Velikovsky "proved" his thesis to his own satisfaction and that of a lot of gullible followers.

Velikovsky had a real research program in the sense that he made concrete predictions that could be tested against reality. In this regard, he is worlds ahead of the "intelligent designauts" whom Paul Gross describes in the September 2003 issue. Like Velikovsky, the intelligent designauts have a thesis that they are determined to prove, whether it is right or not. Unlike Velikovsky, however, they have no research program: they make no predictions whatsoever, unless you count as a prediction the claim that we will never understand the bacterial flagellum. Instead, they seem to think that carping is enough: if they can undermine what they call Darwinism, then they can incorrectly hold out intelligent design as the only alternative.

As Gross notes, Jonathan Wells attended graduate school with the express purpose of destroying Darwinism, presumably a field he had not studied in detail before enrolling (<http://www.tparents.org/library/unification/talks/wells/DARWIN.htm>). A real scientist would have examined the case for Darwinism, not rejected it out of hand. Wells has so far produced nothing that regards intelligent design and has any scientific merit. His colleagues Behe and Dembski have likewise produced nothing that can be tested empirically -- only assertions that amount to a lack of imagination, what Gross calls the argument from incredulity.

No matter: intelligent design is not intended to be scientific. It is a smokescreen designed to hide the defects that were apparent in creationism. Dembski admits as much (Chapter 10 of Paul Kurtz, *Science and Religion: Are They Compatible?* Prometheus, Amherst, N.Y., 2003, pp. 89-97) and crows that "most people" do not find evolution "compelling." Scientific truth is not a popularity contest, as Dembski well knows. That he is willing to make it so is one indication why intelligent design is a political movement and inherently anti-science.

Matt Young

Co-editor

Why Intelligent Design Fails: A Scientific Critique of the New Creationism

Rutgers University Press, 2004 (to be published)

From Andrea Bottaro:

Readers of *Science Insights* should be grateful for Paul Gross' lucid analysis of the Intelligent Design (ID) movement. Hardly a day passes by without some newspaper around the country uncritically reporting about some Discovery Institute press release or P.R. move. As pseudoscience, from whatever source, tends to look easier and less "messy" than real science, a good immunization with a healthy dose of reality is the best

prophylaxis against its subtle appeal.

Alas, your readers will also need to get ready for the now unavoidable onslaught of personal invective that regularly follows nerve-touching anti-ID pronouncements. As with most pseudosciences, wild accusations of censorship, dogmatism, scientific fraud, conspiracy and various forms of unethical behavior have become part of the common armamentarium of ID argumentation: a recent paper by Dembski devotes a whopping twentysome pages to a detailed catalog of alleged Darwinian "tricks" (http://www.designinference.com/documents/2003.09.UncDiss_Intro_Contribs.pdf) (disclosure: I am, according to Dembski, one of the co-conspirators). Even more than the scarcity of scientific substance highlighted by Gross, it is the inordinate amount of time that ID proponents devote to political action, personal attacks and conspiracy mongering, rather than actual scholarship, that ultimately dooms their efforts to the "crankhood" category.

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From Pete Dunkelberg:

One of the intriguing things about intelligent design (ID) is that it has an aura of mystery for many people even though it seems empty to scientists. I'll try to throw some light on this and the related question of ID's similarity to creationism.

It's a question of politics (and so of tactics) and it's really inter-religious politics, with high school science as a proxy battleground.

Mainstream theology is aware that 'God of the gaps' is a bad idea. The gaps keep getting smaller. And why should good religion have to deny scientific discoveries? Those who disagree see usurpation of public schools as the way to defeat their brethren.

Take a moment to read Ronald Numbers' 1982 paper *Creationism in 20th-Century America*, in *Science* 218: 538-544, online at <http://www.majbill.vt.edu/history/barrow/hist3706/readings/numbers.html>. Creationist leader Henry Morris's tactical advice to supporters will sound very familiar to Texans, who have just been through several months of political theater courtesy of the Discovery Institute (DI), documented online here (<http://www.txscience.org/>).

The astute, media savvy and well-financed DI (<http://www.txscience.org/files/discovery.htm>) is the sponsor of the ID campaign. Their strategy is laid out in the Wedge (<http://www.antievolution.org/features/wedge.html>). This document was not supposed to become public, but it was leaked several years ago. As you can see, science as we know it must be vanquished and replaced by theo-science.

This is to be accomplished by unspecified research which has not occurred, and by a massive political campaign which has.

The DI also uses the 'big tent' strategy. Both young- and old earth creationists are welcome. They argue that they are not creationists because they are not specifically young earthers, and that ID is not strictly religious because, they say, the Designer might be a space alien rather than God. But another group of IDists, the Raelians, believe the Designer is a space alien. It is their religion. (<http://www.rael.org/>)

ID's greatest claim to fame, and to being more than mere creationism, is its design detectors. These are allegedly scientific methods of detecting the Designer's handiwork in nature. Although the design detectors have not detected any design, they give ID its sex appeal.

The best known of these is Behe's irreducible complexity (IC). He argues, but gives no evidence, that IC as defined by him cannot evolve and yet he can detect it in nature. But Behe's argument ignores basic biology, and IC evolves easily. See Irreducible Complexity Demystified (ICDMYST)

(<http://www.talkdesign.org/faqs/icdmyst/ICDmyst.html>) for examples. Since IC as such doesn't matter, all that's left of his position is "Gee that looks complex". Note that others may refer to the public image of IC as something that really cannot evolve. I refer just to Behe's definition of IC.

The other Design detector is Dembski's 'Explanatory Filter' (EF) argument and its elaborations. This is discussed in his books, and also by Wilkins and Elsberry, who explore what used to be a favorite example of Dembski's in *The advantages of theft over toil: the design inference and arguing from ignorance (Biology and Philosophy* November 2001, available online at <http://www.talkdesign.org/faqs/theftovertail/theftovertail.html>). In later versions the filter is said to work best with specified complexity (SC). Dembski's complexity turns out to mean improbability. Specification has been defined to hardly anyone's satisfaction, and is best explained with examples. The stone circles of the far north, a whole field of stones arranged in neat circles, provide a good introductory example:

(http://newsimg.bbc.co.uk/media/images/38703000/jpg/_38703439_arc300.jpg). This arrangement is certainly 'improbable' enough (using creationist probability, in other words assuming the circular arrangement resulted from random mixing alone), and 'circular' is a fine specification. Hence the stone circles pass through the filter and must have been designed. Unlike science, design, not "don't know," is the default, as it is in creationist thinking generally. Positive evidence is not required to infer design. But alas, now a natural explanation of the stone circles has been found.

(<http://dsc.discovery.com/news/briefs/20030113/stonecircle.html>).

Dembski proudly claims "No false positives" for his method, or in other words a natural phenomenon is never incorrectly identified as Designed. How can this claim be squared with the fact that, excepting man-made items, only false positives have occurred? Easily. When you think you have found a false positive, for example the stone circles, it

obviously means that the method was not properly applied in the first place. You did not eliminate all non-design explanations after all. The EF works perfectly in hindsight. 'Gedanken' presents an interesting example of specification on ISCID: (http://www.iscid.org/ubb.cgi/ultimatebb.cgi?ubb=get_topic&f=6&t=000411&p=2#000023), where other aspects of EF are debated; there are many more articles on the subject online at talkreason.org and talkdesign.org.

How distinct are the design detectors from good old scientific creationism? First, you need to know that when pressed about their design detectors, IDists finally say, "Oh, we didn't really mean it *has* to be design. But if not, it's very improbable." (using creationist probability, see below). Now take a look at this passage from Morris' famous book *Scientific Creationism*:

This issue can actually be attacked quantitatively, using simple principles of mathematical probability. The problem is simply whether a complex system, in which many components function unitedly together, and in which each component is uniquely necessary to the efficient functioning of the whole, could ever arise by random processes. See *Scientific Creationism* 2nd edition p. 59 and compare Behe's

"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."
Darwin's Black Box, p. 39 (emphasis in original).

Morris doesn't have ID's neologisms and does not claim a design detector as such. However, he argues from creationist probability that the complex systems he describes could not arise naturally. His treatment presages both of ID's design detectors.

"Creationist probability", still very much in use by IDists, means: estimate the probability of a nonrandom outcome on the assumption of random mixing; often assume that evolution has a specific target in advance; ignore population biology; and design is never improbable. It is at the root of many creationist arguments new and old.

Could it be that ID is simply a politically improved creationism? The new terms and bold claims impress the public, but scientifically they introduce new fallacies and misrepresentations.

To fully understand the hubbub surrounding ID, we need one more piece of the puzzle and a final clue. Recall that I said at first it's a matter of politics and tactics. We need to learn of one more tactic: the fall-back position.

It happened first in Ohio, and seemed to be a last minute realization as the DI was about to go before the Ohio state board of education: there is absolutely nothing in ID theory that the DI can present to a school board and say, "Here is our lesson plan. Teach this." Anything singled out for public scrutiny will promptly receive a very public debunking. Grasping for something to say, they came up with "Teach the controversy," meaning the

public, not scientific, controversy they created. This has now changed into "Teach the weaknesses." Of course the DI also supplies the "weaknesses" of biology in the form of DI Fellow Wells' book *Icons of Evolution*. His topics are familiar from scientific creationism, but the new treatment is more stridently bogus than Henry Morris ever dreamed. (<http://www.talkorigins.org/faqs/wells/>)

Whenever they come before a school board, the DI is adamant about their fallback position. We do *not* want you to teach ID they insist. As they are so protective of their brand name product, could it be that they realize the design detectors have no scientific value?

It's not as if no one ever mentioned it to them. Be that as it may, the design detectors, while they don't detect any design, function very well tactically to excite the public, and then it's bait and switch.

With one final clue, it all becomes clear. As I see it, where ID is concerned, (with apologies to Dobzhansky <http://www.2think.org/dobzhansky.shtml>):

Nothing from the Discovery Institute makes sense except in light of the Wedge.

Pete Dunkelberg
Orlando, Florida

Reply from Paul R. Gross:

Après le déluge, moi.

My rejoinder will be shorter than the preceding articles of abuse. Of each indictment, in the order in which they arrived, I make the shortest possible précis. And I answer similarly. In anticipation, however, we need a preamble. It includes a reminder of what I *actually* wrote. The real issue—as it should be for the National Association of Scholars—is politicization of teaching and scholarship. Therefore in the preamble I report on the latest science textbook battle in Texas, now temporarily halted. Time and space allow no more than a terminal nod of gratitude to those who approved my observations.

Preamble

My piece began by identifying—with references—certain diagnostic features of crank-, or pseudo-, or otherwise bad science, as proposed by two well-known physicists. I then said that the newest form of creationism, so-called Intelligent Design (ID) Theory, displays the symptoms named. This was perhaps not kind; but it is true. Everything that followed was in effect supporting evidence. The style of these complaints about my piece simply adds to the evidence.

For a decade there has been a massive political effort to emplace the new creationism in schools and colleges, and to discredit evolution and the relevant geology and cosmology. This has for long seemed to me a matter for NAS concern. But I have had my doubts about raising the question. Recently I was urged by others, and then invited, to write the opinion piece. *Nota bene*: “opinion piece”—an editorial, *not* a textbook; not a technical rebuttal of bad arguments. (Which I can nevertheless provide, have provided, and do so again in a forthcoming book). I supplied citations to the professional literature as well as to the neo-creationist sources.

In the master plan of the most energetic ID-advocacy guild, self-dubbed “The Wedge,” first place was given to gaining scientific respect in the universities and in public education, K-12 and beyond. That was to result from their publication of new, powerful scientific arguments and empirical evidence in favor of ID (therefore against that vast body of modern science they miscall “Darwinism”). This part of the plan has failed. A decade later, there is still *no* support in the scientific literature. But they had already announced, at the start, that “Darwinism” was dead! How then, my essay asked, do ID-advocates explain this? Answer: by the devices the two physicists named. To anyone who reads the references, it will be obvious.

I then reduced the actual scientific claims of ID—those employed in public relations and political maneuvering—to five; three negative and two positive. I dealt with each one, very much compressed, as required for a *Science Insights* opinion, but with documentation. This exercise could not have been gracious. Serious science is overwhelmingly dismissive of ID theory. And, the new creationism is relentlessly derogatory of evolutionary biology and biologists, that is, of modern biology. The derogation is unjustified. If, now, an active and increasingly powerful political-public relations campaign describes us, our professional work, our antecedents and colleagues, as either stupid or blind to the way things *really* are, or worse, as conspirators, covering up the failure of “Darwinism,” are we supposed to respond with deference? Do our humanist and social-scientist members respond graciously and with deference to political assaults on Western culture, or when they are charged with the terrible triad (racism, sexism, and classism)?

Now I quote reporter Terrence Stutz, in *The Dallas Morning News*, Dallas, Texas, November 6, 2003.

AUSTIN — State Board of Education members on Thursday tentatively adopted new high school biology books that fully discuss evolution, rejecting the pleas of social conservatives and other critics of Charles Darwin and his theory of how life on earth evolved.

Despite an intense campaign by opponents of evolution—including thousands of e-mails, faxes and phone calls to board members—the board of education approved 11 new books by a lopsided 11-4 vote.

...

The board vote was a setback for a national think tank that has promoted an alternative theory for the origin of life on earth, called “intelligent design.

...

Under current law, the board may reject a textbook only if it has factual errors, does not cover the curriculum or is manufactured poorly. Critics of the biology books had claimed they contained numerous factual errors about evolution.

Final approval of the textbooks was voted the following day, November 7th, 2003. The record of this conflict and its predecessors in other states, most recently Kansas, Ohio, and Georgia, reflects a changing strategy of the Wedge in its case against evolution. Initially the claim was positive: new discoveries revealing intelligent design in the world; new science to topple the old. Those new discoveries, it turned out, do not (yet) exist. Even laymen began to hear about that. There came a return to old-style negative creationism: claims of gross errors in Darwinism, deductive “proofs” that Darwinian evolution cannot happen. Then came the current version: a collection of putatively “failed proofs,” grave “weaknesses” of evolution, assembled by Jonathan Wells. Those were central to the latest ID push in Texas. They are supposed to be present in nearly all biology textbooks—false evidence of an empirical base for evolution. Thus the intelligent design political strategy no longer emphasizes new science. It now resembles its earliest ancestors: demands for the most minute scrutiny or censorship of anything to do with evolution.

Texas science, and not only its life science, rose to the occasion and opposed the Discovery Institute’s (the Wedge’s) campaign. Here is an example of what the state’s scientists said and did. The Dallas-Fort Worth area (like others in Texas) is rich in biological and medical talent. On September 22, 2003, seventeen local members of the National Academy of Sciences and/or the Institute of Medicine, *all of them biological and medical scientists*, four of them, including Alfred Gilman, Nobel laureates, addressed the school board and their fellow citizens. From Professor Gilman’s published letter:

Some individuals and organizations have long opposed teaching only scientific bases for the appearance and evolution of life on earth. These opponents claim that scientific texts systematically misinform readers. Why? Because, according to the critics, the books in question don’t expound upon supposed weaknesses in the theory of evolution.

These assertions have been refuted in great detail by scientists in testimony prepared for the state board and in analyses of the central arguments raised by opponents of the texts... [emphasis added]

We note that these supposedly scientific challenges are directed selectively at the theory of evolution. There are no similar campaigns being waged against textbooks that don't discuss alleged weaknesses in other major scientific theories, such as gravitation or relativity. Clearly, the motivation for the current challenges lies *not* in science, and the scientific classroom is *not* the proper forum for such a debate.

...

The modern theory of evolution has undergone 140 years of testing. It is now so well established that its veracity and robustness are accepted as fact by the overwhelming majority of scientists in this country and around the world. In the scientific community, the unanswered questions concern not the *fact* of evolution but rather the *mechanisms* by which evolution operates...

For those familiar with the public information style of the Discovery Institute, it will be no surprise to learn that on November 7th, at 1:21 ET, the Institute announced victory (“Textbook Reformers See Last-Minute Victory in Texas Decision”). This was posted online at <http://biz.yahoo.com/prnews/031107/sff038_1.html>; but by Nov. 13th, it had been removed. For a good sense of what that announcement contained, N.A.S. members might look up Robert Graves: “The Persian Version.”

The Indictments

David Berlinski thinks my criticisms are funny. This is a sun-ray in the fog: we are brothers, because I think his writings on science are droll. His contortions in declining to support the claims of ID while yet remaining an anti-Darwinian in good standing are, well...Elizabethan. British English, especially as spoken by the Scots, has an expression for it: “chuntering.”

Phillip Johnson defends the Santorum “amendment,” arguing that it was endorsed even by Senator Kennedy. That was the only surprising name on Mr. Johnson’s short list of supporting legislators. (*It is not, however, an amendment.* It is accessory language in the conference committee report. *Qua* amendment, it was voted down. Nor did the original propose teaching intelligent design. It recommended teaching the evidence on controversial theories. Which is what has always been done anyway, in those exceptionally rare cases of *real* controversy about anything in the K-12 science curriculum.)

The reasons for the large, final supporting vote cited by Mr. Johnson were mechanical and political; the media covered them well. Yet, on March 14, 2002, in a *Washington Times* opinion piece, Senator Santorum misrepresented his amendment and declared that “Sen. Ted Kennedy, Massachusetts Democrat, approves of having alternative theories taught in the classroom. He believes children should be ‘able to speak and examine various scientific theories on the basis of all information that is available to them so they

can talk about different concepts and do it intelligently with the best information that is before them.”

On March 21, 2002, Mr. Kennedy replied in the same newspaper:

“The March 14 Commentary piece, ‘Illiberal education in Ohio schools,’ written by my colleague Sen. Rick Santorum, Pennsylvania Republican, erroneously suggested that I support the teaching of ‘intelligent design’ as an alternative to biological evolution. That simply is not true. Rather, I believe that public school science classes should focus on teaching students how to understand and critically analyze genuine scientific theories. Unlike biological evolution, ‘intelligent design’ is not a genuine scientific theory and, therefore, has no place in the curriculum of our nation’s public school science classes.”

Is Mr. Johnson unaware of Sen. Kennedy’s demurrer? **William Dembski** is not: he published a sneer at Mr. Kennedy’s pretensions to scientific judgment. Matching comment on Sen. Santorum’s qualifications has not been forthcoming.

Jonathan Wells complains that I distorted his religious background. What I wrote about it comes from Wells’ own Unification Church sermon. Already a theologian, he enrolled in a doctoral biology program for the stated purpose of “destroying Darwinism.” This is hardly irrelevant to the issue at hand; it is *ad hoc*, not *ad hominem*; nor was that a good start toward scientific objectivity. Please see <http://www.tparents.org/library/unification/talks/wells/Darwin.htm>.

He offers a long, quasi-technical justification for his attacks upon E. H. Haeckel’s 19th-century drawings of vertebrate embryos, and on peppered moth evolution, two of his “icons.” He says that those attacks are in the scientific literature. There are indeed some, often old, complaints from scientists about details of these and others among the “icons” of Wells’ *oeuvre*. But they amount to little or nothing in modern evolutionary biology. Experts in each of the relevant fields have dismissed—in the scientific literature—Wells’ accusations. See, for another example, “The Talented Mr. Wells,” by Kevin Padian and Alan D. Gishlick, in *Quarterly Review of Biology*, 77, No. 1, 33-37 (2002). A reader who follows my pointers will find many other such rebuttals.

The recent, comprehensive re-examination by Michael K. Richardson and Gerhard Keuck of the work and influence of Haeckel (*Biol. Rev. Cambridge Phil. Soc.* (2002) 77: 495-528) is a case in point. Richardson is one of those who most recently called attention to the inaccuracies in some of Haeckel’s old drawings. Yet in his new study with Keuck he concludes that Haeckel was a founder of comparative morphology and that the broad evolutionary principles he espoused, if not all the details, were sound.

I agree with Wells on only one point: readers who really care about these issues must go to the real scientific literature, some way into the technicalities. And for a start, they might look back to the statement (above) of the Dallas-area Nobelists and National Academy members. Their opinion on these matters is echoed by some 550 working Texas scientists, who said so during the Texas wars. It is implicit in what the chief

executives of fifty or so of the largest scientific societies wrote in connection with the Santorum “amendment” (August 2001: Joint Letter from scientific and educational leaders on evolution in H.R. 1, addressed to Rep. John Boehner and Sen. Edward M. Kennedy). It is implicit in the daily work of tens of thousands of biologists, including all currently contributing evolutionary biologists around the world.

Michael Behe fulminates at great length over my statement that he compares his own “discovery” to those of Copernicus and Galileo. To support these complaints and his homilies on scholarship, he quotes a passage from *Darwin’s Black Box*. Again, I shan’t contribute to the Discovery Institute’s misuse of *Science Insights* for “debate.” Suffice it to say that throughout *Darwin’s Black Box* (which I *did* read: I was paid to review it in *The Wall Street Journal*), Mr. Behe’s message is that the “irreducible complexity” (henceforth “IC,” his coinage) of sub-cellular systems, is implicit in modern biochemistry, and that this has a startling consequence. He compares modern biochemistry with the “assault on the senses” perpetrated by Copernicus and Galileo.

Behe argues that the IC of molecular biological systems—which *he, not modern biochemistry*, claims—makes the evolution of those systems by natural means impossible! The claim that ID must therefore be true is attached, although it does not follow. This is how IC continues to this day to be sold. But biochemistry and cell biology have been a continuum, accumulating knowledge of the contents of “Darwin’s black box,” for some 90 years. It contains no such conclusions. If Behe’s argument is correct, then it is *he*, not the community of biochemists and molecular biologists, who made this Copernican discovery. To date, almost a decade later, science has not noticed.

Several years ago, however, science did notice, and dismissed with counter-evidence, the IC argument itself—dismissed it with counter-examples such as the Krebs cycle, biological clocks, and developmentally-regulated Oxygen-transport proteins, which have demonstrably evolved. All this is in the primary research literature, where it is easily found and where it belongs. There one can also identify the “howlers” to which I referred—and to which word Behe objects: the long-known phenomena (to biochemists) of gene duplication and functional divergence over time, which refute the argument that IC rules out evolution.

The place to refute a major scientific theory is in the primary journals—with evidence. It is *not* true that this vast literature is closed to arguments against “Darwinism.” Such arguments appear weekly in the world literature, just as they do against the standard models in physics and chemistry. Peer review, for all its problems, insures some minimum quality of evidence. Behe’s closing citations of his own work are not for peer-reviewed contributions to the literature of evolutionary biology, biochemistry, or molecular biology. His closest approach is quarrels with critics, in *Biology and Philosophy* and *Philosophy of Science*. Neither Behe nor any other Discovery Institute regular has published on ID in the appropriate venues: the professional journals of evolution, ecology, molecular biology, developmental biology. There are dozens of good ones available. He has had eight years in which to do so. Why should his claims be in the K-12 science curriculum?

A friendly critique of Behe's argumentation comes from Dennis O. Lamoureaux, evolutionist at St. Joseph's College, University of Alberta, Canada. Mr. Lamoureaux offers a review (<<http://www.ualberta.ca/~dlamoure/3Behe.htm>>) of Behe's summary paper in *Canadian Catholic Review*, 1998. To its technical objections, Lamoureaux added this:

“I have two concerns with regard to Behe's thesis for the creation of irreducible structures in 'one fell swoop.' First, before Christians come to claim publicly the existence of any miraculous intervention during the course of geological time, it behooves them to be certain lest they embarrass the Church by rash and intellectually (in this case scientific) unsubstantiated claims. I am more than uncomfortable with the assertions of a single man, the biochemist Behe. Such claims should at the very least be done in a community of biochemists. I know a number of professional biochemists, including many devout Christians, and their assessment of Behe's 'one fell swoop' thesis is quite negative.”

Mr. Lamoureaux ends the review as follows: “I believe that his black box thesis is in reality a black hole or gap in our knowledge, which as history reveals will be filled through the findings of modern science. My respectful suggestion to Dr. Behe is to return to the Mother Church's view of biological origins and leave behind the interventionism and anti-evolutionism of protestant evangelicalism and fundamentalism.

William Dembski. I wrote two paragraphs, a part of whose length was devoted to references: 320 words, total. *Dembski's* “response” occupies three pages: Times New Roman, 10-point, single-spaced, one-inch margins; 2,200 words. This is the treadmill of responding to the Wedge. No sooner has one made some simple point in critique, then one is belabored with a response (if there is response at all) ten times longer, ranging over irrelevancies (e.g., Dembski and Shermer have had drinks in a Waco bar; Dembski knows and has conversation with Stuart Kauffman...), ignoring the central arguments, claiming kinship with greats as opposed to amateurs cited by a critic.

What are Dembski's arguments?

1. That I cited criticisms of his claims without elaborating. But what else? The purpose of my short article was not to elaborate, but to offer an opinion, with references.

2. That he *has* published in the peer-reviewed literature, which I did not acknowledge. Sorry, but no: the one such item was *The Design Inference*, one of a series of Cambridge University Press monographs. That volume, apparently Dembski's thesis effort, is in a series devoted to certain issues of probability and induction, not to evolution. The book itself says nothing about biology. The only examples given of application of the *inference* are trifling. Its application to real biology has not been accomplished. Moreover, it has made no noticeable impact on evolutionary biology, philosophy of science, mathematical

statistics, or information theory. There is no way that I could have *demonstrated* all this in 320 words; but any competent reader of the literatures will confirm the observation.

3. That critics I cited are “amateurs.” I cited certain authors, who are no more “amateurs” of the subject matter than Dembski himself, for their excellent critiques. But the Nobel Laureates and National Academy members mentioned earlier here are *certainly* not amateurs of the subject matter. Steven Weinberg’s Nobel Prize is in (theoretical) physics, and he is one of the world’s most distinguished, writers on science. He is among the many such who have dismissed ID in no uncertain terms. He did so recently, addressing the Board of Education during the Texas wars. Speaking of the near-universal acceptance of the modern theory of evolution, he said:

I know there are Ph.D. scientists who take an opposite view. [But:] There’s not one member of the National Academy of Sciences who does. There’s not one winner of the National Medal of Science who does. There’s not one Nobel Laureate in biology who takes the view that there’s any question about the validity of the theory of evolution through natural selection or that there is any alternative that’s worth discussing. So by the same standards that are used in the courts, I think it is your responsibility to judge that it is the theory of evolution through natural selection that has won general scientific acceptance. And therefore, it should be presented to students as the consensus view of science, without any alternatives being presented.” (<<http://aip.org/isns/reports/2003/081.html>>)

In any honest matching of authorities, the number of qualified thinkers who find ID, IC, and the design inference empty exceeds by orders of magnitude the few who speak for them. Let me symbolize the worth of Dembski’s argument to authority by two examples.

“Kauffman and I are conversation partners,” [he reports]. “...he even graciously consented to do an online chat through the professional organization I helped found...” This is meant to show that Stuart Kauffman, who is an expert, who argues forcibly with certain features of standard Darwinism, and who is the best-known figure in Dembski’s field of evolutionary interest, agrees with Dembski, or is impressed by Dembski’s claims. During a radio talk show appearance on Dallas station KERA, Dembski paired himself with Kauffman. Some listeners asked Kauffman about that. Here is his response:

“Hello. In brief, my own books explore self organization in complex systems and the implications for the origin of life and evolution and ontogeny. I am, however, a Darwinian in the broad sense and hold to the view that mutations are random with respect to prospective adaptive significance. Hence I hold no truck with intelligent design.

“It is fine with me if you publicize my response. We have to fight creationism everywhere it pops up.”

For the background, please find “Dayton” by moving through this set of online messages: <http://www.arn.org/ubb/ultimatebb.php?ubb=get_topic;f=13;t=000924#000016>.

Dembski’s second technical, book, *No Free Lunch*, is an effort to update *The Design Inference*, respond to the chorus of criticism, repair the defects, and make better arguments for ID. Of the latter there are two: (1) an attempt to rehabilitate the failed IC claim of Behe, with a calculation based on a supposed model of IC (the bacterial flagellum). This attempt failed (see Jason Rosenhouse in *Evolution* 56(8), 2002, 1721-22: “a computation that may as well have been written in Klingon...”). (2) It announces a new mathematical insight. This, it is claimed, shows that certain theorems on evolutionary algorithms, a class of computational devices using Darwinian method to solve optimization problems, imply that the evolution of complex biological structures cannot occur by natural means. Those new theorems are discoveries of mathematicians David H. Wolpert and W. G. Macready, who named them “No Free Lunch” (NFL), a light-hearted reference to their significance for algorithmic searching.

Here is how mathematician Wolpert (no amateur), whose discovery gave Dembski the title for his book, received Dembski’s treatment:

“I say Dembski ‘attempts to’ turn this trick [formalizing induction] because despite his invoking the NFL theorems, his arguments are fatally informal and imprecise. Like monographs on any philosophical topic in the first category [not rigorously mathematical], Dembski’s is written in jello. There is simply not enough that is firm in his text, not sufficient precision of formulation, to allow one to declare unambiguously ‘right’ or ‘wrong’ when reading through the argument. All one can do is squint, furrow one’s brow, and then shrug.

This account of the book appeared in *Mathematical Reviews* and is available online at: <<http://www.talkreason.org/articles/jello.cfm>>.

To continue this way would be further to impose upon *Science Insights*. I point to just one published refutation of the assertions Dembski makes here—he has already published them elsewhere. See the analysis by “RBH” of Dembski’s response to my 320 words, especially of his associating himself with eminences such as Medawar. http://www.arn.org/cgi-bin/ubb/ultimatebb.cgi?ubb=get_topic&f=13&t=000924#000016. Even if there were professional interest in Dembski’s musings on the issues of induction, it would be absurd for such material, about which he changes his mind regularly, to be taught in K-12.

John G. West (for Discovery Institute). Re: “Sermonti,” see my comments below on Mr. Koons’s list of non-materialist sages. West is surprised that the NAS printed my little piece, which he says is aimed at shutting down debate. What? My entire argument was, is, *for* debate—debate in the scientific literature, not via stunts, not on radio talk shows, not in publications of religious houses, law reviews, advisories for politicians or school committees. He accuses me of conspiracy-mongering. Well, I suppose the Wedge *is* a

sort of conspiracy—to take over science, or at least the teaching and public understanding of it; to discard post-Enlightenment methodological naturalism; to return science to its former incompetence as a branch of theology. *Please* read the Wedge Document, or the speeches given at Discovery Institute meetings and fund-raisers

“According to Gross, scientists and other scholars supporting intelligent design have religious motives. Therefore their writings about science can be dismissed. Q.E.D.” No. That is Mr. West speaking, not Gross. Gross’s position is that when bad science explodes onto the public scene, when it is used as a club in politics, one should look for a common denominator *other* than the bad science itself. That turns out to be not in my imagination but in tens of thousands of words from Mr. West’s colleagues in the Discovery Institute leadership: a narrowly sectarian motive. This is highly relevant to any inquiry about ID. Q.E.D.

Watson and Crick, Steven Weinberg, Victor Stenger and the others named: They are, according to West “aggressive” atheists! Well then, I concede that this might be considered in trying to understand what *they* say about science, and why they say it. But, their science *works*. Only a mountaintop hermit during the last fifty years can doubt that. The science of the Discovery Institute, on the other hand, not only has not yet worked to explain, or predict, or retrodict anything formerly inexplicable in nature, it routinely *contradicts* itself. Therefore it makes far more sense to ask why that argument continues than it is to study, in connection with the three-dimensional structure of DNA, the religious views of Watson and Crick.

Mr. West attacks my co-author, Barbara Forrest for “building her career” on “outing and denouncing the presumed religious motives of academic critics of Darwin.” Those of us who know Professor Forrest and her research and teaching achievements have a different view of her professional standing. Most of the DI senior regulars, however, including West, seem to have busy careers of bashing Darwinism. If that is legitimate, then Dr. Forrest’s interests certainly are, too. Mr. West and his colleagues surely believe that their own activities are important for philosophy, and for society. Why then should Dr. Forrest, a Professor of philosophy, not study them?

Mr. West and his colleagues want debate. I agree. The subject, Mr. West’s choice, is the content of biology and the extent to which ID should be a part of it for purposes of teaching as well as research. That debate is in progress where most of the participants are qualified to understand it and to contribute: in the scientific literature and in *ad hoc* science groups. Among biologists, ID is rejected by the vast majority who have ever heard of it because it has all the trappings of crank science. What I will not debate with Mr. West—not here, anyway—is the merits of his or my religion. What is taught to students in the schools, in the pitifully few hours devoted to science, should have nothing to do with religious debate. There is an important place in school for discussion of religion, but not in the laboratory or the field of natural science. That is methodological naturalism, which is how natural science works.

James Downard's penetrating discussion of David Berlinski's *Commentary* attack on an admirable *Proceedings of the Royal Society* paper by Nilsson and Pelger, on Richard Dawkins, and on a host of "Darwinists" (myself included), is cited in my *Science Insights* piece. Mr. Downard thinks I spoke too strongly. That may well be so. There are provocations, however, as anyone who has read the literature of ID, or just the foregoing "responses," should know. Mr. Downard reports that he and Berlinski have indulged in a "provocative" but (presumably) civil exchange of views. Good! I thank Mr. Downard for his well-meant comments, and ask nevertheless that readers go to his fine essay, examining not only his account of Berlinski's peculiar scholarship, but also that of ID. My opinion piece may well have been "counterproductive rhetorical excess"; but if so, I am at a loss for an alternative response to charges of "A Scientific Scandal" (Berlinski), or that Darwinists conspire to mislead children, or that Darwinism is a primary source of evil in society. Mr. Johnson regularly, and seriously, it seems, describes himself and his movement as "revolutionary." History reveals that decorous exchanges with revolutionaries do nothing for peace.

Robert Koons, a philosopher, should be famous for having nominated William Dembski "the Isaac Newton of information theory." The world's information theorists have not seconded that motion; but perhaps Koons knows something about information that they don't. No substance here until one gets to "the venerable scientific tradition" of "Louis Agassiz, St. George Mivart, Richard Goldschmidt, Pierre Grassé, Gerald Kerkut, Hans Driesch, Marcel-Paul Schützenberger, and Michael Denton." He says that this tradition grows daily in strength. If so, neither I, nor the hundred or so working biologists I know best have heard about it. The list itself is something of a joke. Agassiz was a good morphologist and the founding spirit of a marine laboratory of whose descendant, a century later, I was the Director (1978-88); but he was also an inflexible enemy of evolution and his arguments were even then wrong. Mivart, early a Darwin disciple, ended his life angry and thwarted, a religious denier of Darwin. Goldschmidt (chairman of a biology department of which I was chairman from 1971 to 1978), doubted that ordinary point-mutations account for the evolution of animal body-plans, and proposed instead macro-mutations, yielding "hopeful monsters." He was wrong. This is all ancient history in biological science. What Goldschmidt has to do with resistance to "narrowly materialistic explanations" is a mystery.

It gets worse. Driesch is an interesting case. His experiments, done at the end of the nineteenth century on sea urchin embryos, had a startling result: what became known as "regulative" development. In (some but not all) species, subdivision of the early embryo yields duplicate small, complete larvae, rather than (the expected) monsters. The effort to find an explanation for this seems to have unhinged him as an investigator. He decided that the explanation must be a non-material entity, an "entelechy." Within twenty years, the material explanation had become evident; it was almost complete with the beautiful microsurgical work of Sven Horstadius and others in the very early 1950s. The *molecular* proof of this mechanism—a particular, asymmetric spatial distribution of RNA sequences in the unfertilized egg—was published by W. H. Rodgers and P. R. Gross in 1978 (*Cell*, 14: 279-288). Driesch's lucubrations are long forgotten.

Dr. Koons's argument is about philosophy of science and theism versus atheism, not biology. It is irrelevant to judgment of what is today good science and what is not, what should be taught to schoolchildren in science class and what elsewhere. In *Daubert v. Merrell-Dow Pharmaceuticals*, The United States Supreme Court did its scholarly best on what is to be admissible scientific evidence. In the court's judgment, the views of God held by prospective expert witnesses would be neither here nor there.

"I predict that, in our lifetime, we will be able to generate genuine hypotheses from the Darwinian template (and from various non-Darwinian alternatives) and subject them to rigorous testing." So says Koons. But the "Darwinian template" is tested rigorously every day! Today, this week's (the November 6th) issue of *Nature*, the huge-circulation weekly professional science journal, has arrived. A regular *News and Views* section of *Nature* is *Evolutionary Biology*. Today's covers new *experiments* testing this hypothesis: that natural selection *is* (or *is not*) responsible for the remarkable pattern of spermatogenesis, the relevant neurophysiology, and the consequent copulation behavior of cockerels. It takes an Olympian indifference to the quotidian reality of science to believe that the "Darwinian template" is *not* tested rigorously.

J. B. S. Haldane described one rigorous test of Darwinism. "Find a Cambrian rabbit." Since then, an astonishingly rich Cambrian fauna has been found, by thousands of paleontologists in thousands of fossil-beds around the world. No Cambrian rabbits. Every day, a hundred predictions are made about what will happen in experiments on microbial populations, in cell cultures, within the immune system of patients with autoimmune disease. These are predictions that test "Darwinism": so far not one has failed. Evolutionary developmental biology has discovered, in the last few years, a universal genetic toolkit for animal body-plan organization *and reorganization*. Meantime, there have been *no* "rigorous" tests of an anti-Darwinian, or a non-materialist, or theistic "template."

Finally, Roland F. Hirsch. I suspect that Mr. Hirsch isn't clear about what constitutes an "ad hominem" attack. He carps about my mention of Jonathan Wells's connection with the Rev. Sun-Myung Moon, and with my failure to mention that Wells has a Ph.D. from Berkeley. I don't see the relevance of *Berkeley* to this forum, and I have already addressed the considerable relevance of Mr. Wells's religious motives. It is Wells himself who discusses his current work in biology. That work is not experimental or theoretical inquiry, and it does not include publication in professional journals. The two Wells publications mentioned are apparently early results from his doctoral or postdoctoral work. But his job now is searching the life sciences literature for items that might help to destroy Darwinism—which is what he undertook to do from the start.

Speaking of Behe and my account of the IC claim, Mr. Hirsch says that "As we learn about the major cellular machines we recognize the inadequacy of evolutionary theory to account for them." But that is just Behe's claim repeated. For it, Behe has provided no evidence, yet. Hirsch's hopeful addition to the list of putatively IC "machines," the ribosome, is beside the point. The point *is* that Behe claims to have discovered a property of some subcellular "machines" that makes their emergence by descent with modification

from ancestral “machines”—their evolution, in other words—improbable or impossible. There is no evidence that *such* IC exists in any biological machine.

I am not, as he believes, an “ardent Darwinist,” whatever that is supposed to mean. In my biological research field, mechanisms for the genetic control of development have been discovered that are unanticipated in the modern synthesis of evolution. They present a picture of macroevolution (the creation of new body-plans) departing from the model that has been standard for some fifty years. Hirsch’s quotation from Richard Lewontin on evolution—a mere jibe at some of Lewontin’s peers, not at evolution, in which Lewontin certainly believes—impresses me no more than did Lewontin’s Marxist tract (with Rose and Kamen), *Not in Our Genes*.

Mr. Hirsch wants *Science Insights* to publish “scientific argument.” Impossible. “Scientific argument” takes place among scientists, with peer review, before audiences and with participants having reasonable competence to judge the details. Scientific argument about evolution is continuous in the scientific literature. If Mr. Hirsch “doubt[s] the validity of the basic claims of Darwinian evolutionary theory,” *and if* he has a good reason to doubt, he should submit it at once to *Science*, or *Nature*, or *Evolution*. If it is a good reason, his name will be in lights. Anybody who knows science and its opportunism knows that.

Those who supported my account: I thank them for having found this somewhat obscure venue, for going to the trouble of writing well and concisely, and especially for knowing what they’re talking about.

Paul R. Gross

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