

REPORTS

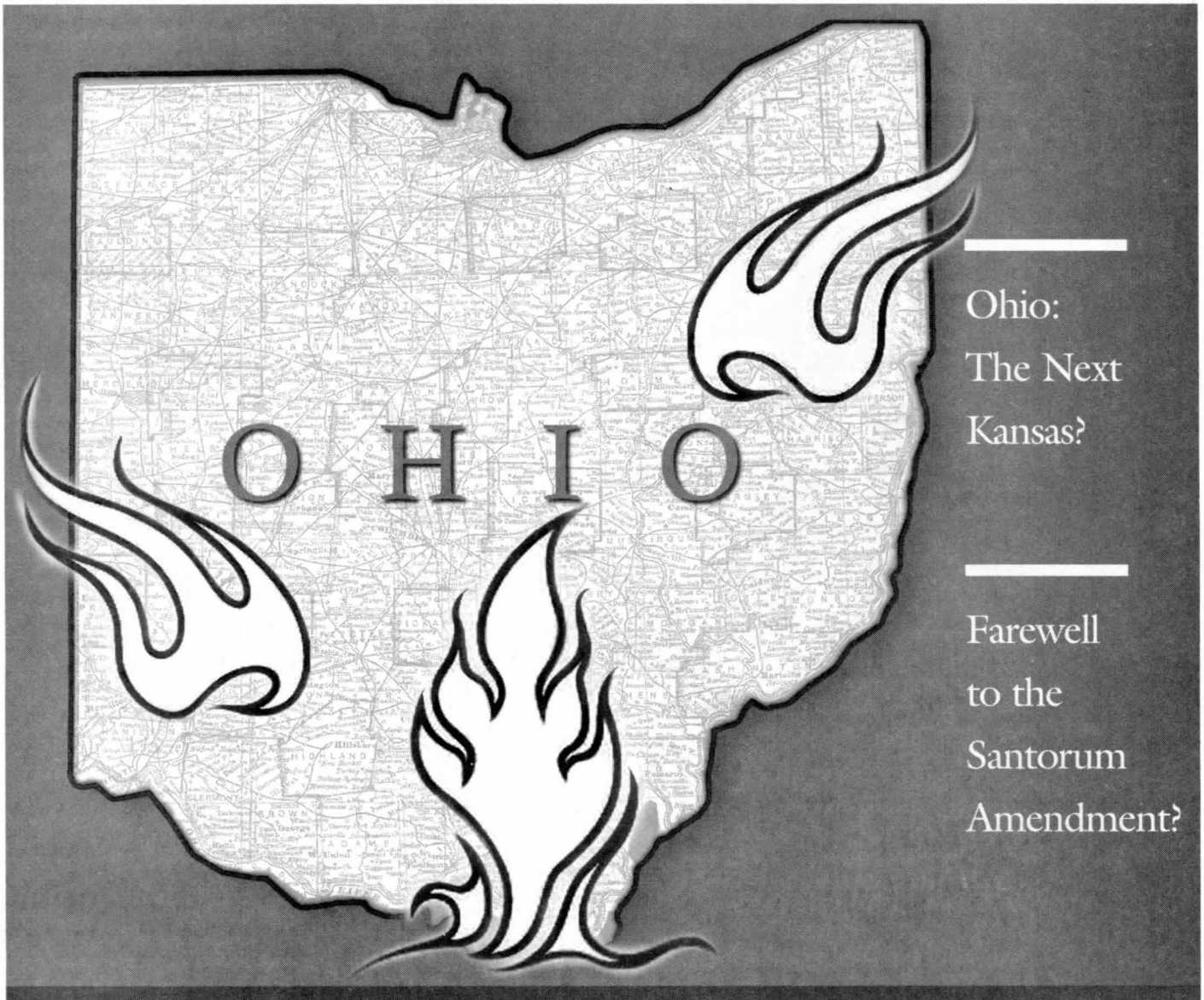
OF THE
NATIONAL CENTER FOR SCIENCE EDUCATION
DEFENDING THE TEACHING OF EVOLUTION IN THE PUBLIC SCHOOLS



Volume 22, Numbers 1-2

JAN-APR, 2002

CONTINUES NCSE REPORTS &
CREATION/EVOLUTION



Ohio:
The Next
Kansas?

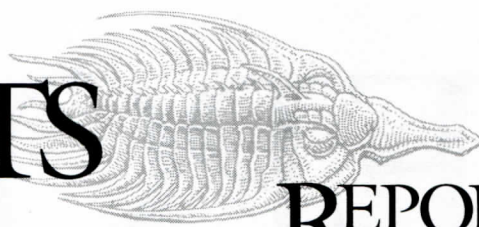
Farewell
to the
Santorum
Amendment?

What Science
Can and
Cannot Say

What's Wrong
with "Intelligent
Design"

Geocentrism
and Orthodox
Jewish Scientists

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VOLUME 22, NR 1-2, JAN-APR 2002
ISSN 1064-2358

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Views expressed are those of their authors
and do not necessarily reflect the views of NCSE.
RNCSE is published 6 times a year.

Address editorial correspondence to the editor.
Style guidelines can be found on the inside back
cover of this issue. Write to the publisher regarding
address changes, missing issues, purchases of
back issues, reprint rights, and related issues.

Cover: Nina Hollenberg

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In this issue we revisit the several aspects of the science and religion dialog. During the past several years, there has been a virtual explosion of scholarly activity in this area — including books, research articles, conferences, and public meetings. Although many see the domains of science and religion as entirely separate — and separable — it is clear that the public's understanding and acceptance of science is predicated, at least in part, on its concordance with principles, practices, and beliefs that are based in religious belief.

Whenever *RNCSE* publishes articles that explore the interface between science and religion, we hear from our readers. Some praise our coverage, but others wonder why NCSE should be concerned. The answer, in part, is contained in a brief introduction to this issue's features written by Phina Borgeson, NCSE's Faith Network Director. Phina writes:

[M]any NCSE members are people who belong to communities of faith. They support the teaching of evolution, they disagree strongly with creationist attempts to substitute their spin on religion for science, yet they are themselves religious. ... Not all Christians are creationists, and many are not happy about the appropriation of the name "Christian" as synonymous with anti-evolutionist ... [m]any moderate and liberal Christians, and yes, even some conservative Christians, are our allies in working to keep religion out of the science classroom.

As an organization, NCSE is primarily about promoting good science education that includes evolution. Although a lot of anti-evolutionary activity is based in religious beliefs, NCSE is opposed only to those beliefs' masquerading as science. It is important to recognize that there is a rich ongoing discussion of the impact of new scientific knowledge on theological scholarship — much of which accepts evolution as given. It serves our members and our organizational goals to recognize and to assist where possible those religious scholars seeking a more thorough understanding of contemporary scientific ideas. It also serves our members to inform them of NCSE's efforts in this regard and of the results of legitimate schol-



arship about the interface of science and religion.

This will likely not be the last issue to explore this interface — science and religion programs are blossoming all over the world. However, it is important for our readers to know that NCSE's position on this issue has not changed: NCSE will not be involved in promoting or denouncing specific religious ideas or denominations. Our role is to provide a thoughtful report and reflection of current ideas, trends, and research as they relate to science in general and evolution in particular. Our concern is that the ideas and materials presented in the science classroom are based solely on the best contemporary scientific knowledge. We will continue to have no official position on the intrinsic value of religious ideas or the relative acceptability of one religious idea over another.

Because of the wealth of information, we present the first *RNCSE* of 2002 as a 64-page double issue. We hope that *RNCSE* readers find this issue interesting and thought-provoking.

ON THE INSIDE

Our main article is a challenge by philosopher Reed Richter to the limits of the methodological naturalism of science. He argues that the position that naturalistic science cannot rule out divine intervention is too restrictive and that, in some cases, science *can* say, "God didn't do it." Since Reed's comments were inspired by remarks on the topic by NCSE Executive Director Eugenie Scott, we also carry a response from Genie in this issue. Reed will be back in a future issue with some related thoughts.

This issue also carries a number of features — many reprinted from other publications for the convenience of our readers — on various

aspects of the dialog between science and religion. We have an interview with Howard van Till, an evangelical Christian and retired Professor of Physics and Astronomy at Calvin College; van Till strongly supports evolutionary theory and has some difficult questions for proponents of "intelligent design". And NCSE member Jean Pond has allowed us to reprint her challenges to the concept of the nature of science that serves as the foundation for "intelligent design" and other contemporary anti-evolution movements.

Later, Colin Tudge tells us why scientists might not be communicating the wonder of science and why people might erroneously suppose from this state of affairs that science is inimical to many cherished institutions — including religion.

Alexander Nussbaum writes from metropolitan New York that biblical geocentrism is on the rise among Orthodox and Ultra-Orthodox Jewish communities as *the* scientific conclusion about the nature of the universe.

IN THE NEWS

The biggest news over the last few months has been from Ohio. As the Ohio Board of Education tries to hammer out science education standards — this time including strong evolution language — opponents are hard at work trying to water them down. Anti-evolutionists suffered a setback early in March when it became clear that "intelligent design" theory was not going to be included in the standards. Since that time, the momentum and the tactics have shifted.

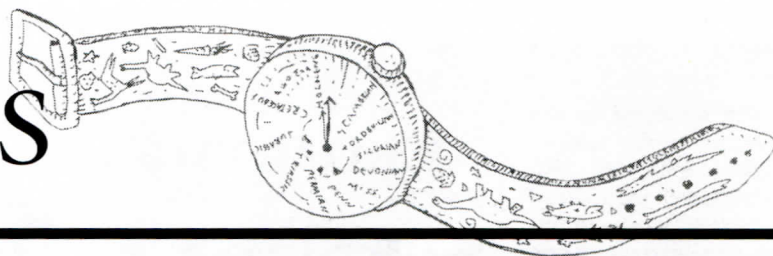
The infamous "Santorum Amendment" was finally stripped from the education bill in conference committee. However, supporters of ID in Ohio — and even Santorum himself — seem convinced that the language became the law of the land.

READING UP

This issue also features five book reviews — four of which examine books related to the dialog between science and religion. Read reviews of Ken Miller's *Finding Darwin's God*, Michael Ruse's *Can a Darwinian be a Christian?*, and Cornelius Hunter's *Darwin's God: Evolution and the Problem of Evil*.

And this is just the beginning. There is much, much more between the covers.

RNCSE 22 (1-2) was printed in May 2002.



Ohio: The Next Kansas?

Skip Evans
NCSE Network Project Director

THE STATE OF SCIENCE EDUCATION IN THE STATE OF OHIO

When Steve Edinger reported on evolution education in Ohio (*RNCSE* 2000; 20 [5]: 4-5), he described the efforts by state legislators to mandate the teaching of creationism whenever evolution was taught. HB 679, introduced on May 2, 2000, was a hodgepodge of classic young-earth creationism with the trendier "intelligent design" thrown into the mix as well. The bill had strong vocal support but was eventually defeated by opposition from science education supporters. Representative Ron Hood, who introduced the bill, vowed to reintroduce it every year until it became law. He never got another chance; Hood lost his seat in the next election to Democrat John Bocchieri in a close race.

Starting in 2000, Ohio began work on statewide educational standards, including the sciences. The new standards, as proposed by the 45-member writing team, are Ohio's opportunity to correct the assessment in the Thomas B Fordham Foundation's report *Good Science, Bad Science: Teaching Evolution in the States*, compiled by Lawrence Lerner and published in September 2000. In that report, Ohio received the grade of F for its treatment of evolution in the curriculum. The curriculum guidelines — Ohio actually had no statewide standards at the time — substituted the phrase "change over time" for the word "evolution" in order to avoid potential controversy.

The newly proposed standards do not shy away from the word "evolution" as the guidelines did.

Topics covered include how the early evolution of life changed the oxygen content in the atmosphere, how classification systems reflect evolutionary relationships, genetic drift, and mutation. In Lerner's view, "[t]he new draft treats evolution in exemplary fashion — not only evolution as it is pertinent to the life sciences, but with respect to the earth and space sciences and the essential connections among these sciences as well. ... I would give the new standards, if enacted, an A" (see "Echoes of Oz?", p 9).

ENTER THE ANTI-EVOLUTIONISTS

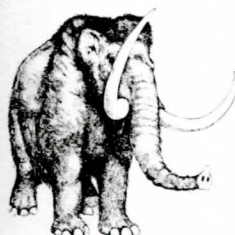
But as Edinger warned, support for including creationism in the newly planned standards was still present after HB 679 was defeated. In early December 2001, NCSE learned of a new "intelligent design" (ID) advocacy group in Ohio, euphemistically named Science Excellence for All Ohioans (SEAO). Described on its web site as a project of the American Family Association of Ohio, SEAO began to lobby the state Board of Education for the inclusion of ID creationism in the newly drafted, and still under review, science standards.

Although SEAO is a project of the American Family Association of Ohio — a conservative Christian group that is sure to include many young-earth creationists — its proponents (who include Jody Sjogren, the illustrator for Jonathan Wells's *Icons of Evolution*) attempted to portray ID as a purely scientific and scholarly endeavor. On numerous occasions they made statements to distance themselves from the biblically-based creationists. "It's totally different than [*sic*] creation science. 'Intelligent design' says nothing about religion or about the designer. All it makes is the inference", said Robert Lattimer, the only ID proponent on the standards

writing team and a member of SEAO (quoted in the Youngstown, Ohio, *Vindicator*, 2002 Feb 4).

On the other hand, Lynn Elfner, director of the Ohio Academy of Science, said, "It's not science, it's creationism" (quoted in the *Vindicator*, 2002 Feb 4). Not only is the scientific community not persuaded, but the general public and newspaper editors do not seem to be buying into the ID rhetoric either. NCSE has been monitoring several of the larger Ohio papers on-line on an almost daily basis and has received numerous clippings from smaller papers around the state. Although there is evidently a degree of grassroots support for creationism, its proponents typically promote the same discredited arguments that young-earth creationists have been circulating for decades: denial of transitional forms, claims that evolution is "just a theory" or a "theory in crisis", diatribes advocating a strict interpretation of Genesis, and so forth. They generally do not distinguish creationism from ID, confirming the accuracy of Leonard Krishtalka's memorable characterization of ID as "creationism in a cheap tuxedo".

SEAO posted a document on its web site describing the changes it would like to be made to the newly proposed standards (see <<http://www.sciobio.org>>). These include removal of references to the scientifically accepted age of the earth and the insertion of qualifiers in many of the places evolution is presented as a well-supported conclusion of science. In a section of the standards discussing historical developments in evolutionary thought, SEAO's proposed changes would add William Paley, the late-18th-century theologian who proposed divine design as an explanation for adaptiveness, and Michael Behe, author of *Darwin's Black Box*, alongside Darwin, Lamarck, and Mendel.



NCSE's complete analysis of SEAO's proposed changes, written by NCSE's Network Project Director Skip Evans and Postdoctoral Scholar Alan Gishlick, is posted on our web site at <http://www.ncseweb.org/resources/news/2002/OH/884_ncse_analysis_of_ohio_standard_1_2_2002.asp>. It describes in detail how SEAO's proposed modifications exhibit the standard set of misconceptions and errors characteristic of creationist advocacy groups. Lerner, for his part, agrees, writing that SEAO's "version of the standards would receive an F — or worse." NCSE's analysis has been widely read on the web site and used by pro-evolution activists in Ohio.

ANTI-EVOLUTION SURFACES IN THE BOARD OF EDUCATION — AND THE LEGISLATURE

The controversy spilled over into the media and then deepened on January 13, 2002, when Kansas lawyer John Calvert, of the Intelligent Design Network, was given 30 minutes to make a presentation to the state board of education at a special meeting. Scientists in the audience were not allowed to comment on Calvert's remarks. When asked if any other state in country included ID in their science standards, Calvert confessed that none did. Board member Deborah Owens-Fink remarked that Ohio had "an opportunity to be on the cutting edge". Owens-Fink and Michael Cochran have been the most outspoken proponents on the board of including ID in the new science standards.

A few members of the board have already announced their skepticism about ID. Jennifer Stewart said, "I have very strong reservations against alternative methods. I doubt I will be swayed", and Martha Wise exclaimed, "I can't go along with this", adding, "Somebody's dreamed up another way of expressing creationism, for heaven's sake" (see <http://www.cleveland.com/education/index.ssf?/xml/story.ssf/btml_standard.xsl?/base/news/1011090607690215.xml>).

It is uncertain how many of the other board members feel. At-large member Joseph Roman summed up the undecided position by admit-

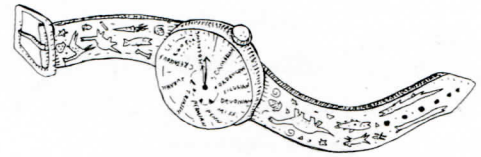
ting, "I haven't learned enough yet to make that decision." (The *Cleveland Plain Dealer* asked all of the board members for their opinions on "intelligent design"; for their responses, including Stewart's and Roman's quoted here, see <http://www.cleveland.com/sundaymag/plaindealer/index.ssf?/xml/story.ssf/html_standard.xsl?/base/sunday_mag/10147230171873739.xml>.)

In February, the board decided that the regular March meeting would include a panel discussion of experts on evolution and ID. The meeting took place on March 11 in the state capital, Columbus. Participants were Discovery Institute (DI) Senior Fellow Jonathan Wells, Stephen C Meyer, Director of the DI's Center for the Renewal of Science and Culture, Kenneth R Miller, Professor of Biology at Brown University, and Lawrence Krauss, chairman of the Physics Department at Case Western Reserve University in Cleveland (see "Goodbye, Columbus", p 6).

Meanwhile, although the ardent creationist Ron Hood was no longer in the state assembly, there were attempts by the legislature to influence or circumvent the board's decision on the proposed science standards. By the end of January, three new bills had been introduced — two in the House and one in the Senate — drawing the legislature into the controversy. Representative Linda Reidelbach (R-District 26), sponsored both bills in the House. The first, HB 481, largely mirrored the so-called Santorum Amendment (see "Farewell to the Santorum Amendment?", p 12). The second bill, HB 484, mandated House and Senate approval of the final draft of the science standards, effectively usurping the authority of the school board to develop curriculum independently. An identical bill was introduced in the Senate as SB 222 by Senator Jim Jordan (R-District 12). All three bills are currently in committee.

OHIO CITIZENS FOR SCIENCE

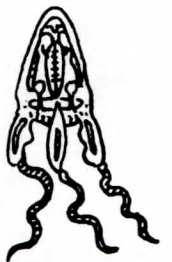
While the anti-evolutionists were at work, friends of good science education were not idle. NCSE quickly began working with Ohioans who were organizing in opposition to



the creationists' efforts. Scientists from campuses around the state, representatives of the business community, public school teachers, members of the clergy, parents, and concerned citizens from diverse backgrounds have formed a group to protect the integrity of the standards: Ohio Citizens for Science (OCS), which maintains a web site at <<http://www.ohioscience.org>>. The formation of OCS was officially announced at a press conference on February 7, 2002, at the Cleveland Museum of Natural History. The group's goals, as stated on its web site, include "improving science literacy in Ohio by bringing Ohio's students into contact with the creative and dynamic world of real science and working scientists. Our current project concerns Ohio's proposed science standards for public schools. We support the teaching of leading scientific theories and methods in all areas of science, including biology where evolutionary theory is the foundation."

Members of OCS have published numerous letters and op-ed pieces in newspapers around the state. And they have also taken their public education efforts directly to Ohioans. On March 2, at Case Western Reserve University, the group sponsored an event called Evolution & God: Why Intelligent Design Theory Isn't Science. Speaking at the event were Brown University's Kenneth R Miller and Case Western Reserve University's Lawrence Krauss (see "Ohio Forum: Why ID is Not Science", p 8). The discussion was moderated by Case Western Reserve University anthropologist (and National Academy of Sciences member) Cynthia Beall.

OCS hopes that the efforts of its members will bear fruit — in the form of solid science standards for the state. NCSE will continue to work closely with OCS and other concerned Ohio citizens and to monitor events as they unfold, keeping members and supporters informed.



Goodbye, Columbus

Kenneth R. Miller
Brown University

The much-anticipated "intelligent design" / evolution panel discussion sponsored by the Ohio Board of Education (OBE) took place on Monday, March 11, 2002, in the Veterans Memorial Auditorium in Columbus, Ohio. Speaking on behalf of "intelligent design" (ID) were Stephen C Meyer, Associate Professor of Philosophy at Whitworth College in Spokane, Washington, and a Senior Fellow of the Discovery Institute's Center for the Renewal of Science and Culture, and Jonathan Wells, the author of *Icons of Evolution* (Washington [DC]: Regnery, 2000) and, like Meyer, Senior Fellow of the Discovery Institute's Center for the Renewal of Science and Culture. Speaking on behalf of evolution were Lawrence Krauss, the Chair of the Physics Department at Case Western Reserve University in Cleveland, Ohio, and me.

My host (Patricia Princehouse of Case Western) drove me to the site about an hour before our 8:30 AM start time. Anticipating a crowd of thousands, the board had moved the discussion from its original venue to Veterans, which has a capacity of 4000. We paid \$4.50 to park, and strolled past a group of "Repent or Burn in Hell" picketers into the huge theater-like room.

Lawrence Krauss and I set up our laptops, and within a few minutes Meyer and Wells arrived. We nodded to one another briefly and shook hands. OBE President Jennifer Sheets spoke to all four of us together, laying down the ground rules and making it clear that our presentations would be timed to the second — as, it would turn out, they were. Each of us was allotted 15 minutes to make a presentation to the board, and Sheets, as moderator, was careful to ensure that no

one ran over by more than a few seconds.

I had prepared my talk assuming that Wells would go right after one of my textbooks, and I was right. Leading with the "Haeckel embryo fraud", he displayed the cover of one of my textbooks that he said contained the fraudulent drawings, tsk-tsking that, although it was "nothing personal" against me, I had helped to spread Haeckel's fraudulent claims to students.

The rest of his 15 minutes was occupied by a recitation of the classic "icons" he discusses in his book. He showed a slide of a "peer-reviewed" 1999 article in *The American Biology Teacher*, and told the audience about the "Darwinist persecution" of teacher Roger DeHart. He also showed a slide with David DeRosier's picture from his "peer-reviewed" *Cell* paper together with Dave's comment that the bacterial flagellum, more so than other biochemical motors, has many features of machines designed by humans. In fact, I would wager that the single most repeated phrase in his talk was "peer-reviewed paper", which he applied to nearly every publication he cited.

He showed Darwin's drawing from the *Origin* illustrating the divergence of taxa and commented on how poorly it described the great gaps between the animal phyla, ignoring the fact that it was designed to depict speciation, not the origins of major animal groups. To my delight, he introduced Michael Behe's argument from "irreducible complexity" (which meant that I would not have to explain it myself). He (correctly) anticipated that I would rebut Behe's argument, and tried to undercut what I might say by telling the audience that there was a well-qualified scientist in the audience (Scott Minnich) who disagreed with me — as if bringing along one more colleague from the Discovery Institute somehow made a difference.

Lawrence Krauss, Chair of the Physics Department at Case Western, spoke next. He was clear and forceful, and uncompromising on the standards of science — standards that "intelligent design" simply does not meet. In one of the most-quoted phrases of the morn-

ing, he pointed out that the two-on-two format of this presentation did not render a fair picture of the sentiment in the scientific community. A more reasonable arrangement, he noted, would have one member of the Discovery Institute on one side, and ten thousand scientists on the other. He also made the telling point that two of the Discovery Institute's nine senior fellows were the ID speakers who were there; if they had not been there, the only place to find more advocates for ID would be back at the Discovery Institute. If Krauss or I had not been there, however, we could have been replaced by scores of scientists from just about any college or university anywhere in Ohio.

Steven Meyer followed Krauss. His presentation contained cute, cartoon-like slides similar to the drawings published in ID books. One compared the "controversy" to two shouting people holding signs labeled "Theory A" and "Theory B". How are students to deal with them? By being told that there is a controversy, of course. "Teach the controversy" was Meyer's message. He quoted Darwin on the importance of hearing all sides of a scientific issue, and then attempted to rebut Krauss's criticism of the fact that the ID people mostly seem to publish books, not scientific articles, by pointing out that folks such as Copernicus and Darwin had first published their theories in books, too. (While he was speaking, I scribbled a note on his pad reminding him that Darwin and Wallace had published a joint paper before the publication of the *Origin*. I am sure he was unimpressed!)

Finally, and most importantly, Meyer offered a "compromise" on the issue. This was, of course, accompanied by a slide labeled "compromise" showing cartoon people smiling, shaking hands, and slapping one another on the back. Compromises, apparently, make people very happy. The compromise was that his side was willing to drop its insistence that ID be placed in Ohio's science education standards — if, of course, the standards made it clear that individual teachers should be free to teach the scientific controversy about Darwinism. This, he said, would help Ohio to open the minds of its

Kenneth R. Miller is Professor of Biology at Brown University and the author of *Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution* (New York: HarperCollins, 1999).



students, and would meet the high standards for evolution education mandated by the "Santorum language" in the new education law, the No Child Left Behind Act. My jaw dropped as he concluded with this statement (which I will discuss later).

In the first five minutes of my presentation, I exposed Wells's tactics when he writes or speaks about evolution. I chose three of his icons to show how he misrepresents, distorts, or simply lies about the facts. These were the peppered moths, which he claims do not rest on trees, when in fact they do; the Haeckel embryo drawings, which I corrected in my own textbooks two and one-half years before he wrote about them in *Icons*; and human evolution, in his discussion of which he used out-of-context quotes to distort Henry Gee's views of human evolution and systematically withheld data in order to provide a false picture of this field. The point that Wells is not reliable was made very clearly.

Both speakers from the Discovery Institute had stressed Behe's arguments about "irreducible complexity". I used Behe's own language to show that he has, in fact, made a testable scientific prediction based on his idea: that the parts of an irreducibly complex machine, such as a flagellum or a mousetrap, should be "by definition nonfunctional". Unfortunately for Behe and ID, both the mousetrap and the flagellum fail

OCS Announces E-Mail News List

Ohio Citizens for Science has a news list for distributing news via e-mail. To join the list, send the following (in the body of an e-mail) to majordomo@inia.cls.org: **subscribe ocs [your e-mail address]**

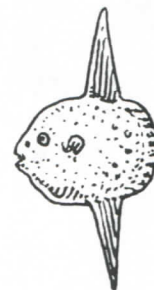
This list is not a discussion list, but a way for OCS to distribute news about the controversy over the Ohio state science standards.

that test, falsifying the prediction. To the delight of the crowd, I illustrated the failure of Behe's prediction by pointing out that I had removed two parts from a mousetrap and was now using my "nonfunctional" mousetrap as a perfectly functional tie clasp! Wells and Meyer never brought Behe up again, except when Meyer claimed that my refutation of Behe would convince only people who heard only "one side" of the story. Curiously, he did not seem to be able to supply the "other side" himself.

I pointed out the many failures of ID to explain the fossil record, especially the problem of extinction, about which ID enthusiasts are notably silent — if all those organisms Wells claims were "designed" in the Cambrian were the work of an "intelligent designer", why did all of them succumb to extinction? Neither Wells nor Meyer, of course, had an answer. Finally, I made it very clear that there was a simple way that ID could, in principle, find its way into the scientific curriculum, and that was the same way taken by

every other idea that is currently included in the standards — by fighting it out in the scientific marketplace. Instead, the proponents of ID are asking for special treatment from the government, a sure sign that their ideas cannot stand on their own merit.

The question period, in which each speaker was given one or two minutes to respond to each question, provided opportunity for us to reiterate and amplify our points. One particularly telling moment came when a questioner asked about the "Santorum language" in the No Child Left Behind Act, which supposedly requires the teaching of alternative scientific theories. Meyer enthusiastically agreed that it did, and urged Ohio to follow the "law". I stepped to my computer, asked for its screen to be projected in front of the audience, and then explained that I had a copy of the law on my laptop and would execute a search for the word "evolution", which supposedly is in the language of the bill. As the audience buzzed (and a few of its members



The Real Kenneth Miller Stands Up

In the original hardback edition of *Icons of Evolution* (Washington [DC]: Regnery, 2000), Jonathan Wells attributes the text of the article "What does it mean to be one of us?" (*Life* 1996 Nov: 38-56) to "Brown University biologist Kenneth Miller" (see p 104 of the hardback edition). Wells criticizes the author of the article for making what he regards as misleading claims about human embryology.

Although the article was by Kenneth Miller, it was not by the Brown University biologist; *Life* employs a staff writer of the same name. According to Miller, he e-mailed Wells, pointing out that a careful look at the article would have prevented his error; Wells responded by promising to correct the error in future editions of *Icons*.

In the new paperback edition of *Icons*, Wells now simply attributes the *Life* article to "Kenneth Miller". Since Wells refers three times in *Icons* to textbooks coauthored by Kenneth Miller and Joseph Levine — which the Brown University biologist *did* write — his readers will naturally assume that he is also the author of the *Life* article, although Wells no longer explicitly makes the identification. (In addition, the index to the paperback edition fails to have separate entries for the two Kenneth Millers.)

At the March 11, 2002, panel discussion of evolution and "intelligent design" in Columbus, Ohio, Miller reports, he attempted to discuss the issue with Wells, who repeatedly refused to talk to him about it.

chuckled), the search came up empty. Why? "Because", I informed the audience, "the ID folks have misled you" (I should have been blunt enough to say that they lied). Santorum's amendment to the Senate's version of the bill was first watered down during the conference committee and then was relegated to its report. The language that Meyer cited is not part of the bill, was not signed into law by the president, and does not have the force of law.

The effect on the audience was dramatic. The ID folks had been caught in a lie. How did Wells respond? Incredibly, he simply picked up a copy of the conference report and read the language slowly, apparently on the principle that if a falsehood is repeated often enough, people will begin to believe it. No one was fooled, however, and the ID folks had blundered badly on the most basic issue of all — telling the truth.

The rest of the hour-long question period was great fun as well. At one point I diagrammed the Cambrian explosion to make the point that the "major animal groups" Wells likes to talk about as appearing suddenly in a geologically short period of time include only the phyla, and do not include what most people think of as "major groups", such as insects, reptiles, mammals, and birds. It also completely excludes the plants, and I pointed out that nearly all the plant phyla (which botanists call "divisions") appeared well after the Cambrian. Wells then borrowed my drawing and, of course, contended that he meant "phyla" by "major animal groups", saying that he meant to mislead no one. And the phyla really do appear in the Cambrian.

As the question period drew to a close, the ID folks claimed that we wished to suppress the discussion of controversy. Krauss scored points with the audience by emphatically and humorously stating that, on the contrary, we scientists like nothing so much as "to prove another scientist wrong".

The final questions gave me an opportunity to plug my new textbook and to prove Wells wrong yet again in a single stroke. Speaking on the origin of life, he pleaded with the OBE to reject a "dogmatic"

Darwinian approach on the origin of life, and allow ID to explain to students just how uncertain and controversial theories about the origin of life really are. Textbooks, he implied, present the origin of life as solved. Since Meyer had already broken the commercial ground by plugging a videotape sold by the Discovery Institute, I gleefully held up my new textbook and quoted from the section on the origin of life, which clearly indicates the scientific uncertainties Wells had claimed that we suppressed. Another point lost for the ID side.

Post-debate chatter in the evolution camp was jubilant, if somewhat muted by the political realities of the current situation in Ohio. Krauss and I felt that we had exposed the empty nature of "design" at every hand. Yet to many members of the board, it was doubtless clear that, at the conclusion of the debate, there were still "two sides" talking away on the issue. As much as I enjoy the debate format and the opportunity to expose the flimsy science and misleading tactics of the ID folks, the two-on-two format clearly promotes a mistaken impression of there being "two sides to the issue", and that is the continuing danger. Nonetheless, Krauss and I had great fun, and the lack of scientific evidence on the other side was obvious to anyone who was willing to recognize it.

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Ohio Forum: Why ID Is Not Science

Frank Lovell

Creationist interest groups are laying siege to the Ohio Board of Education (OBE) in an effort to have the evolution content of Ohio K-12 science curriculum dumbed down by eliminating discussion of the age of the earth and including "intelligent design theory" (see "*Ohio: The Next Kansas?*" p 4).

In order to help the citizens of Ohio to prepare for this and better to understand this issue, Case

Western Reserve University (CWRU) invited Stephen Jay Gould (Harvard; paleontology), Kenneth Miller (Brown; cell biology), and Lawrence Krauss (CWRU; physics) to speak in a free public forum in Cleveland entitled *Evolution & God: Why Intelligent Design Theory Isn't Science*. Cynthia Beall (CWRU; anthropology) moderated the discussion, which was held on March 2, 2002, at Case Western Reserve University.

Although I do not live in Ohio and I already understand why "intelligent design" theory is not science, I decided to drive from Louisville, Kentucky, to attend this event because I usually attend creationist rather than evolutionist programs; I thought I would treat myself to a program where I would not feel pressure to take copious notes, strain my brain thinking of counterarguments, or suffer elevated blood pressure. I could for a change just sit back and enjoy. Unfortunately, when the program began we learned that Gould would miss the program, having been hospitalized in Boston the day before.

An hour before the event, there were already over 300 people waiting for the doors to open. When the event began I could see no unoccupied seats in the theater (which one colleague estimated holds 2500 people). No one knew what part of the audience leaned toward regarding "intelligent design theory" as science, but the questions asked at the end of the event seemed to be the sorts that people sympathetic to ID would ask.

THE MAIN EVENT

Moderator Cynthia Beall opened the program, explaining why this free public event was being held. She elaborated on the importance of not tainting Ohio's public science education by intruding religious non-science into the science curriculum. She then introduced the two main presenters, physicist Lawrence Krauss and cell biologist Kenneth Miller.

Krauss's presentation was rather brief but he was an effective, delightfully engaging speaker. For example, he said that since "evolution and God" was on its face a biological controversy, the audience was probably wondering why a



physicist was at the podium as the first speaker. "It's because physicists are closer to God than biologists", he quipped while grinning at Miller.

Krauss said creationists feel that it is unfair for science to exclude supernatural explanations. Agreeing that indeed science is not *fair* on that account, he explained that science is not fair because empirical science is not concerned about treating ideas fairly, but about judging them on their empirical merit. Science is a process for empirically producing reliable knowledge about physical nature and can only do so regarding events that are strictly "regular" under the constraints of natural law. Therefore science is unable to investigate anything that is spiritual or supernatural or unconstrained by natural law. Only ideas that can be empirically tested/falsified are scientific ideas, he said; we do not know how to test empirically or falsify ideas about the supernatural.

Next, Krauss explained how contributions to scientific knowledge are made through research in peer-reviewed scientific journals and/or presented (and debated) at scientific meetings. The "intelligent design theorists" do not do these things, he pointed out; instead they bypass presenting at scientific meetings and publishing in peer-reviewed scientific journals, engaging critical scientists only in public forums and working to build political (rather than scientific) pressure to intrude ID into public science education by popularizing ID among those members of the public who are not science professionals. ID promoters also try to make ID *seem* scientific to the nonscientist public by having public debates with scientists, but public debates do not qualify as scientific research.

Kenneth Miller took the podium next and gave a dynamic presentation. With the help of computer-generated slides, he simply and effectively illustrated why biological and biochemical "irreducible complexity" is not irreducibly complex. He even tackled Behe's example of the mechanical "irreducible complexity" of mechanical mousetraps. He then took from his pocket a standard mousetrap that had 3 of its parts removed and showed how what was left was fully functional as

a tie-clip (which he promised to wear to the upcoming March 11 public hearing of the OBE on the issue of including "intelligent design" in science classes).

Miller also used data on radioisotope abundance in the earth's crust to illustrate why the earth *is* billions of years old (reference to the old age of the earth is one of the things the OBE is being asked to eliminate from the public science curriculum). He illustrated how the appearance of major groups of organisms over time refuted the flood geology arguments of creationists and their claim that all major groups of organisms are represented in the faunal record of the "Cambrian explosion".

Miller explained that while the origin of life is of great interest to evolutionists, it is not a part of the evolutionary diversification of life and that the fact that there is no current scientific consensus on just how life first arose does not in any way diminish scientific confidence that life has diversified on earth via evolution over hundreds of millions of years.

Miller effectively addressed a number of other anti-evolution claims and "intelligent design" arguments, and wrapped up his presentation by explaining how he (for one) accepts the scientific validity and historical reality of biological evolution and also actively embraces religious faith in God and spiritual salvation. This included an explanation of why Miller regards evolution's operating in nature without divine guidance to be the only way a Creator could (ultimately) produce soulful intelligence endowed with genuine free will.

QUESTION AND ANSWER

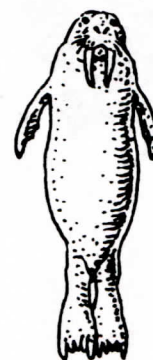
Written questions from the audience were solicited during the presentations, but only about 6 were entertained at the close of the program, all which were answered with adroit aplomb. Several followed the same pattern of making a comparison between ID and other examples of "alternative views" in the sciences. These were generally handled in the same way, so one example will suffice for illustration.

QUESTION: Since light as particles-versus-waves was debated

scientifically, why should competing theories of unguided evolution versus "intelligent design" not be debated scientifically?

ANSWER (given jointly by Kenneth Miller and Patricia Princehouse, CWRU Department of Philosophy): Both wave theory and particle theory were scientifically admissible and debatable because both enjoyed the support of considerable empirical evidence in the form of experimental data; so far, there is *no* empirical evidence in support of "intelligent design" in biology. Before ID can be admitted to the debate, it has to bring some *data* to make its case.

The program was very enjoyable; it was even worth the 11 hours of road time. The 2000 or so people in attendance were treated to a superb program that thoughtfully yet entertainingly dealt with all the major points that need to be considered. I do not know how many (if any) of the OBE members attended, but the whole program was videotaped, and I hope copies will be distributed to each member.



Echoes of Oz? The Wicked Witch Hovers Over Ohio

Lawrence S Lerner

It was a special pleasure to read the fall 2001 draft of the Ohio science education standards. With respect to its treatment of the historical sciences, and especially biology, the new draft contrasts with the old (1996) document as day with night. (I reviewed *Science: Ohio's Model Competency-Based Program* in its entirety in Lerner 2000c and specifically with respect to its treatment of evolution in Lerner 2000b; see also Lerner 2000a.)

The old document earned the grade F on account of its slippery

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avoidance of biological evolution. ("Evolution [is] treated here as if it were not proper conversation in polite company. The E-word is avoided and the evolutionary process occupies a near-negligible part of an extensive document" [Lerner 2000b: 15].) The new draft treats evolution in exemplary fashion — not only evolution as it is pertinent to the life sciences, but with respect to the earth and space sciences and the essential connections among these sciences as well. Moreover, the basic concepts underlying evolutionary processes in all these sciences are introduced at the most elementary levels and their treatment is continued and enriched in a consistent, pedagogically admirable manner as the student progresses through the grades. The treatment culminates in a sophisticated and comprehensive exposition of the sciences in their indissoluble evolutionary context at the high-school level. I would give the new standards, if enacted, an A.

It is interesting to note how the creationist coalition, the self-styled Science Excellence for All Ohioans (SEAO), which apparently consists of both young-earth and "intelligent-design" creationists, has crafted the modifications they desire (see <<http://www.sciobio.org/seaoindi.htm>>). The intent is clearly threefold: to eliminate all references to the central role played by evolution in the historical sciences, to soft-pedal references to the great age of the earth and the universe, and to shoehorn a discussion of "intelligent-design" creationism into the upper-grade specifications.

Since they have abandoned the possibility of sweeping evolution entirely under the rug, they have adopted the ploy of inserting "alternative" explanations. In making these proposals, the creationists have displayed their lack of understanding of the role of evolution in the sciences. For example, there is essential evolutionary content in the Grade 2 specifications:

Observe and investigate that smaller rocks come from the break down of larger rocks through the actions of plants, animals, and weather.

Observe and understand that

extinct organisms may resemble organisms that are alive today.

Infer that many kinds of organisms that once lived on earth have disappeared.

At Grade 4:

Compare how individuals of the same kind differ in their characteristics and sometimes the differences give individuals an advantage in survival.

At Grade 6:

Know that fossils provide important evidence of how life and environmental conditions have changed.

Know that sedimentary rock is deposited in layers with the oldest layers on the bottom and the youngest layers on the top. Thousands of layers of sedimentary rocks confirm the long history of the changing surface of the earth.

At Grade 8:

Describe how stars formed early in the development of the universe when matter, clumped together by gravitational attractions, formed countless stars early in the development of the universe.

Know the earth's crust is divided into plates moving at extremely slow rates in response to movement in the mantle.

Know that major geological events (e.g., earthquakes, volcanic eruptions, and mountain building) result from plate motion.

Thus SEAO has missed all the groundwork done before Grade 10, and has concentrated on an attempt to introduce alternative phraseology wherever the word "evolution" occurs.

Now, creationists may argue at length for "alternative explanations" of the phenomena that are accounted for by evolution over the sweeping spectrum of the astronomical, geological, and biological sciences. But the K-12 classroom is not the place to do this. The function of

K-12 science education is to inform students as accurately as possible about what scientists have done and are doing, and how they do it. Evolution is the central principle of the historical sciences as surely as Newton's laws are the central principle of classical physics and conservation of mass and energy is the central principle of chemistry. On the other hand, creationists simply do not make contributions to scientific progress; these "alternative explanations" are simply not to be found in the peer-reviewed scientific literature (Scott and Cole 1985; Gilchrist 1997). Thus, to tell K-12 students that there is a credible explanation of the present state and history of the world other than evolution is to delude them and to distort their understanding of what science is.

To adopt standards modified as the creationists have proposed is to put Ohio in the shameful position that Kansas has just vacated. Their version of the standards would receive an F — or worse. Ohio's students deserve better.

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ERRATUM

Thanks to member John D Haun who pointed out an error on page 7 of *RNCSE* 21 (1-2). At the end of the joint letter, we wrote "American Geophysical Institute" where we should have written "American Geological Institute".



"Creationism" Discussion Belongs in Religion Class

Lawrence M Krauss

Improving the standard of living of Ohioans depends upon our ability to produce an educated citizenry.

To prepare our children to function and flourish in our modern technological society, we owe it to them to provide the best science education that we can afford. This pressing goal makes the recent effort to introduce a new form of creationism in science class particularly destructive.

Last year, the Ohio General Assembly called for new state standards in several areas, including science. A standards committee team has been working on the project and implementing recommendations from groups such as the Ohio Board of Education Science Advisory Committee and from the National Academy of Sciences.

In the face of this work to bring Ohio's science standards up to date, a well-organized effort is under way to introduce the concept of "intelligent design" as an alternative to evolution into the Ohio curriculum. Under the guise of "fairness" and "diversity", this effort merely undermines the teaching of science.

Proponents argue that the notion of "intelligent design" (that life's origin and evolution may be directed by some creative force) is not raised in biology classes when discussing the evolution of life. It is only fair, they say, that this alternative to evolutionary biology be introduced to students.

The seductiveness of this argument is that it avoids the word "creationism" and makes it seem as

though by introducing such an alternative to evolution we are making our science curriculum more inclusive. The problem is, however, that the concept of "intelligent design" is not introduced into science classes because it is not a scientific concept.

The group pushing this agenda, Science Excellence for All Ohioans (a project of the conservative American Family Association of Ohio), bemoans the fact that scientists confine their investigation to phenomena and ideas that can be experimentally investigated, and that science assumes that natural phenomena have natural causes.

This is indeed how science operates, and if we are going to teach science, this is what we should teach. But while this methodology has helped create the modern technological society in which we live, it is absolutely true that science has limitations on the areas it can study.

One may feel unsatisfied that science does not address notions of the existence or nonexistence of God, but this issue is simply not relevant within the domain of scientific inquiry. There should be room for discussion of such limitations elsewhere in the curriculum, in philosophy or religion classes, for example. But science classes should focus on the knowledge that can be gleaned from the scientific method, and not on pushing the philosophical agenda of individuals who would like to use science classes to discuss religion. And make no mistake about it: this is the stated intent of groups such as the SEAO. Their web site argues that the "intelligent design" initiative should allow ideas that otherwise would be labeled "creationism" to be introduced into science classes.

The notion of "intelligent design" suggests that living systems are far too complex to have arisen naturally, and must therefore have been designed by an intelligent creator. The problem with this notion is that it is untestable within the context of the scientific method and therefore has no place within our science curriculum. As a practical matter, it is also worth noting that the scientific investigation of the origin and evolution of life has not thus far run up against any insurmountable roadblocks. There

is much we do not know at the present time, but there is no evidence that there are limits to what we *can* know in this regard. While groups such as the SEAO promote the notion that biological evolution is a controversial science topic, this is simply not true. Evolution is to modern biology what Newton's laws are to modern physics. There is no controversy within the scientific community on this issue.

When Kansas officials removed evolution from the state science curriculum, they not only subjected their state to ridicule in the national media, they set off a backlash that had serious potential economic consequences for the state. Several major national corporations announced plans to reconsider relocating to Kansas because of concerns about the education the children of their employees would receive.

If Ohio enacts standards that erode the teaching of science in our schools, we will be taking a giant step backward in our efforts to compete economically on the national and international playing fields of our modern, technological society. As such, we will not only be doing a disservice now in the education of our children, but we will diminish their future opportunities for economic and cultural advancement in our state.

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New Encyclopedia of Biology

NCSE member Ken Saladin wrote to let us know of the publication of a new high-school biology encyclopedia that includes Ken's contribution on creationism. His entry features descriptions of the NCSE, the Committees of Correspondence, and the NCSE web address. Its goal is to provide a resource for high school students and teachers looking into the issue.

Saladin KS. Creationism. In: Robinson R, ed. *Biology* vol 1. New York: Macmillan Reference, 2001. p 185-7.

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Letter to the Ohio Board of Education

David W Ball

As President of the Cleveland Technical Societies Council (CTSC), I would like to express some thoughts and concerns about the development of statewide science standards for K-12 education. CTSC is a consortium of over 30 scientific and technical societies in northeast Ohio. Representing over 22 000 scientists and engineers in the region, CTSC fosters collaboration, promotes technical awareness, and encourages excellence in education. We support science fairs with funding and volunteer manpower, coordinate scholarships for dozens of deserving students annually, and bestow awards on excellent scientists, engineers, and educators in the area. Thus, we are keenly interested in a quality science education for our children in Ohio schools.

There have been recent high-profile discussions regarding certain science standards, focusing on the theory of evolution and something called "intelligent design" (ID). Proponents of ID tout it as a scientific alternative to evolution, and as such deserving to be included among the science standards for K-12 education. To be blunt, a vast majority of scientists would consider that assertion ludicrous.

Science is based on experiment and evidence. There is no experimental work on ID, and there is no evidence in favor of it either — how can it be "science"? Proponents of ID pretend that by criticizing evolution, they can promote support of their own ideas. This is not how science works — in science, you build support for your ideas by finding demonstrable evidence in favor of it. ID supporters do no such thing.

In addition, some attempt to demean evolution as "only a theory" and argue that other theories deserve their fair share of science classroom time. This argument only serves to demonstrate an ignorance of basic science. In science, a "theory" is a general statement that explains a large number of observations and facts. In the general ver-

naular, the word "theory" is used synonymously with "hypothesis", but not in science. No self-respecting chemist would dismiss the atomic theory as "only a theory", yet these same chemists would try (and have tried) to demean the theory of evolution as "only a theory". Such people demonstrate an ignorance of science that should definitely not be encouraged in our children.

As to the fairness issue, let me be blunt again: good scientists should not care about being fair. Rather, good scientists should care about finding the proper models to explain the natural universe around us. One could argue that it would be fair to present geocentrism and heliocentrism in the science class and let students decide for themselves which is "right" — but that is not good science or good education. It is also not good science to teach students that diseases are punishments from evil witches who live in our midst, despite arguments that "evil spirits" are an alternative to germ theory (there's that word again!). The content of a science class should be good, demonstrable science. ID is not, and it does not belong in the science classroom.

"Intelligent design" is not intelligent; it is merely a design — a design to get religion into the science classroom. It is creationism in sheep's clothing. It is promoted by an extreme and vocal few who see a product of good science — the theory of evolution — as a personal and philosophical threat, and whose response to good science is to legislate scientific content to their own liking.

In the late 1800s, an Indiana state legislator introduced a rider on a bill that would define the mathematical ratio pi as equal to 3 (its actual value is 3.1415926...). Fortunately for Indiana, that bill died in committee. In 1999, Kansas was not so lucky: religious zealots with a political agenda managed to change the statewide science standards. The result was world-wide contempt. As a direct consequence, several supporters of the changes were not re-elected and the state standards were restored to reflect good scientific thought. Now the state of Ohio is being asked to consider including non-science (non-

sense?) in its science classroom. Is the state prepared to have its children's education become a laughingstock?

As our society becomes increasingly technological, a solid general science background becomes increasingly crucial for all of its citizens — starting with our children. K-12 science standards deserve to include the best contemporary understanding of the natural universe, including atomic theory, germ theory, plate tectonic theory, quantum theory, and — yes — the theory of evolution. ID has no place in the science classroom.

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Farewell to the Santorum Amendment?

Glenn Branch
NCSE Office Manager

Despite the claims of creationists and other ideological opponents of evolution, the so-called Santorum Amendment — which, by singling out evolution as uniquely "controversial", was apparently intended to discourage evolution education — was not included in the No Child Left Behind Act, passed by Congress in late 2001 and signed into law by President Bush in early 2002. Although the Joint Explanatory Statement of the Committee of Conference for the bill contains a brief and not as objectionable mention of evolution, the contents of the Joint Explanatory Statement enjoy no force of law. Teachers in particular should be aware that the No Child Left Behind Act in no way requires them to teach evolution any differently than they do now.



BACKGROUND

On June 13, 2001, the US Senate adopted a Sense of the Senate amendment to the Elementary and Secondary Education Act Authorization bill, S 1, then under consideration. Proposed by Senator Rick Santorum (R-PA), the amendment read:

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 the subject generates so much continuing controversy, and should prepare the students to be informed participants in public discussions regarding the subject.

As Eric Meikle explained (*RNCSE* 2000 Nov-Dec; 20 [6]: 4), the fact that evolution is singled out as uniquely controversial amply indicates the amendment's anti-evolutionary intention. There were several indications that "intelligent design" proponents were instrumental in framing the resolution. In proposing the amendment, Senator Santorum cited a law review article coauthored by "intelligent design" proponent David K DeWolf, Professor of Law at Gonzaga University and Senior Fellow at the Discovery Institute's Center for the Renewal of Science and Culture. And the godfather of the "intelligent design" movement, Phillip Johnson, was quoted in the June 18 *Washington Times* as having "helped frame the language" of the amendment.

On June 14, the bill, including the Santorum Amendment, passed the Senate 91-8. It seems likely that most of the senators who voted for the bill were unaware of the anti-evolution implications of the Santorum Amendment, although Senators Sam Brownback (R-KS) and Robert Byrd (D-WV) alluded to them in their remarks in the *Congressional Record*. Unsurprisingly, anti-evolution groups such as Answers in Genesis were

quick to rejoice at the token of support for their cause embodied in the Santorum Amendment.

Because HR 1, the version of the bill that passed in the House of Representatives, contained no counterpart of the Santorum Amendment, the House-Senate Conference Committee needed to reconsider it when it met to reconcile the two versions of the bill. Thus there was still a chance for the scientific and educational communities to influence the outcome, and they seized the day. The officers of almost 100 scientific and educational societies, together representing over 100 000 scientists, called upon the chairs of the conference committee to drop the Santorum Amendment (*see RNCSE 2001 Jan-Apr; 21 [1-2]: 7 for the text of their letter*).

In December 2001, the joint committee finished its work. The compromise bill was submitted to Congress, which passed it (renaming it the No Child Left Behind Act in the process) and sent it to President Bush for his signature, which it duly received on January 8, 2002.

THE GOOD NEWS

The good news is twofold. First, the Santorum Amendment was substantially weakened during its stay in committee, eventually appearing in the following two sentences:

The conferees recognize that a quality science education should prepare students to distinguish the data and testable theories of science from religious or philosophical claims that are made in the name of science. Where topics are taught that may generate controversy (such as biological evolution), the curriculum should help students to understand the full range of scientific views that exist, why such topics may generate controversy, and how scientific discoveries can profoundly affect society. [*See <http://edworkforce.house.gov/issues/107th/education/nclb/conference/stateofman/title1pa.htm>.*]

Note that evolution is no longer singled out as uniquely controversial: it is merely used as one exam-

ple of a host of potentially controversial topics. The conference committee's wish to keep "religious and philosophical claims that are made in the name of science" out of the science classroom is, of course, fully supported by NCSE. "Creation science", including "intelligent design", indeed consists largely of religious and philosophical claims that are disguised as science, and that is why NCSE opposes its presence in the science classrooms of our nation's public schools. Note also that the Santorum Amendment's original desire for students "to be informed participants in public discussions" was replaced with the conference committee's desire for students "to understand the full range of scientific views" — although creationism might be regarded as a matter of public discussion, it is certainly not a scientific view.

Second, the Santorum Amendment, even in its weakened form, is not present in the bill that was signed into law. It appears only in the Conference Report, buried deep in the Joint Explanatory Statement of the Committee of Conference in Title I, Part A, as item 78. The Joint Explanatory Statement is not part of the bill itself; it is simply an explanation of how the conference committee reconciled the various provisions of the House and Senate versions of the bill. The text of the bill itself neither mentions evolution nor includes any sentiments reflecting the Santorum Amendment. Thus the No Child Left Behind Act in no way requires teachers to teach evolution any differently.

It appears as if the conference committee largely heeded the call of the officers of the scientific and educational societies. The Santorum Amendment was dropped from the bill; the fact that a weakened version of it was included in the Joint Explanatory Statement of the Committee of Conference, where it enjoys no force of law, was probably intended to appease religiously conservative constituents — politics is, after all, the art of compromise.

THE BAD NEWS

The bad news is that many creationists and other ideological opponents of evolution took the



Santorum Amendment and jumped on the propaganda bandwagon with it. In a press release dated December 21, 2001, with the headline "Congress gives victory to scientific critics of Darwin", Bruce Chapman, president of the Discovery Institute, announced, "The education bill just passed by Congress calls for greater openness to the study of current controversies in science, notably including biological evolution." Although he evidently recognized that the Santorum Amendment was substantially weakened and that the weakened version appeared not in the bill but only in the conference committee report — writing that "What began as the 'Santorum Amendment' ... now resides in report language" — he nevertheless misleadingly characterized the bill as "a substantial victory for scientific critics of Darwin's theory and for all who would like science instruction to exercise thoroughness and fairness in teaching about contemporary science controversies." Interestingly, Chapman harped on Darwin and Darwinists, although Darwin's name never appeared in the Santorum Amendment; the Discovery Institute's practice of tendentiously equating evolution and "Darwinism" is documented by Skip Evans in "Doubting Darwinism by creative license" (see *RNCSE 2001 Sep-Dec; 21 [5-6]: 22-3*).

Then, apparently in response to a precursor of the present report posted on the NCSE web site, the Discovery Institute issued a further press release on December 28, 2001, entitled "Congress urges teaching of diverse views on evolution, but Darwinists try to deny it". It also appeared in a slightly revised form as "Deny, deny, deny" by John West in *WorldNetDaily* <http://www.worldnetdaily.com/news/article.asp?ARTICLE_ID=25946>. In both versions, West contended that NCSE originally was wholeheartedly against the Santorum Amendment and then, when it appeared in weakened form in the conference committee report, opportunistically engaged in "after-the-fact attempts to rewrite history" by praising the conference committee's wish to keep "religious and philosophical claims that are made in the name of science" out of the

science classroom. Needless to say, he misrepresented NCSE's views: it was only clause (2) of the Santorum Amendment that was intrinsically objectionable.

The Discovery Institute was misleading on the status of the Santorum Amendment vis-à-vis the bill that was signed into law, but Phyllis Schlafly of the conservative Eagle Forum was downright wrong. In an editorial posted on the conservative web site *TownHall.com* on February 6, 2002, Schlafly wrote:

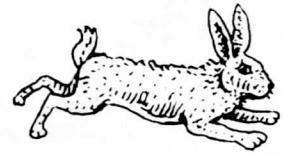
The "No Child Left Behind" bill signed by President Bush on Jan 8 includes a science requirement that focuses on "the data and testable theories of science". This new federal law specifies that "where topics are taught that may generate controversy (such as biological evolution), the curriculum should help students to understand the full range of scientific views that exist" [<http://www.townhall.com/columnists/phyllisschlafly/ps20020206.shtml>].

Because Schlafly was discussing the ongoing controversy about state science standards in Ohio (see "*Ohio: The next Kansas?*", p 4), she may have been relying on misinformation about the Santorum Amendment posted on SEAO's web site, which was later corrected.

To give credit where credit is due, the anti-evolutionist ministry *Answers in Genesis* recognized that the fact that the Santorum Amendment was not present in the No Child Left Behind Act was a defeat for the anti-evolution movement. In "Honest science 'left behind' in US education bill", posted at the AIG web site on January 7, 2002, Mike Matthews emphasizes that "The final version of the bill ... says not one word about evolution or the controversy surrounding it" and remarks in a footnote that "The original Senate amendment was 'watered down' in two senses", citing the same changes of wording cited above (<http://www.answersingenesis.org/docs2002/0107ed_bill.asp>).

Nevertheless, expect to see distorted reports of the Santorum Amendment in the anti-evolution press from now on. As we know

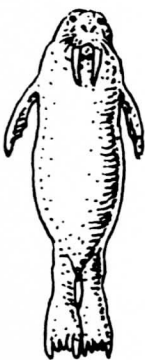
from long experience, creationist misinformation is hard to quash.



UPDATES

Indiana, Columbus: A petition requesting that an elective class in "creation science" be taught has been presented to the Bartholomew Consolidated School Corporation Board in Columbus, Indiana. According to a report in the *Columbus Republic* on February 3, 2002, about 1300 people signed the petition. A school district committee delegated to evaluate the request will attempt to determine if any other public schools offer such a separate "creation science" class and if any curricula exist for such a class.

Pennsylvania, Greene County: On January 24, 2002, the West Greene school board voted 6-2 to allow young-earth creationist Steve Grohman (who maintains a web site at <<http://www.creationseminar.net>>) to address students during an assembly during school hours on March 25. Those not wishing to attend could choose not to do so. High school principal Brian Jackson reviewed a tape from Grohman, who asserts that evolution is not true science and that both creationism and evolution should be taught in public schools, according to a story in the *Washington, Pennsylvania, Observer-Reporter* on January 25. Subsequently, the executive director of the American Civil Liberties Union of Pennsylvania, Witold Walczak, wrote to the school board to warn that the planned assembly is unconstitutional. In his letter, Walczak remarked, "In 1925, the ACLU represented John Scopes in the famous Tennessee 'Monkey Trial.' That is the last time we have



lost one of these cases." On March 1, the *Observer-Reporter* reported that in its meeting on February 28, the school board voted 6-3 to cancel Grohman's presentation. Grohman did make a presentation at the school on the afternoon of March 22, when school was dismissed early.

Washington: On January 18, 2002, a new anti-evolution bill was introduced in the Washington state Senate and referred to the Education Committee. According to the bill's digest, SB 6500 "[f]inds that the teaching of the theory of evolution in the common schools of the state of Washington is repugnant to the principles of the Declaration of Independence and thereby unconstitutional and unlawful. Provides that all textbooks and curriculum that teach the theory of evolution shall be removed from the public schools forthwith and replaced with textbooks and curriculum that teach the self-evident truth of creation." For the full text of SB 6500, see <http://www.leg.wa.gov/pub/billinfo/2001-02/Senate/6500-6524/6500_01182002.txt>. Its sponsor, state senator Harold Hochstatter, is the legislator who introduced SB 6058 in 2001, which would require "all science textbooks purchased with state moneys" to contain an evolution disclaimer very similar to the infamous Alabama disclaimer (see *RNCSE 2001; 21 [5-6]: 21*). On January 23, 2002, an identical "companion bill", HB 2681, was introduced in the Washington House of Representatives and referred to its Education Committee. On February 12, 2002, the Ellensburg, Washington, *Daily Record* reported that SB 6500 died in committee. The report also noted that Hochstatter was scheduled to "give a presentation on how evolution as a philosophy creates relativistic values where there are no absolute right-and-wrongs" at a Darwin Day celebration at Central Washington University (see <http://news.mywebpal.com/news_tool_v2.cfm?pnpid=665&show=archive_details&ArchiveID=638472&om=1>).

NCSE NEWS

NCSE's Scott Receives National Science Board Public Service Award

The 2002 National Science Board (NSB) Public Service Award for increasing public understanding of science and engineering will go to NCSE Executive Director, Eugenie Scott. The annual award recognizes one individual and one institution for outstanding contributions to communicating, promoting, or helping to develop broad public policy in science and engineering.

"These awards...go to the heart of what is really important for our nation — informing, educating and building greater literacy in science and engineering", said NSB Chairman Eamon Kelly. "Eugenie Scott has had a profound impact on influencing and encouraging a new group of next-generation scientists and engineers."

"In an appropriate manner, Eugenie Scott struck a chord for the nation in the teaching of evolution. She communicated her message in a positive way among other competing, sometimes opposite, and often emotional points of view", added Paula Apsell, who chairs the NSB Public Service Award advisory committee.

Scott, a member of the Council of Scientific Society Presidents, currently serves as president of the American Association of Physical Anthropologists. She says that her background in physical anthropology enables her to look at the debate over creationism versus evolution from both scientific and cultural perspectives.

Scott has consulted for a PBS-produced video series on evolution, and for other programs on the creation/evolution debate and on pseudoscience. She also has consulted with the National Academy of Sciences on its books *Science and Creationism* and *Teaching About Evolution and the Nature of Science*.

"I feel that the contribution I have made over time is bringing a certain civility into the dialog about

evolution versus creationism", Scott says. "People have strong feelings about the issue, and I have tried to keep communications channels open and positive."

News from the Membership

Glenn Branch
NCSE Office Manager

From time to time we like to report on what our members are doing. As the following list shows, they have a lot to be proud about!

Judith Allard, who has taught at Burlington High School in Burlington, Vermont, since 1978, was named the 2001 Teacher of the Year by the Biological Sciences Curriculum Study (BSCS). She was honored during a reception at the National Association of Biology Teachers (NABT) convention in Montreal in November 2001, where she received a prize of \$1000 for herself and \$1000 for her school's biology department. The prestigious award is the latest in a series for Allard, who was NABT's Outstanding Biology Teacher in 1975, a recipient of the Presidential Award for Excellence in Science Teaching in 1983, and Vermont Teacher of the Year in 1998. (See the Winter 2001 issue of BSCS's newsletter *The Natural Selection*, pages 16-7, for further details.)

Michael F Antolin and Joan M Herbers's article "Evolution's struggle for existence in America's public schools" appeared in *Evolution* 2001 Dec; 55 (12): 2379-88. In the article, Antolin and Herbers explain, "we outline the typical creationist arguments we encounter from students, teachers, school-board members, and neighbors. We explain briefly how knowledge of both microevolution and macroevolution is important in medicine, agriculture, and biotechnology. We describe a science education controversy that arose within our own school district [the Poudre School District in Fort Collins, Colorado], how we responded, and



what we learned from it. Finally, we argue that even modest outreach efforts to science teachers will be richly repaid." For *RNCSE*'s coverage of the controversy, see *RNCSE* 1999; 19 (4): 4-5 and 1999; 19 (5): 10.

Philip Appleman's anthology *Darwin: A Norton Critical Edition*, third edition (New York: WW Norton, 2001) was reviewed in *Skeptic* 2002; 9 (2): 102-3 by **Betty McCollister**, who describes it as "both comprehensive and eclectic, an altogether magnificent achievement." She added, "Appleman has made an unsurpassed contribution to literature on Darwin and on evolution and put together an indispensable addition to the libraries of all who marvel at Darwin's revolutionary idea..." Appleman's *Darwin* was also reviewed by **John C Greene** in *RNCSE* 2000 Nov-Dec; 20 (6): 26-8.

Gary L Bennett's op-ed piece commemorating Charles Darwin's 193rd birthday appeared in two newspapers (the Emmett, Idaho, *Messenger Index* and the Nampa, Idaho, *Press-Tribune*) on February 12, 2002. Bennett presented Darwin's life in miniature, described the theory of evolution by natural selection, and concluded by pointing out that "[i]t cannot be emphasized enough that there is nothing anti-religious in Darwin's theory. In fact, evolution is silent about religion. The major Judeo-Christian-Islamic religious denominations in the US have accepted evolution as the way God works" and quoting the famous concluding sentence ("There is grandeur in this view of life...") of the *Origin of Species*.

During the controversy about whether the Chetek, Wisconsin, school district should teach creationism to tenth-grade students along with evolution (see *RNCSE* 2000; 20 (6): 8), **Jack Bennett** wrote to the Eau Claire, Wisconsin, *Leader-Telegram* to explain that "All of the sciences support evolution. Creationism doesn't fit into science because it is a religious belief, not science." Regarding the superintendent's decision to form a committee to discuss the issue, Bennett quipped, "If the student had complained that her belief in a flat earth was not being presented as science, would the school be obliged to form a committee to study the issue to see if a curriculum change should be made?" In this case, the committee

decided that the biology curriculum would be unchanged.

NCSE Office Manager **Glenn Branch's** article "Fighting for evolution" was published in *The Biological Physicist*, the newsletter of the Division of Biological Physics of the American Physical Society (2001 Dec; 1 [4]: 5-6; on-line at <<http://www.aps.org/DBP/newsletter/dec01.pdf>>. Warning that creationism is alive and well, Branch described and debunked the "three pillars of anti-evolutionism" — the claims that evolution is a theory in crisis, that evolution is antireligious, and that it is only fair to teach both sides. He concluded, "So if creationism comes to your community — and don't assume that it never will, or that it hasn't already — be prepared to explain what is wrong with the three pillars of anti-evolutionism. And call us at NCSE. We can help." Thanks to **Sonya Bahar**, editor of *The Biological Physicist*, for commissioning the article.

Wesley Elsberry received the Fairfield Memorial Award for Innovation in Marine Mammal Research for his presentation, "Interrelationships between intramural pressure and biosonar sound production in the bottlenose dolphin", at the 14th Biennial Conference on the Biology of Marine Mammals, held from November 28 to December 3 in Vancouver. Elsberry's review of William A Dembski's *The Design Inference* appeared in *RNCSE* 1999; 19 (2): 32-5.

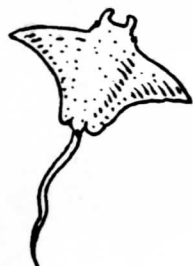
Karl Fezer's *Scholarly World, Private Worlds* (Philadelphia: Xlibris, 2001) is now available. A wide-ranging text on critical thinking, it starts by proposing a bargain to the reader: "learn how to defend your existing beliefs; the price will be that your beliefs will be challenged and that you may see fit to modify them." Fezer was among the first members of NCSE's board of directors and also served as the editor of *Creation/Evolution Newsletter* from 1984 to 1988, so it is unsurprising that *Scholarly World, Private Worlds* frequently discusses evolution and creationism as examples of good and bad science, respectively. For more information, see <<http://www1.xlibris.com/bookstore/bookdisplay.asp?bookid=13187>>.

NCSE Postdoctoral Scholar **Alan Gishlick's** article "The function of the manus and forelimb of

Deinonychus antirrhopus and its importance for the origin of avian flight" was published in *New Perspectives on the Origin and Early Evolution of Birds: Proceedings of the International Symposium in Honor of John H Ostrom*, Gautier J, Gall LE, eds. New Haven (CT): Peabody Museum of Natural History, 2001, p 301-18. Investigating the forelimb of *Deinonychus* within a functional, phylogenetic, and behavioral framework, Gishlick argues that the predatory habits of theropods may have been important to the development of avian flight.

Evan B Hazard, Professor Emeritus of Geology at Bemidji State University in Minnesota, contributed a bibliographic essay on "The least popular theory: Evolution and its opponents in the '90s" to *Choice* (2001 Nov; 39 [3]: 435-47); *Choice*, a publication of the Association of College and Research Libraries, is widely used by academic libraries in collection development. In his essay, Hazard examines the recent works of evolutionists and creationists — including evolutionary biologists, old-earth and young-earth creationists, theistic evolutionists, and proponents of "intelligent design". NCSE is proud that he describes *RNCSE* as "a major source of information on maintaining the integrity of science education" and NCSE itself as "a major resource for teachers being pressured to omit or water down evolution education." [Thanks to Susan Branch for the news.]

NCSE Supporter **Philip Kitcher's** *Science, Truth, and Democracy* (Oxford: Oxford University Press, 2001) appeared; its publisher describes it thus: "Striving to boldly redirect the philosophy of science, this book...examines the heated debate surrounding the role of science in shaping our lives. Kitcher explores the sharp divide between those who believe that the pursuit of scientific knowledge is always valuable and necessary — the purists — and those who believe that it invariably serves the interests of people in positions of power. In a daring turn, he rejects both perspectives, working out a more realistic image of the sciences — one that allows for the possibility of scientific truth, but nonetheless permits social consensus to determine which avenues to investigate. He then pro-



poses a democratic and deliberative framework for responsible scientists to follow." A professor of philosophy at Columbia University, Kitcher is also the author of *Abusing Science: The Case against Creationism* (Cambridge [MA]: MIT Press, 1982).

In a letter to the editor of the Mansfield, Ohio, *News-Journal* (2001 Sep 24: 6A), **Andrew O Lutes** announced the airing of the PBS series on *Evolution*. He went on to pre-empt creationist complaints about the series by explaining that "[a]nti-evolutionists wrongly imagine that evolution causes people to deny God, and equally wrong, that denying God causes people to be evil. These attitudes are in error." Lutes's most recent contribution to *RNCSE* was his review of Derrick Neill's young-adult novel *Duck Egg Blue* (*RNCSE* 2000 Nov/Dec; 20 [6]: 32-3).

Responding to the discussion of "intelligent design" creationists Phillip Johnson, Jed Macosko, and Jonathan Wells in Mark Athiak's "Looking for God at Berkeley" (*SF Weekly*, 2001 Jun 20), **Damian J McCoil** noted that "10 years after Johnson's book *Darwin on Trial*, the scientific community awaits the debut of a single peer-reviewed paper on 'intelligent design' in a recognized journal. ... The reluctance of practically all scientists to support the 'intelligent design' hypothesis comes not out of some desire to manipulate or control the truth but because all the data we have, such as the genome projects and 200 years of paleontology, geophysics, and astronomy, support evolution." His letter appeared in the July 4 issue of *SF Weekly*.

Calling Bernadette's Bluff (Philadelphia: Xlibris, 2002), a novel by **Dale McGowan**, is now available. "There's only one real taboo left in 21st-century America, and Jack Kassel's got it bad. He doesn't believe in God. And even that might be all right if he didn't teach at the College of Saint Bernadette, but he does. Nothing is more important to Jack than reason, the triumph of truth over comforting fantasies, but Saint Bernie's is the land of created realities, where critical thoughts go to die. When his oldest partner in disbelief shows up as the campus priest, Jack edges nearer the abyss, finally plunging over when his ex-wife enrolls their brilliant young son in a Lutheran school and the boy

begins quoting Scripture in response to Jack's questions. Back against the wall, Jack starts to 'come out' as a non-believer at what turns out to be the worst possible time — as a Marian apparition turns the college into a holy pilgrimage site." For more information, see <<http://www1.xlibris.com/bookstore/bookdisplay.asp?bookid=12552>>.

Writing to *The New York Times* (2002 Mar 18) about stories concerning evolution education in two different locales, **Douglas E McNeil** drew a fascinating parallel: "As Tunisia moves its schools into the future by teaching Darwinian evolution ..., Ohio moves into the past by considering teaching of the inherently religious doctrine that life is the product of 'intelligent design' ... Perhaps the two school systems will eventually meet somewhere in the middle, say, around 1859, when Darwin's 'Origin of Species' first appeared."

John A Moore's *From Genesis to Genetics: The Case of Evolution and Creationism* was published by the University of California Press (Berkeley, 2001). NCSE Executive Director Eugenie C Scott writes, "There are few scientists as knowledgeable and clear about how science works, and as thoughtful about the creation and evolution controversy as John A Moore. A product of Moore's wisdom and his over 60 years' experience as a brilliant and productive scholar, *From Genesis to Genetics* will bring understanding to both citizens and scientists who are grappling with the contentious issues of science and religion, evolution and creationism."

An op-ed piece, "Creationism in denial", by **Gregory S Paul** appeared in the *Washington Times* (2001 Nov 4). Paul was responding to two op-ed pieces by fellows of the Discovery Institute, Jonathan Wells's "Evolution for the masses" (2001 Sep 23) and Philip Gold's "Darwinism in denial" (2001 Aug 23). "Although not fundamentalists of the kind Mr Gold disparages as 'Bible-thumping buffoons', he wrote, 'Mr Gold and Mr Wells employ classic creationist tactics that grievously misinform the reader. These include trying to fool the public that 'intelligent design' (ID) creationists are becoming a major force in science, their progress only hindered by conspiring Darwinists.' Referring to Wells's complaints about the PBS *Evolution*

series, Paul pointed out that "For the PBS series 'Evolution' to have given equal weight to creationism would be as absurd as a program titled 'The Mind' including the views of psychics, or an 'Astronomy' series giving serious attention to astrologers." And in considering the lack of practical applications of creation science, he quipped, "Why hire someone who peers into microbes only to exclaim, 'Darn, this is so complex that a supreme deity must be behind it?'"

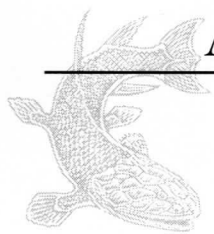
Stephen C Meyer is not only the director of the Discovery Institute's Center for the Renewal of Science and Culture but also an associate professor of philosophy at Whitworth College. So when the college newspaper, *The Whitworthian*, reprinted his op-ed attacking PBS's *Evolution* series from WorldNetDaily (<http://www.worldnetdaily.com/news/article.asp?ARTICLE_ID=24710>), the entire biology department, including **Finn Pond**, wrote to explain that "Meyer takes pieces from these current debates [within biology] and uses them out of context, attacking a version of evolution theory which is oversimplified and outdated at best." And **Jean Pond**, responding to Meyer's claim that the variants in the universal genetic code invalidate the inference to common descent, tartly added, "I will do him the kindness of assuming he simply does not understand the significance of what he is talking about; the alternative explanation for his words holds a great deal less charm." Meyer replies at <<http://www.discovery.org/viewDB/index.php3?program=CRSC%20Responses&command=view&id=1090>>.

[Publications, achievements, honors? Tell RNCSE so we can pass on the good news to all of our members. Call, write, or e-mail.]



ERRATUM

In "News from the Membership" (*RNCSE* 2001 May-Aug; 21 [3-4]: 9-11), **JS Bullion Jr** was incorrectly quoted as referring to creationism as "an obstacle to science teaching uncontaminated by scientific belief or discredited 'scientific' objections." His actual phrase was "uncontaminated by supernatural belief...". NCSE regrets the error.



What Science Can and Cannot Say: The Problems with

Contemporary anti-evolutionists are keen to attack the science and research that supports evolution. The larger problem is that attacking scientific standards supporting the theory of evolution is attacking the fundamental standards of science itself — the very same that support the theory of relativity or the theory of plate tectonics. Because the battle is fought with words and rhetoric, winning requires understanding and persuasion — directed not just toward professionals and people with doctorates, but also toward parents, gardeners, and shopkeepers. It is NCSE's task to make this case accessible to "Joe Citizen" and the voting public. This is quite a challenge given the complexities and esoteric reaches of science.

NCSE's Executive Director Eugenie Scott follows a common strategy by drawing a sharp, comprehensible line between science and the supernatural. Religion is a species of supernaturalism, so banning supernatural criticism of scientific claims in effect bans religious challenges to the veracity of science. Scott writes, "Science attempts to understand and explain the natural world using natural processes/mechanisms.... Matter, energy, and their interactions are all we use to explain the natural world." On this view, supernatural explanations are inadmissible in science. She concludes, "If science is limited to using natural explanations, this means that [creationists/supernaturalists] can't claim 'God did it' is science; it also means that [philosophical materialists] can't say 'God didn't do it' is science" (Scott 1998: 20). Science and religious beliefs can coherently coexist as long as they keep to their proper places.

Scott's position is commonly called "methodological naturalism". Methodological naturalism is to be distinguished from "philosophical naturalism" or "materialism". Philosophical naturalism is the doctrine that God and the supernatural simply do not exist — all that is really out there is a natural universe composed of natural objects and forces obeying inviolable physical laws. According to methodological naturalism, the supernatural may well exist, but by definition (as well as by practicality), the supernatural is beyond the scope of scientific explanation. Alternatively, methodological

naturalism is also expressed as the view that supernatural claims are inherently "untestable" and as such are beyond proper scientific investigation.

Scott's position on methodological naturalism is designed to accomplish two things: (a) to provide a rationale for keeping supernatural religious doctrines out of science and the science classroom; and (b) to insulate science from the criticism that it is committed to or promotes atheism. While this position has merit, it also has problems. I will argue that methodological naturalism is neither necessary nor useful for accomplishing either goal. Appealing to methodological naturalism only confuses the issues. The purpose of this paper is to provide a more accurate and practical way of achieving these ends in the context of the creationism/evolution debate; there is a better way of delineating science.

WHAT IS METHODOLOGICAL NATURALISM?

Methodological naturalism does not imply the nonexistence of God or the supernatural; rather it is intended to describe the nature of science and scientific claims. According to methodological naturalism, scientific claims must be testable by way of a certain empirical methodology. The paradigm would be a hypothesis rigorously tested against predicted consequences of that hypothesis. Untestable claims adopted and believed on the basis of faith, revelation, authority, or psychological comfort do not meet this criterion and are thus unscientific. For example, Scott writes:

If ... religion makes a fact claim about the natural world, science often can say something about it. But we need to recognize when a statement is something science can comment upon, and when it is outside of science. ... Hinduism says that humans go back 300 million years. As a physical anthropologist, I can say that there is no evidence for this claim, and much against it. A young-earth creationist would say that the whole world was covered by water during Noah's flood. As scientists we can say that there is no evidence for this, and much evidence against it. A believer might say, "Well, a miracle happened; God made it look

Methodological Naturalism *Reed Richter*

like it didn't happen", at which point he or she has ventured outside of science. *Any fact claim that relies on a miracle is outside of science*, and has to be accepted on faith alone. This is true for the believer as well as the non-believer: for a believer to claim factual proof of a miracle is to seriously confuse two epistemologies (Scott 1998: 20, emphasis added).

Thus religion can make fact claims, but whether or not science can judge them (either negatively or positively) really depends on the purported basis of the claim in question. For example, the Roman Catholic Church's claim that the communion wafer mystically transforms into Christ's flesh (transubstantiation) is not purported to be subject to scientific analysis. By Church doctrine, no amount of scientific evidence is relevant to the truth of the claim. Transubstantiation is to be believed on the basis of faith, and as such is beyond the scope of science. On the other hand, the Church used to teach that God put the earth in the center of the universe, with the heavens circling about. But eventually the Church abandoned the factual geocentric claim on the basis of scientific evidence.

Scott's understanding of proper scientific methodology is key to understanding her position. According to this position, any proper scientific claim has to be testable. Her complaint is that supernatural claims, especially claims about an omnipotent, supernatural being such as God, cannot be properly tested. She writes:

The essence of a supernatural power is one who is *supernatural*, *beyond* nature... God is not composed of matter and energy, and does not obey the laws that matter and energy beings have to obey. ... God is not only supernatural, [but also] omnipotent, which also supports my contention that "God did/didn't do it" lies outside of science. Think about what a scientific explanation is. It involves testing an explanation *against* the natural world. Empirical *testing* is the key to a scientific explanation. The bottom line of a *test* is that

some variables are held constant — whether experimentally, observationally, or statistically. To test an explanation scientifically means to *control* some of the variables. Omnipotent powers — if they exist — by definition cannot be *controlled*; you can't put God in a test tube (or keep him out of one). So how can one say that one can scientifically prove that God didn't do it? How does one control for the effects of an omnipotent power? Especially a power that ... could (in His omnipotence) make some event or process look completely natural, but actually have controlled every nuance. At this point, clearly, one passes from the realm of science to the realm of theology. I would argue that one cannot empirically prove that God didn't create the whole universe *with the appearance of great age* only 15 minutes ago... Reasons for doubting this have to come from outside of science (Scott 2002:23).

It is true that fact claims have to have a certain pedigree to be considered properly scientific. So if, on the sole basis of a chance, vivid dream, a shaman somewhere declares with absolute conviction that the speed of light is 186 355 miles per second, that particular (true) claim, in that particular context, is not scientific. As long as faith-based claims and beliefs do not purport to challenge good scientific claims, Scott has no problem respecting the claim or its advocates — at least from the point of view of a professional scientist:

If a Hopi believes, based on his religion, that his ancestors were created by gods and emerged from the San Francisco Peaks in Arizona, I'm not going to argue with him. But if Native American activist Vine Deloria claims that there is no scientific evidence that his ancestors crossed the Bering Strait from Asia, that his ancestors have "always been here", he is making a statement about science. This is a fact claim that can be refuted: there is copious evidence to show a link between Asia and the New World (Scott 1998: 20).

WHAT IS WRONG WITH METHODOLOGICAL NATURALISM?

The way Scott describes the line between science and non-science is problematic: "If science is limited to using natural explanations, this means that [creationists] can't claim 'God did it' is science, it also means that [philosophical materialists] can't say 'God didn't do it' is science" (Scott 1998: 20).

I will tentatively grant for the sake of argument that science is limited to using natural explanations. I will grant that science cannot support or establish the truth of supernatural claims. But as a simple matter of logic, it

does not follow that science cannot establish the falsity (or at least the non-truth) of some supernatural claims. Scientific confirmation and disconfirmation are not necessarily symmetrical. Perhaps science cannot ever directly establish a supernatural truth on the basis of non-supernatural facts. Nevertheless science can defeat a supernatural claim on the basis of non-supernatural facts. For example, take a real case of a clash between science and the supernatural: the Shroud of Turin. A

Google.com search on "Shroud of Turin" and "miracle" produces 2270 hits. But as with anti-evolution experts, for the most part pro-Shroud experts do not explicitly make any supernatural claims. Their agenda is to establish that the facts determined by science are consistent with the supernatural account of the Shroud's human image. While many pro-shroud experts attribute the image to a mysterious energy burst (see *Shroud of Turin web references on page 22*), most of the scientific and historical debate centers on whether the physical properties of the Shroud are consistent with the claim that it was in fact the burial cloth of Jesus of Nazareth. Nevertheless, the efforts of these Shroud scholars bolster a huge number of faithful in their belief that the image on the Shroud is truly miraculous (supernatural) and will never be explained by science.

So I assume the methodological naturalist grants that, if the evidence is there, scientists (with rigorous historical research) can legitimately establish that probably, as far as science can determine that

- (A) The image on the Shroud of Turin is naturally produced, and likely a man-made, intentional hoax composed of red ocher and vermilion tempera paint.

On the other hand, assume that the faithful believe that

- (B) God directly created the image on the Shroud of Turin by supernatural means and manner beyond human capability at the time.

The belief of the faithful, (B), implies the denial of (A). (A) and (B) both cannot be true, and *not even a miracle* can make (A) and (B) logically consistent. Hence if science can conclude that (A) is probably true, then science can conclude that (B) is probably *not* true (as far as science is concerned). In other words, science can in this circumstance say that quite probably "God did not do it." This is a fundamental point that I

call the Implication Principle: If science can say (support, establish) some claim P, and P implies Q, then science can also say Q.

Contrary to methodological naturalism, then, science *can* say "God didn't do it." Science can say this by direct logical implication in establishing the probability of a competing natural account — even if science cannot directly establish a supernatural claim or admit (B) as a claim of science.

The ability of science to defeat a supernatural claim is necessary and not trivial. For example, if the supernatural account of the Shroud's image were what really happened, one would expect to find no hard, systematic scientific evidence contradicting the account. There should be no systematic evidence that the Shroud is at most only a few hundred years old. There should be no systematic evidence that the image is reproducible by means and materials readily accessible to artisans in the Middle Ages. Suppose many scientists and other researchers had independently and systematically looked long and hard, found no such evidence, and in the end had to conclude that the Shroud's image cannot be explained by any known and understood natural process. That kind of sustained effort on the part of science would and should raise the credibility of (B). It would not in any way "prove" or scientifically establish (B), but it would increase the practical possibility of (B)'s truth. So the systematic natural evidence favoring (A) does have substantial impact on the credibility of (B). The pro-Shroud experts understand this, which is exactly why they seek to discredit the evidence in scientific terms.

Oddly, methodological naturalists take the view that either (1) scientific support for (A) has no implications for the probability of (B), or (2) if it does, it is simply not in the job description of proper "science" to comment on these implications: others might conclude that God did not do it, but do not ask a scientist to draw such a conclusion in the name of science. I have already argued that as a matter of logic alternative (1) is wrong, but what about alternative (2)? In other words, the Implication Principle is true, but not without qualification: it simply cannot be applied to supernatural claims. The principle only holds for testable claims that are all within the scope of science and can be directly confirmed by the evidence. On this view, while the inference from (A) to not (B) is perfectly valid and obvious, as a technical matter of the definition of "science", one cannot judge the probable truth or falsity of such supernatural claims as (B).

Alternative (2), however, is not supportable. It makes the issue of what science can properly say or establish in the case of (B) a matter of unreasonable and arbitrary definition. For example, science has established that the disease we used to know as "consumption" is naturally caused by the action of tubercle bacilli — hence the name tuberculosis. What about the *possibility* that cases of consumption are almost always caused by primarily by some natural radiation from another physical dimension, and that the presence of tubercle bacilli, if there, is entirely coincidental? Of course, virtually *anything* is possible. It is possible if I

Science can defeat a supernatural claim on the basis of ... natural facts.

walk 15 paces out of my front door and dig a hole 30 feet down, I will find a pot of gold. But *mere* possibilities, in and of themselves, are just that, and rationally ought to be assigned a negligible probability. We are quite justified in treating such mere possibilities as highly unlikely and very probably false: it is highly unlikely that I will find a pot of gold in my yard, and highly unlikely that tuberculosis symptoms are caused by some unknown radiation.

So if a patient presents coughing up blood with all the normal symptoms and history of consumption, blood swimming with tubercle bacilli, the medical expert quite rightly diagnoses tuberculosis and claims that the symptoms are likely to be caused by the microbes. If asked to consider the hypothesis that the patient's condition is caused by radiation (unrelated to microbes) from another dimension, without the slightest support for such a contention, the expert quite rightly would dismiss that possibility in the name of science. Of course, if we had not the slightest evidence for the microbe theory, or any other possible cause of consumption, then it would not be correct scientifically to dismiss the radiation hypothesis out of hand.

But here is the point: Suppose other physical dimensions exist but it is physically impossible for us either to access these other dimensions or test for their existence. (Many scientists openly wonder if it will ever be physically possible to test string theory.) And suppose that any radiation emitted from other dimensions would (for all practical purposes) be undetectable by any instrument. If so, then the radiation hypothesis may be untestable. However, being untestable does not make the possibility more likely or probable. It is completely absurd to say that the medical expert can dismiss the untested radiation hypothesis in name of science if it is in principle testable, but cannot dismiss it if it is untestable.

In reality, science has lots of systematic, hard evidence for the microbe theory. On this basis science can justifiably dismiss the groundless, competing radiation hypothesis. Its status as testable or untestable is beside the point. It would be absurd to employ a definition of "science" that would imply that science cannot properly say that "undetectable radiation from another dimension didn't do it." Similarly, having hard systematic evidence for the medieval forgery Shroud theory (A) would justify dismissing (B), the mere possibility that God supernaturally caused the image. (B)'s status as testable, untestable, natural, or supernatural is beside the point. Arbitrarily defining "science" to rule out professional comment on the likelihood of (B) is completely unwarranted. If the evidence is there, favoring a competing theory, science can say "God didn't do it."

TESTABILITY AND SCIENTIFIC CONFIRMATION

Is there any good reason to believe that the supernatural is "untestable"? Scott claims that God cannot be put in a test tube subject to controlled tests or experiments. A central problem here is that Scott assumes a particular type of scientific methodology. A rigorously controlled scientific test or experiment is indeed a powerful, successful method of scientific investigation.

It is a sophisticated refinement of scientific method. The amazing success of the experimental sciences of physics and chemistry is testament to the power of this methodology. But it is not the only scientific method for supporting a theory. Darwin did not base his main conclusions on tests that carefully controlled variables. Nor did Copernicus support his heliocentric theory with controlled experiments. His theory had no more general predictive success than the theory it sought to replace. In these and other cases, the theory is principally established by a general pattern of evidence compared to competing alternative theories. Usefulness, economy, consilience, and explanatory power are the ultimate arbiters of a theory's acceptance. Controlled experiments help us to make these determinations.

It is true that being supernatural, God would be beyond any robust scientific explanation of his nature and existence — just as many physicists argue that if there is a physical meta-universe beyond ours, any comprehensive understanding of its nature may be beyond

our science due to the physical impossibility of accessing this meta-universe. Time and space purportedly started with the Big Bang; light and information may not extend beyond it. But just because we will never fully understand such a meta-universe, we can still hope for credible physical evidence that it probably exists. We can hope, by indirect means, to find some interesting information about its nature.

Similarly, Scott cannot reasonably infer from a lack of full access to the supernatural that such posits are completely beyond the pale of scientific investigation. For example, if vampires really existed, perhaps their blood, under careful, long-term, systematic scrutiny by a number of independent researchers, would appear never to decay in normal circumstances and to contravene the laws of thermodynamics. Even if the researchers were deeply convinced for a variety of reasons that the blood was indeed supernatural, it would still be possible to subject the blood to experiments. Hypotheses about the nature of the supernatural agency could still be made and tested. Does it only sizzle when in contact with iron crucifixes — what about wood? What about a Star of David? Is it O-negative?

Predictions can be made; hypotheses tested. "Supernatural" does not automatically imply arbitrary, capricious action as Scott implies. There is no reason why supernatural agents cannot be subject to laws and regularities. So if this is what Scott means by "controlled" testing, supernatural entities may well be subject to such control. Or if God were openly willing to cooperate, a group of independent researchers could rigorously monitor and test his purported omnipotence. "God, at precisely 4:00 PM EST, please instantaneously remove the moon from the solar system for 24 hours without any harm being done to life on earth." And zap: at precisely 4:00 PM, the moon disappears, and the tides react appropriately (but no harm comes of it).

**The amazing
success of the
experimental
sciences of physics
and chemistry
is testament to
the power of this
methodology.
But it is not the
only...method.**

All the myriad predicted consequences of the hypothesis that “an omnipotent God removed the moon from the solar system for 24 hours” come to pass, thereby confirming (but not proving) the hypothesis.

Of course, as Scott points out, if the evidence seems to go against the supernaturalists (as with the Shroud), they can always appeal to a miracle or some other spurious posit. Or if the moon seems not to disappear at 4:00 PM, the faithful can claim it really has, but God is making it look as though it has not. Historically, defenders of the supernatural almost always appeal to such capricious, *ad hoc* defenses. Many scientists tend to identify the supernatural with

such arbitrary and capricious action. But this identification is confused along with two distinct senses of “untestable”.

A hypothesis H can be untestable in that: (a) no possible evidence can affect the probability of its truth; or (b) no possible scientific test or evidence can convince irrational proponents of H that H is unlikely or false. Spurious, *ad hoc* posits that render a hypothesis “untestable” in sense (b) are the hallmark of any pseudoscience, whether it is AIDS denial, “UFO-ology”, flat-earth “geology”, or astrology. This sort of maneuver has nothing to do with supernaturalism *per se*. *Ad hoc* explanations (natural or supernatural) with no independent support are what distinguish real science from pretend science.

Indeed, one cannot prove God did not supernaturally create the Shroud, if by “prove” one means “eliminate the possibility of any *ad hoc* accommodation of the evidence.” But in that sense it cannot be “proved” the earth is not flat. After all, evidence such as movies of a round earth taken from space may be fake evidence produced by a massive government conspiracy to fund the space pro-

gram. So while the claim “the earth is flat” is not “untestable” in sense (a) above — the legitimate scientific sense of testability — it may be “untestable” in sense (b) above, as far as flat-earthers are concerned.

But if by “prove” one means “gather systematic evidence that repeatedly confirms and makes the claim highly likely”, then one can prove the Shroud’s image is natural and not supernaturally zapped into existence by God. And by proving the earth is over 4 billion years old, one thereby “proves” it did not suddenly appear 15 minutes ago — naturally or supernaturally. This is a fundamental matter of logic.

In light of the discussion above, reconsider what Scott is trying to communicate to “Joe Citizen”. She is telling Joe that according to science, human beings evolved over eons by natural means and did not suddenly pop into existence. On the other hand, Scott wants to assure Joe that science is not challenging his faith-based belief that God did cause humans to pop suddenly into existence: science cannot say “God didn’t do it” (Scott 1998: 20). This is supposed to be clear?

WHAT SHOULD WE SAY TO JOE?

We should say to Joe that, according to science, there are some things it is likely that God did not do, for example, zap humans instantaneously into existence. However, the fact that God did not do it that way does not rule out the possibility that God caused a universe in which evolution would bring humans into existence. What science says does not rule out the possibility of God — it does not imply materialism or atheism. We should say to the Hopis that, according to science, it is probably untrue that humans emerged from the San Francisco Peaks in Arizona. This is stronger than simply saying (as Scott would have it) that, according to science, there is “no evidence for this claim, and much against it”. After all, we want to say that according to science, humans likely emerged from Africa. We must not pull back from the logical consequences of scientific claims because they might offend sensibilities.

There is, however, a very important set of issues not addressed thus far in this discussion: rationality, respect, freedom of belief, and turf. Although my stance affirms a core conflict between science and many faith-based beliefs, I have said nothing about how to deal with these conflicts politically, culturally, and rationally. In an accompanying paper, I will address these issues and give practical advice on the public stance that NCSE and similar organizations might take.

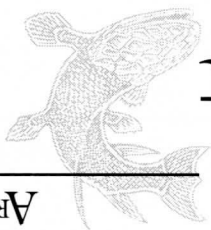
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Comments on Richter's "What Science Can and Cannot Say"

Eugenie C Scott
NCSE Executive Director

I confess! As a scientist, I quite probably do have an oversimplified view of confirmation and disconfirmation. Worse, because of the nature of my job, I tend to simplify science and philosophy of science maybe even more than Richter fears! But it does not take appearing on very many radio call-in shows before one realizes that the sort of academic discussion presented here is way beyond what the average American understands about science, and I have become a connoisseur of half loaves. I figure that if I can get Joe Citizen to understand some *basics* of science, I am ahead of the game.

Okay — here is what I think, for what it is worth. I have frequently written and stated that methodological naturalism requires that we scientists limit ourselves to explaining the natural world *using natural causes*. Thus when Duane Gish (or Phillip Johnson) says "God did it", they are welcome to their opinions, but they cannot call it science. Richter would not disagree. Where he and I disagree is my further statement that turnaround is fair play: because science is *limited* to explaining the natural world using natural causes, to say "God didn't do it" is no more science than saying "God did it".

This does not mean that it is impossible to reject any claim involving supernatural powers. Claims containing empirical elements — fact claims — can often be rejected. If someone makes a fact claim, such as when Krishna creationists claim that human fossils go back 350 000 000 years, it can be shown to be wrong — empirically wrong. If someone makes the claim that the Shroud of Turin is 2000 years old, and good, uncontradicted, repeated radiocarbon dates show that it is only 700 years old, the claim that it is 2000 years old is disproven (assuming that one accepts radiocarbon dates). If a Native American claims that North America rests on the back of a giant turtle, this can be shown to be wrong. Many empirical supernatural claims can be shown to be empirically wrong. This is not the same as saying that "God did it" is disprovable.

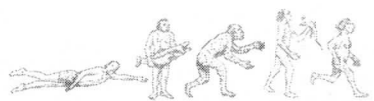
My reasoning is simple — probably too simple for a philosopher of science, who spends much time thinking about these things. My argument makes sense to me, and others are welcome to disagree. The essence of a supernatural power is one who is *supernatural*, beyond matter and energy, and does not obey the laws that matter and energy beings have to obey. I will also argue that in at least the religious traditions with which we

are most familiar — the Middle Eastern monotheisms of Christianity, Judaism, and Islam — God is not only supernatural. He is omnipotent, which also supports my contention that "God did/did not do it" lies outside

of science. Think about what a scientific explanation is. It involves testing an explanation *against* the natural world. Empirical *testing* is the key to a scientific explanation. The bottom line of a *test* is that some variables are held constant — whether experimentally, observationally, or statistically. To test an explanation scientifically means to *control* some of the variables. Omnipotent powers — if they exist — by definition cannot be *controlled*; you cannot put God in a test tube (or keep him out of one). So how can one say that one can scientifically prove that God didn't do it? How does one control for the effects of an omnipotent power? Especially a power that (as Richter explains) could (in His omnipotence) make some event or process look completely natural, but actually have controlled every nuance. At this point, clearly, one passes from the realm of science to the realm of theology. I would argue that one cannot empirically prove that God did not create the whole universe *with the appearance of great age* only 15 minutes ago just because all the empirical tests confirm that the earth is closer to 5 *billion* years old. Reasons for doubting this conclusion have to come from *outside* of science.

So given my understanding of philosophy of science, it makes sense to disallow both "God did it" and "God did not do it" as statements one can call scientific. Doing so also avoids another error, which often arises from accepting the idea that science proves God does not exist. This is the error of inferring that one cannot be a scientist and still be a believer, an error that is empirically proven false by the existence of scientists who are devout Christians, Muslims, and Jews.

In addition to the philosophical reasons for denying scientific status to "God did not do it", doing so also avoids the practical consequence that such statements encourage people to think that science equates with atheism, and thus evolution equates with atheism, and we do not want our kids being taught that atheistic stuff at school, do we? If we are going to solve the creation and evolution issue, we have to be very clear about the nature of science — and help to dispel the erroneous idea that somehow there is vast disagreement between evolution (or science in general) and religion.



Why NCSE Should Be Involved in the Science-Religion Dialog

Phina Borgeson, Faith Network Director

From time to time at NCSE, we hear questions from skeptical, agnostic, and atheistic members who wonder what we are doing getting involved with people of faith. Creationism in its several forms is, after all, largely motivated by religion. Many of the household names in evolutionary science are quite vocal about the death of religion as they see it, while others seem to see religion as tolerable as long as it is limited to private, individual faith or to informing moral and ethical decisions. So why would NCSE want to be involved in science and religion conversations?

Perhaps the first reason is simply that many NCSE members are people who belong to communities of faith. They support the teaching of evolution; they disagree strongly with creationist attempts to substitute their spin on religion for science, yet they are themselves religious. NCSE is a membership organization, and a part of what we do is support our members in their advocacy for evolutionary science. That means being where they are, and that is sometimes in the thoughtful dialogs between science and theology — the places not just where science and theology conflict and contrast but where they make contact with and confirm each other's assumptions and world views.

The second reason is what we might unabashedly call good politics. Not all Christians are creationists, and many are not happy about the appropriation of the name "Christian" as synonymous with anti-evolutionist — as well as with other reactionary and exclusivistic stances. Many Christians deplore equating "Christian" with the radical religious right and enemies of reli-

gious liberty. Many moderate and liberal Christians, and yes, even some conservative Christians, are our allies in working to keep religion out of the science classroom. We simply cannot make common cause with Christians who stand for evolution if we use the categories "Christian" or "religious" for one narrow stripe of Christian tradition and activism.

When working for Unitarian-Universalist Project Freedom of Religion in Southern California in the late 1990s, I did considerable reading and research on all the issues that were favorites of the religious right. Reading *Perfect Enemies: The Religious Right, the Gay Movement and the Politics of the 1990s* by Chris Bull and John Gallagher, I saw how easy it is to make perfect enemies — how tempting it is for both sides on a controversial issue to play to each other's prejudices, hobby horses, and weaknesses in such a way as to keep the conflict going without getting anywhere.

Two significant ways to avoid such a situation caught my attention. Do not adopt a campaign mentality, but build a movement for the long haul — a strategy at which NCSE excels. Another involves finding those people in the middle who are more open to dialog than invested in being the perfect enemy. When it comes to supporting the teaching of evolution, those people are most likely to be found among people of faith who reject the claims of the religious right, but themselves make faith claims of a broader and more exploratory nature. Allying with such folks is good politics. There is no need to make perfect enemies.

These are perhaps the major reasons, and the most obvious ones,

that NCSE needs to be there in science and religion dialogs. But there are also softer reasons — reasons not just of obligation and expedience, but of values.

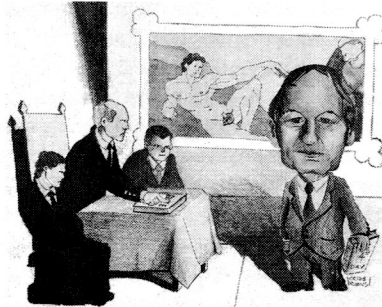
One I have already mentioned is the ethical connection. People of different faiths and no faith agree that the insights of both the biological sciences and of theological reflection are needed if the human community is to grapple effectively with issues in human genetics and the human impact on the rest of the life on our planet. While these issues are not primary to the mission of NCSE, the scientific literacy we support and advocate is partnered in public debate with theological and philosophical literacy. While actively working for better science teaching, free of religious restraints, we must also respect those exchanges in which we "deal with our deepest differences".

Finally, NCSE has been effective because we connect, encourage, and provide resources to people at the grassroots — dealing with real threats to the teaching of evolution in their communities. We recognize that it takes whole communities to do this, with activists from education, science, citizen groups, and religious congregations working together. Yet many religious congregations that want to be partners in our cause have not done the dialog work at the local level that can help them to argue for sound science teaching from a faith perspective. We cannot do that work for them, but we can point them toward resources that can help if, and only if, we are involved and informed about what is happening nationally and internationally in the conversation between religion and science.

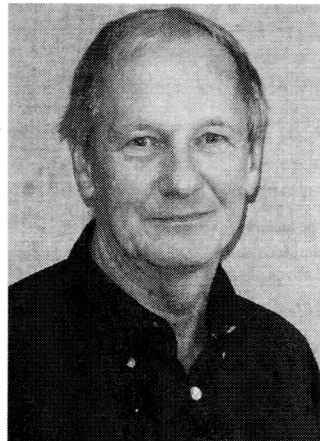


Rebel with a Cause

HOWARD VAN TILL IS
PROFESSOR EMERITUS
OF PHYSICS AND ASTRONOMY
AT CALVIN COLLEGE.
HE IS THE LEADING
EVANGELICAL SPOKESMAN
FOR THEISTIC EVOLUTION.
THOMAS JAY OORD INTERVIEWED
VAN TILL LAST SUMMER.



ALTHOUGH EVANGELICAL, VAN TILL QUESTIONS INTELLIGENT DESIGN



Thomas Jay Oord (TJO): *What, in your early years, were some personally formative experiences pertaining to issues in science and/or religion?*

Howard van Till (HVT): My father was a man who did not have the opportunity for a higher education. His family immigrated from the Netherlands to the States when he had only 6 years of schooling. He never had a chance for an education, but he was a thinker. He wondered about things. I would see him sitting in his chair reading every evening. His curiosity and willingness to explore was an important formative element for me.

My pastor in high school also set an example from the pulpit. He was very careful to demonstrate an interest in intellectual concerns. He concentrated on thought-based preaching for the most part. His example was an exemplary demonstration that one's faith must be thoughtfully crafted and expressed.

I was a student at Calvin College from age 17 to 21. Many of the professors I encountered there stimulated that same concern for a carefully crafted articulation of the faith. In the science and religion territory, one of the chemistry professors, Jon Derese, wrote a book called *Beyond the Atom*. It was not strong on an evolutionary concept of creation's formation (it affirmed old-earth special creationism), but

the fact that the multi-billion-year chronology was something to be celebrated rather than to be feared was interesting to me. I was interested in the sciences and was ultimately working toward a major in physics.

TJO: *How did your interest express itself in your teaching?*

HVT: When I was teaching at Calvin College, the creation/evolu-

tion debate was raging in North America. I was not actively involved in it, but I could see what was happening. I became increasingly unhappy with the way in which science and Christian beliefs were presented as adversaries. I made my judgmental remarks increasingly candid.

In the late 70s, I said to myself, "I have to make a choice: either stop complaining about the way the science and religion discussion quickly degenerates into a creation/evolution debate or try to make a constructive contribution towards it." I chose the latter.

My writing in science and religion began when my former department chair said, "Howard, the Carl Sagan series of videos is being shown on public television, and a lot of people in church are asking what they should make of all of that." Because I was already becoming interested in astronomy at that point, he said, "Why not write a review of that for the *Banner*?" which is the publication of the Christian Reform Church. So I did. I enjoyed doing it, and I enjoyed experiencing reader feedback and the like.

On my next sabbatical, I decided to craft a whole book of my thoughts and reflections. The book dealt with how scientific concepts, such as evolution, might be evaluated from a combination of Christian and scientific perspectives. After three years, including an eight-month period with no teaching commitments, I wrote *The Fourth Day*. It came off the presses in early 1984.

TJO: *For those readers unfamiliar with your first book, The Fourth Day: What the Bible and the Heavens Are Telling Us About the Creation, what is your basic thesis, and why do you argue it?*

HVT: The basic thesis is that there are good reasons for concluding that good science and good bibli-

cally-based theology do not need to be seen as adversaries, in competition, or inconsistent with each other.

The first one-third of the book reflects on ways one ought to read the Scriptures. That involves an emphasis on setting aside modern, Western, scientifically-focused questions and trying to recover the questions and concerns of the worlds or communities that provided the context for the Old Testament Scriptures.

I spent a lot of time learning about the culture, religion, even a little bit about ancient Near Eastern science, including Babylonian astronomy. I was trying to stand in the sandals of an ancient Near Eastern person who lived 2-3000 years ago. Unless you know something about the questions that concerned the ancient Hebrews, and the way concerns of that sort were presented in the literature of the day, you will miss the agenda. In fact, you will not even *know* the agenda of the biblical text.

The second part of the book dealt with how one takes the cosmos seriously. That included the major contributions from the sciences, which attempt to discover what the world is like, how it functions, what kind of a formational history might it have had, and what kind of capabilities of atoms and molecules and cells and organisms may have contributed to the formational history of the universe. Most of my scientific examples in *The Fourth Day* were drawn from astronomy and cosmology.

In the third part of the book, I talk about how to bring these two concerns together — how to take both the Bible and the cosmos seriously.

TJO: *What were the main reactions to your book?*

HVT: Well, I used the word “evolution” frequently. I talked about stellar evolution, that is, the formational history of stars, galactic evolution for galaxies, elemental evolution for the formational history of the chemical elements. One can even talk about spatial evolution, because space has a formational history.

Then I made an infamous comment about biological evolution. It was something to the effect of, “I

know of no scientific reasons, no philosophical reasons, no theological reasons, no biblical reasons to rule out the possibility that all of life developed in a way that the biological sciences envision, including human life.”

This sentence was most quoted because, as a Christian community, we are very concerned about our own identity as humans and our relationship with God. In North American Christianity, there is a deep-seated fear that the concept of biological evolution, especially if it includes humanity, will threaten the uniqueness and special value of the human and the unique relationship humans have with God.

The Fourth Day aroused a lot of concern that focused on two areas. First, I found that many people are uneasy when you use the word “evolution” in a friendly and almost celebrative sense. Second, the North American Christian community is very anxious about statements that one makes concerning the nature and authority of biblical text. What I said was very carefully crafted, but it nonetheless raised some deep concerns in the areas of science and biblical interpretation.

TJO: *As a physicist, what models of the divine world interaction do you find most satisfying?*

HVT: I think that the Christian community and those engaged in the science and religion discussion are facing the difficult issue of how to talk about divine action in the everyday phenomena of life. I am exploring a variety of ways in which theologians, theologically informed scientists, and scientifically informed theologians are trying to craft a vocabulary for talking about divine actions. This vocabulary attempts to capture the strength of the Christian heritage. It benefits from what we think we have learned about the way the world functions and operates thanks to the work of scientists in of the last century.

I come from a community with a rich theological heritage, and I would not give up any element of what I received from that community. My heritage is the North European Calvinist theological tradition, but I take that heritage as an

extraordinarily valuable starting point, not as a place to rest forever. I want to stimulate the people of that community to re-articulate their heritage using new conceptual vocabulary and new theological structures, taking into account what we have learned about creation via the sciences.

I do not want my community trapped in a conceptual vocabulary or theological framework that was cast in stone in the late 16th century. I think there is a real danger in that possibility. Theology has to be a dynamic, ongoing activity that is never absolutely done.

We have words in our vocabularies today that we could not even have anticipated 10 years ago. Theology has to allow its vocabulary and thought structure to change and take into account changes in the world around us, and the growth in our knowledge about how the world operates.

Theology is not changing if it amounts just to fine-tuning vocabulary and structure set in place four centuries ago. Such a theology is a museum case rather than a dynamic activity. I want to see theology continue to be a dynamic activity.

TJO: *What direction would you like to see the science and religion discussion go toward?*

HVT: I hope that both science and religion continue to expand upon a willingness to deal with respect for the other party. Representatives of the sciences and representatives of religion need to approach the discussion with a sense that there is something valuable to be learned from each other. That may seem obvious, but it is not always the case. There are many occasions where scientists have just closed off the discussion with a quick remark about the incredibility of the whole religious enterprise. That does not help anyone. Nor does it help when a portion of a religious community writes off the sciences as being built upon a platform of atheism and heresy. That is an equally serious error.

Step one is to keep working on developing a positive, respectful, and constructive attitude toward the other party in this discussion. David Griffin's overall analysis is not

far off the mark. His question is "how much do [science and religion] both need to change in order to come to a common worldview that will provide the way for a continued, constructive interaction?"

For the sciences, he suggests that what he calls "maximal naturalism" be set aside. Maximal naturalism not only rejects supernatural intervention in the world but also rejects any concept of God and divine action. The scientific community must disassociate and distance itself from maximal naturalism. Griffin argues that rejecting maximal naturalism would provide a basis for a better set of sciences and a better way to understand the character of the world scientist's study. I think he has made a good case.

Griffin also asks the religious community to give a particular concept of divine action. He does not ask that it give up the concept of deity or divine action generally. Rather, he asks it to give up a particular concept of divine action — the supernatural action, whereby God interrupts the natural cause and effect process. God cannot force others to do something different from or beyond their natural capabilities.

Griffin offers "interruptionist supernaturalism", an enriched form of divine action and an enriched concept of natural action, because natural action is now permeated with divine action. I would like to see religious communities take Griffin's proposal seriously enough to find out what it represents. They should not ignore it or rule it out without an adequate investigation. I think it has deep merit worthy of serious consideration.

If science were to dissociate itself from the maximal (God-denying) naturalism, and if religion were to adopt a concept of nonsupernatural but ubiquitous design action, perhaps religious and scientific communities could become partners in our attempt to understand who we are and what life is about.

This interview was originally published in the January 2002 issue of Research News & Opportunities in Science and Theology (2/5): 24-5, 33). It is reprinted here with permission. For more information about this publication, see the display ad on page 45 of this issue of RNCSE.

VAN TILL ON "INTELLIGENT DESIGN"

My chief concern with "intelligent design" is that there needs to be a better distinction and clarification made of two major kinds of action or ability that fall into the rubric of "intelligent design": the action or ability of a mind to conceptualize things, and the ability to make or assemble things.

The term "design," as the natural theology movement of a couple centuries ago used it, was based on what I call "the artisan's metaphor". William Paley's clockmaker conceptualized a clock first. The clockmaker wondered about the kind of parts it would have, then went to the shop to form the parts into complete systems. The result was a functioning clock. So, the artisan metaphor for design includes both mind-action and hand-action as the two major and very different categories of actions formed by the one agent.

In contemporary usage, the term "designed" is more commonly restricted to the mind-action creativity. The typical example is this: if you go to a major auto manufacturer like General Motors and ask for the representative of their design team, you would end up talking to people who conceptualize new automobiles for the marketplace.

However, when you ask to see examples of that automobile being assembled, you would be sent to the assembly lines to watch that automobile being assembled. In modern usage, the action of "design" entails a conceptualization of something for the accomplishment of a purpose. That activity is quite distinct from the forming of parts and the assemblage of parts into a complete unit.

It is essential for our evaluation of the "intelligent design" movement that we know whether its proponents are talking about design as conceptualization — an act of mind — or about the way things are formed or assembled from components into a final working system. The "intelligent design" movement does not adequately present the distinction between design as conceptualization and design as assembly. Most of the time the term "design" or "intelli-

gent design" is used as a label for the hand-action of forming parts and assembling them into final structural units.

I find ambivalence in the "intelligent design" literature. When proponents are talking about the formation of living creatures or parts of living creatures, the proponents basically say, "Look, this particular creature or part of a creature could not have been assembled naturally. Therefore, it must be the product of 'intelligent design'." The underlying assumption is that the work of the designer is to make things that the natural system is incapable of making or assembling, because the natural system does not have the right stuff to form parts and assemble them into the final structure. The argument toward the conclusion of "intelligent design" seems to be based on the necessity of certain formational capabilities that are missing.

On the other hand, there are other occasions when proponents of "intelligent design" say, "Look at the fine-tuning of the universe, the speed of light, Planck's constant, the expansion rate of the universe, the gravitational constant, and on and on. Look how remarkable it is that this list of parameter values is just right to make the formational history of the universe work in the way that cosmology and astronomy and theology are suggesting."

This fine-tuning argument points to a designer. The designer provided all the resources and capabilities to be just right so that an evolutionary developmental galaxy could take place. Here, the argument is that if the universe does have all these properties and capabilities, it must have been designed.

Earlier, when we looked at natural capabilities and what was missing, we argued that there was design. The examples offered from the realm of cosmology and astronomy are used in one line of argumentation, and the examples from biology are used in a contradicting line of argumentation to reach the same conclusion. I find that a major inconsistency. It sort of reminds me of, "Heads, I win; tails, you lose."





Science and Christianity: What's Wrong with Creationism and "Intelligent Design"

Jean Pond

In Science & Christianity: Four Views, edited by Richard F Carlson, five Christian scholars presented four views on the relationship of science and Christianity: Wayne Frair and Gary D Patterson argued for "Creationism: An inerrant Bible & effective science", Jean Pond argued for "Independence: Mutual humility in the relationship between science & Christian theology", Stephen C Meyer argued for "Qualified agreement: Modern science & the return of the 'God hypothesis'", and Howard J van Till argued for "Partnership: Science & Christian theology as partners in theorizing". Each contributor was given the opportunity to comment on the essays of the others. RNCSE is pleased to reprint the following excerpts from Jean Pond's comments on the essays by Frair and Patterson and by Meyer.

RESPONSE TO FRAIR AND PATTERSON: SCIENCE WITHOUT FAITH

Frair and Patterson state that the Bible "... is an essential part of the practice of science for a Christian" (p 28). As a scientist I cannot agree, unless it is in the sense that the Bible is a part of my faith, and my faith is part of who I am. A person could just as well say that the Bible is an essential part of the practice of professional baseball for a Christian. True in the sense mentioned above, but the pitcher's mound is the same distance from the plate for Buddhists as it is for Methodists.

In science the rules are the same for Christians and non-Christians alike. I doubt we would really want

it to be any different. With respect to the science and technique of flying an airplane, we want Christian pilots to have the same education and training every other pilot gets. We want Christian physicians to have the same understanding of human disease as every other physician. When pharmaceutical research is carried out on chimpanzees, we are willing to use those drugs, even if the theory underlying the use of chimps — inordinately expensive and difficult animals to work with — is their evolutionary closeness to humans.

We want all the modern goods and comforts technology gives us, and we do not question either the underlying science that provides these things or the religious faith of those who do the science. The Kansas Board of Education can feel free (in August 1999) to downgrade educational standards in biology because an understanding of biological evolution is not immediately necessary for the food on their tables, the heat in their homes, or

their water supply. Otherwise, it would have been a very different thing.

Frair and Patterson also make a number of statements concerning the anxieties scientists feel when they are confronted with a godless science. Astronomy, for example, "has produced a profound insecurity in many scientists" (p 29) because the universe is so big, and we are such a small part of it. Geology "has driven many scientists to question the significance of a species that they believe has existed for a trivial fraction of the age of the earth" (p 29), and biologists are "confused about the place of humankind in the animal kingdom" (p 29).

But is this how people truly feel? I think it is important that we do not make casual assumptions about how others react to the revelations of modern science. For example, I believe that relatively few of us — scientists or nonscientists, Christians or non-Christians — are troubled by the knowledge that the

Jean Pond, who earned her PhD in microbiology from the School of Medicine at the University of South Dakota, is formerly Visiting Associate Professor of Biology at Whitworth College in Spokane, Washington; she is now retired from teaching.

earth is very, very old, and the universe is really, really big. Perhaps if a person from pre-Copernican times were transported into the 20th century, the abrupt transition from a small, young universe to a big, old universe might be shocking. But recent generations have grown up in a world of far-away galaxies and billion-year-old rocks. Moreover, my own experience suggests that human beings have no difficulty whatsoever putting themselves at the center of the universe, regardless of what science says. Christian evolutionists — and we are legion — are particularly sensitive on this topic, having been accused all too many times of the atheistic nature of our discipline. Creationists need to spend more time asking us how *we* view the interplay between our faith and our science, and less time suggesting that we are either closet atheists or deluded.

I am not in the least bit confused about the place of humans in the animal kingdom, nor are any of the other biologists I know, although the details of our answers, of course, may vary. Frair and Patterson speak of “persistent efforts to dehumanize our race by reducing humankind to nothing more than a naked ape” (p 51). I do not feel these sorts of statements are helpful. What efforts? Who is making these efforts? Why does a family relationship to other species on earth reduce us? Why would we be dehumanized by an evolutionary connection to apes or to starfish or to any other living thing? Is a chimpanzee less of a chimpanzee because it is related to us? Is a rose less of a rose because it is related to a petunia?

It seems arrogant to demand from God that our species arrived on earth in any particular manner. Why would it make any difference to Christians whether *Homo sapiens* is the product of a creative act sometime in the last few thousand years or the result of long eons of evolution? Do we choose to impose a limit on God's methods of creation? For myself, I find the idea of being part of an enormous, several-billion-year family tree rather appealing.

We cannot assume that evolutionary biology is dehumanizing because we wish it to be so. We can-

not *assume* that atheists — or agnostics, Hindus, Confucians, or what have you — find no purpose or moral center to their life because we wish them not to. We must ask. Thomas Henry Huxley (“Darwin's bulldog”) has been portrayed as a foe of Christianity — and there is truth to that description — but did Huxley's lack of Christian faith prevent him from finding meaning in his own life? Here is part of his reply to a clergyman friend who sought to console him on the death, in 1860, of Huxley's three-year-old son:

As I stood behind the coffin of my little son the other day ... the officiating minister read, as a part of his duty, the words, “If the dead not rise again, let us eat and drink, for tomorrow we die.” I cannot tell you how inexpressibly they shocked me ... What! because I am face to face with irreparable loss, because I have given back to the source from whence it came, the cause of a great happiness, still retaining through all my life the blessings which have sprung and will spring from that cause, I am to renounce my manhood, and, howling, grovel in bestiality? Why, the very apes know better... (letter to Charles Kingsley, September 23, 1860, quoted in Gould 1999: 60).

Human beings find meaning in life through a variety of philosophies and faiths. We advance no cause by proclaiming that those who disagree with us feel something or act in some way that *they* know they do not.

RESPONSE TO MEYER: “INTELLIGENT DESIGN”: GOD OR A REALLY SMART GUY?

Stephen Meyer presents a well-articulated narrative of Western science in which we move from the early modern scientists, who approached their disciplines from a theistic perspective (good), to a post-Darwinian science, in which God becomes passé (bad), to a bold new contemporary science, which features “the return of the God hypothesis” (good). There is a sweep and symmetry to this story

in which we can combine our love of the good old (pre-Darwin) days with the excitement of young crusaders (see especially Phillip Johnson's comments on “the Wedge” [Johnson 1999]) fighting against the old-fogeydom of entrenched atheistic science. But the devil, as they say, is in the details.

When I was an undergraduate, I had a friend who had been raised in a very conservative evangelical church in rural Minnesota. This particular church had emphasized the influence of the devil in every mistake he made growing up, and possibly as a result, he had developed a bitter hatred of Christianity. He majored in mathematics at the university and was, when I knew him, almost a poster boy for scientific materialism.

Although he had little use for Christian beliefs in general, my friend had an interesting take on miracles. The parting of the Red Sea, manna from heaven, the blind restored to sight, Lazarus raised from the dead — he was quite willing to believe that any or all of them really occurred as described in the Bible.

How? He felt that (in theory anyway) an extremely powerful being could have performed these miracles, using highly advanced technologies of some sort. These powers or technologies — although far beyond current human understanding — were *natural* powers or technologies. That is, once our own science became advanced enough, we could explain each “miracle” in terms of natural law.

In other words, the Bible does not speak of God, just some really smart guy. (My friend did not believe that “the really smart guy” actually existed, by the way: only that this was one hypothesis to explain the miracles described in Scripture.)

I am reminded of my friend every time I read the arguments for “intelligent design”. Because as I see the problem, the only designers we *really* know and understand are people. So the only design we can really contemplate is human design. Each time we talk about design in biological systems, we inevitably consider it in terms of human capabilities, not divine ones. And God

becomes just a really smart guy. Robert Pennock calls this the "naturalizing" of God:

The "intelligent-design" theorists have given us a scientifically gussied-up version of Paley's venerable argument: God becomes a big watchmaker in the sky, a divine genetic engineer, or a souped-up "intelligence." ...When they try to infer God's "intelligent design" by naturalizing God, ["intelligent-design" creationists] are making God a part of the machine (Pennock 1999: 303-4, 308).

The "really smart guy" issue is the underlying and critical source of my opposition to "intelligent design" theory.

In conclusion, let me say that I agree with Meyer about one thing: the systems of life are stupefyingly, mind-bogglingly complex. Here's the irony: no one knows this better than biologists. And yet we remain — the great majority of us, Christian or non-Christian — evolutionists, committed to the elucidation of these systems without recourse to the supernatural. Why? Part of the answer lies in the reason we went into science in the first place: the personal satisfaction involved in *figuring things out*. As I pointed out in my own chapter, it is no more satisfying for most scientists to say "God did it" in answer to a tough

scientific problem than it is for a detective to say "God did it" in solving a murder mystery.

Another part of the answer probably relates to a disinclination by scientists to use what PS Churchland calls the "I-cannot-imagine" gambit. The fact that a given person cannot imagine how the bacterial flagellum evolved says more about that person than it does about the question at hand. Churchland gives good advice here: "Learn the science, do the science, and see what happens" (Churchland 1997: 42-3). (Richard Dawkins has another name for the "I-cannot-imagine" gambit: he calls it "the argument from personal incredulity" [Dawkins 1996: 38].)

For me as a Christian, there is also a very important third part to this answer. Some creationists claim that the supporters of evolution have been brainwashed by a creed of scientific materialism, but this is a judgment on their part and an offensive, unsupported one at that. *How many times do we have to say this?* Believing that evolution has occurred — that humans and all other living things are related as part of creation's giant family tree, that it is possible that the first cell arose by the natural processes of chemical evolution — neither requires nor even promotes an atheistic worldview.

I reject the hypothesis of "intelligent design" both on the basis of

what I know as a scientist *and on the basis of what I believe as a Christian*. I find myself unwilling to reduce God to a really smart guy. I refuse to try to fit God into a scientific box.

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Announcing: Darwin Day 2002 Series

Beginning this year, the Darwin Day Program will publish a compilation of the lectures and presentations featured in annual events and celebrations throughout the world. We invite organizers or speakers to send us any manuscripts that they wish to be considered. With your help we hope to make this a regular feature with Volume One scheduled for August 2002.

The publication will be sold as a book through the Darwin Day Program with a number of copies distributed to participating programs, which will be credited in the publication and included in contact information. All authors will retain copyright of their work.

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God, Darwin, or Both?

Duane Gish, Hugh Ross, and Eugenie C Scott in Conversation

On September 29, 2001, at the Santa Clara First Baptist Church in Santa Clara, California, the Institute for Creation Research's Duane Gish, Reason to Believe's Hugh Ross, and NCSE's own Eugenie C Scott participated in *God, Darwin, or Both?* — a discussion of the relationship between science and religion in general, and the relationship between the biblical story of creation and the deliverances of modern science in particular. The discussion was not a debate — as readers of *RNCSE* know, NCSE considers creation/evolution debates to be counterproductive (see Eugenie C Scott, "Debates and the Globetrotters", *Creation/Evolution* 1994 Winter; 14 [2]: 22-6; available on request from the NCSE office) — but a civil and uncontentious venue in which the participants expressed their respective views — which is not to deny the occasional tone of asperity!

Each of the participants spoke for 20 minutes; a panel discussion (moderated by Bob Smithson) and a question-and-answer period followed. The proceedings were professionally videotaped, and NCSE is pleased to offer VHS videotapes of the event to its members for \$25.00 apiece (plus \$2.00 shipping; plus 8.25% sales tax for California residents). To order, either call 1-800-290-6006 or fill out and return the form below.

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EXPLORING THE SCIENCE-RELIGION DIALOG

Exploration of the science-religion dialog seems to be something of a growth industry nowadays. This is good news for scientists who enjoy reflecting on how their work and their faith interrelate and for people of faith who love science. It is also challenging news for religious leaders who recognize that their science education was neglected. Fortunately, a number of volumes are available that do not assume scientific literacy, but instruct as they go, laying a foundation for continuing the dialog. Check out the following interesting books, now available through the NCSE web site: www.ncseweb.org/bookstore.asp. And remember, every purchase benefits NCSE!



Illustration by Dave Smith, used with permission of the University of California Museum of Paleontology.

CHRISTIAN THEOLOGY GROUNDED IN EVOLUTION

*The God of Evolution:
A Trinitarian Theology*
by Denis Edwards

Edwards, a Roman Catholic theologian, has written a number of titles in the science-religion vein, including work on Christian environmental ethics. In this small, well-written volume, he brings insights from evolution into dialog with trinitarian theology — the creating, self-limiting, and life-giving God — and also discusses the wisdom of God and the sinfulness of human beings. A good primer in how evolution informs contemporary Christian theology. Edwards is a Lecturer in the School of Theology at Flinders University in Adelaide, Australia.

God After Darwin
by John Haught

To those who follow the players in science-religion dialog, Georgetown University's Haught needs no introduction. The central theme of his *God After Darwin* — “the God of vulnerable, self-giving love” revealed through evolutionary processes — is similar to Denis Edwards's *The God of Evolution*.

Chapter titles like “Beyond design” and “Evolution, tragedy and cosmic purpose” remind us that Haught is nobody to shrink from the big questions. You know the scientific arguments against “intelligent design”. Now learn the theological ones.

Finding Darwin's God
by Kenneth R Miller

Miller's *Finding Darwin's God* would be especially good for a faith-based book group that does not know much biology. There is something here for everyone: the witness of a scientist, science accurately and clearly explained, and connections to historical and conventional theology of the Western Church. “Miller has an uncanny gift for expressing profound ideas in clear and graceful prose”, writes Francisco J Ayala. Miller, Professor of Biology at Brown University, is a Supporter of NCSE.

ESPECIALLY USEFUL FOR CONGREGATIONAL STUDY GROUPS

Science and Christianity: Four Views
edited by Richard F Carlson

While many volumes of science and theology are series of isolated contributions, this book from a conservative Christian press actually includes

dialog among the contributors. The perspectives are creationism (Wayne Frair and Gary D Patterson), “intelligent design” (Stephen C Meyer), independence (Jean Pond), and partnership (Howard J Van Till). Christians who are already firm in their commitment to evolution will benefit especially from the responses of Pond and van Till to the other writers. For congregations with a wide spectrum of approaches to the authority of scripture and theological method, the whole volume can stimulate critical and constructive conversations.

The Sacred Depths of Nature
by Ursula Goodenough

The epic of evolution is laid out lyrically here in an attractive volume by a professional biologist. Goodenough's scientific narrative should appeal to almost any faith group. Readers may want to generate their own reflections on the narrative from their tradition and experience before reading Goodenough's own. Goodenough is Professor of Biology at Washington University.

*Toward a Christian View of a
Scientific World: Fifteen Topics for
Study*

by George L Murphy
Murphy, who earned a PhD in physics

before becoming a Lutheran pastor and seminary professor, offers an introductory course on science, theology, and ethics for the congregation, complete with thoughtful ideas for discussion and suggestions for further reading. Origins, evolution, and the church's role in promoting scientific literacy are among the issues he takes up in short focused chapters. David E Arthur writes: "This comprehensive and readable work by a well-qualified and experienced scientist, theologian, and pastor fills a very important gap in the current literature regarding the new dialog that has been emerging in recent years between science and religion."

A LITTLE HISTORY

Religion and Science: Historical and Contemporary Issues, revised edition
by Ian Barbour

In *Religion and Science*, Barbour actually gives us more than just a little history. In fact, he presents a thorough historical theological treatment of major themes in science. This volume is not for the faint of heart or the casual reader, but it may be as close as one can come to a definitive text for basic courses in science and theology. "For a generation to come, anyone setting out to explore the subtle relationships [among] science, religion, ethics, and technology will begin with Barbour as the guide", writes the reviewer for *Religious Studies Review*. Barbour was the recipient of the 1999 Templeton Prize for Progress in Religion.

Evolution's Workshop: God and Science on the Galapagos Islands
by Edward J Larson

According to the reviewer for *Publishers Weekly*, "Larson's first-rate history not only will entertain and engage lay readers but also is required reading for those seriously interested in Darwin, evolution, or these remarkable islands." But since Larson mixes his history of science with the history of religion as well, *Evolution's Workshop* is a good choice to recommend to those, including many mem-

bers of the clergy, who have little background in the evolutionary sciences but a keen interest in the history and cultural dynamics involved in the interplay of science and religion. As in *Summer for the Gods*, Larson sustains the reader's interest with anecdotes, observations, and musings.

Summer for the Gods: The Scopes Trial and America's Continuing Debate over Science and Religion
by Edward J Larson

Larson's Pulitzer-Prize-winning account of the events in Dayton, Tennessee, in the 1920s and their continuing impact on American life puts the persistent conflicts between science and modernity-resistant creationists into historical perspectives. *Summer for the Gods* is endorsed by such diverse readers as Phillip Johnson, Will Provine, and Ronald L Numbers, who says that it "is, quite simply, the best book ever written on the Scopes trial and its place in American history and myth." Many questions that arise in faith groups today are echoes of those resounding in the courtroom of Darrow and Bryan.

RULES OF ENGAGEMENT

When Science Meets Religion
by Ian Barbour

In *When Science Meets Religion*, Barbour addresses a sampling of issues in the science-religion dialog — the Big Bang, quantum physics, Darwin and Genesis, the question of genetic determinism, and the relationship between a free God and a law-bound universe — while modeling how further thinking and research might be approached. Like Haught in his *Science and Religion*, he offers four ways of considering each: conflict, independence, dialog, and integration. It is in his discussion of the latter two that Barbour is most interesting and stimulating.

Scholarly World, Private Worlds: Thinking Critically About Science, Religion and Your Private Beliefs
by Karl D Fezer
Basically a textbook for a student

audience considering how we know what we know, Fezer's book summarizes decades of his experience in teaching biology and advocating for evolution. He lays out the "principles that underlie all scholarly disciplines" and presents with clarity the limits of science as a way of knowing. There's a richness of resources here, thoughtful discussion questions, and helpful frameworks, such as "Twelve ways that people handle conflicts between science and their religious beliefs". Fezer was on the original board of directors of NCSE and edited *Creation/Evolution Newsletter* from 1984 to 1988.

Science and Religion: from Conflict to Conversation
by John Haught

Here Haught offers a way of considering key questions that arise when science and theology meet. Origins, reductionism, the meaning of human life, teleology, ecology, and other topics are addressed in a four-stage approach: conflict, contrast, contact, confirmation. The discussion of each is stimulating, and the model lends itself to application to other questions. Langdon Gilkey describes *Science and Religion* as "Not only readable and easily understandable ... but filled with genuine learning and thorough comprehension of contemporary natural sciences as well as of the major issue between those sciences and present-day religion."

An Evolving Dialogue
edited by James Miller

Collections of essays are almost by definition a mixed bag, but there must be something for everyone here. Unlike many volumes that contain only essays by neo-Darwinians of various shades and liberal theologians, *An Evolving Dialogue* also contains several essays by leaders in the "intelligent design" movement (Michael J Behe and William A Dembski). Ideal for the reference shelf and for browsing alike, *An Evolving Dialogue* (in the words of its publisher) "demonstrates that there can and must be constructive engagement between evolutionary science and religious and ethical reflection".





NCSE on the Road

A CALENDAR OF SPECIAL EVENTS, PRESENTATIONS, AND LECTURES

DATE June 8, 2002
CITY Washington DC
PRESENTER Eugenie C Scott
TITLE Understanding Evolution — the Role of the Natural History Museum
EVENT Natural Science Collections Alliance
TIME 1:30 PM
LOCATION Hyatt Regency Washington
CONTACT Judy Scotchmoor, jscotch@uclink4.berkeley.edu

DATE June 16, 2002
CITY Columbia MO
PRESENTER Eugenie C Scott
TITLE Creationism or Evolution? (A False Choice)
EVENT A talk on creation/evolution for students at the Missouri Scholar's Academy
TIME TBA
LOCATION University of Missouri-Columbia
CONTACT Eugenie C Scott, scott@ncseweb.org

DATE June 17, 2002
CITY Haverford PA
PRESENTER Andrew J Petto
TITLE Powerful Pedagogy: Science and Religion in the Classroom
EVENT Interpretation Matters: Science and Religion at the Crossroads
TIME 9:30 AM
LOCATION Haverford College
CONTACT Eric Weislogel, weislogel@metanexus.net

DATE August 3-10, 2002
CITY Marble Canyon AZ
PRESENTER Eugenie C Scott, Alan Gishlick
TITLE "Creation/Evolution" raft trip down the Grand Canyon
EVENT NCSE Excursion
TIME TBA
LOCATION Grand Canyon National Park
CONTACT Alan Gishlick, gish@ncseweb.org

DATE August 3, 2002
CITY Madison WI
PRESENTER Andrew J Petto
TITLE Plant Evolution at the Head of the Class
EVENT Botany 2002
TIME TBA
LOCATION Pyle Conference Center, University of Wisconsin, Madison
CONTACT Pat Gensel, pgensel@bio.unc.edu

DATE October 25, 2002
CITY San Francisco CA
PRESENTER Eugenie C Scott
TITLE The Big Ideas of Human Evolution
EVENT California Science Teachers Association
TIME 12:00 noon
LOCATION Bill Graham Civic Auditorium
CONTACT Judy Scotchmoor, jscotch@uclink4.berkeley.edu

[Check the NCSE web site for updates and details — <<http://www.ncseweb.org>>.]

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Michael Behe and “Intelligent Design” on National Public Radio

Steven Schafersman

On February 13, 2002, the day after Darwin Day, Dr. Michael Behe, a biochemistry professor at Lehigh University, appeared on Talk of the Nation (TOTN) on National Public Radio. Since the publication of his book *Darwin's Black Box* (New York: The Free Press, 1996), Behe has made dozens of public appearances to promote his creationist ideology and respond to criticisms with specious arguments; and he has — so to speak — learned on the job. Even I was impressed at the excellence of his sophistry. TOTN listeners would never surmise that every single one of the reviews of Behe's book in scientific journals by scientists thoroughly slammed his book and the ideas of irreducible complexity and “intelligent design” (ID) as unscientific and essentially worthless — a genuine argument from ignorance (many of these reviews are posted at Behe's Empty Box at <<http://www.world-of-dawkins.com/Catalano/box/behe.htm>>).

Behe represented himself as a scientist persuaded by the evidence

— not as a creationist with an agenda. To a question from host Melinda Penkava about how his ideas differ from creationism, Behe disingenuously answered, “Well, now to tell you the truth, I'm not real knowledgeable about creationism. I'm a Roman Catholic.” Behe used his “I am a Roman Catholic” mantra more than once to divest himself of the creationist label. Needless to say, this argument against an embarrassing label — while apparently convincing in Behe's mind — is not really conclusive (since many Catholics are creationists — see, for example, Patrick O'Connell's *Science of Today and the Problems of Genesis* [Rockford (IL): Tan Books and Publishers, 1993], reviewed by Colin Groves in *RNCSE* 2000 Nov-Dec; 20 [6]: 17-8, 23-4). In addition, most of his ID colleagues would not be able to use the same argument!

Behe's analogy for why irreducible complexity proves “intelligent design” was simple: If one were to gaze upon Mt Rushmore, one would conclude that a sculptor — an “intelligent designer” — created the complex set of faces; these could not be due to natural wind and water erosion over time. Likewise, complex biological structures, such as the biochemical “motors” of bacterial flagella, are like little biochemical machines that should be interpreted the same way as are human-designed and -constructed machines, such as the outboard motor of a boat. Such features, according to Behe, are irreducibly complex — composed of many separate parts arranged so that if even one part were removed or altered, the structure would not work. Therefore, the separate and mutually interdependent parts must

have been designed with a final purpose in mind; they could not have evolved as different and independent parts that fortuitously and ultimately worked together to form a functioning complex structure. This argument can, of course, be used with every biological feature, structure, and process, since all are complex and make use of interdependent and interacting parts, themselves exceedingly complex.

As readers of *RNCSE* know, this argument is over 200 years old; it has been thoroughly and consistently discredited by many thousands of scientific observations and experiments and, on this basis, is firmly rejected by scientists. “Irreducible complexity” is a term employed by Behe to argue that evolutionary processes cannot account for at least some of the observed complexity in living things. However, Behe's insistence that complex structures must always retain the *same* function and must be built step-by-step overlooks many well-known evolutionary processes. While it is true that there are complex biologic features and processes that would not operate at 100% effectiveness or even at all if one part were removed or altered today, legitimate scientists understand that these features and processes were formed by a natural process (that is, evolution by natural selection).

One point that Behe persistently ignores is that evolution utilizes precursor features and processes, perhaps less efficient and sometimes having completely different functions (in such cases termed *preadaptations* or *exaptations*), that exist as steps on the evolutionary pathway to the current feature or process. Despite their relative ineffi-

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ciency, however, these features and processes nevertheless possessed adaptive value (that is, they contributed to increased fitness) of their own — irrespective of the function that they would eventually serve in future generations. They would thus be favored during natural selection and would adaptively evolve. Behe irresponsibly either ignores or dismisses this natural and historical explanation — which happens to be the one that other scientists accept. For Behe, apparently, complex structures have no history at all, which is why he can see *only* their proximate usefulness and current interdependence of parts. Behe is a creationist precisely because he does not seriously explore the possibility of the evolutionary historical modification and change of interdependent parts.

Where Behe gives the hoary creationist argument a modern twist is by introducing biochemical complexity. The older arguments were refuted by Darwin's demonstration — and subsequent demonstrations in developmental and molecular biology — that complex structures at the organ level could change by modification of existing parts. In this way, the eye could evolve by the gradual change of light-sensitive structures from generalized light sensors to the complex, highly-adapted, and efficient eyes of vertebrates and squid. All biologically complex features and processes at the organ and organ system level, and most at the tissue level, can today be explained this way, with abundant empirical genetic, physiological, anatomical, and fossil evidence to back up the explanations. This is not true, however, of such features at the cellular and biochemical levels: scientists simply do not know enough to explain how many of the complex features and processes at this level evolved — yet. Behe cleverly exploits these gaps in scientific knowledge, filling them with an intelligent designer. This is classic God-of-the-Gaps sophistry.

However, some of the gaps have been filled. A number of reviews of Behe's book have convincingly described some, if not all, aspects of flagellar evolution. The same is true for most of the other biologic features and processes claimed by cre-

ationists to be evidence of "intelligent design" and not natural evolutionary processes because they are irreducibly complex. We still have gaps in knowledge about the evolutionary history of all sorts of complex features and processes, but the gaps are not necessarily permanent. Scientists have been filling such gaps in knowledge and expect to keep doing so.

On TOTN, Behe also repeatedly mischaracterized modern evolution — what he called *Darwinian* evolution — by claiming that only random processes generated the complexity we see in organic life. Of course, natural selection, the primary mechanism of this process, is neither a chance nor a random process, but a wholly deterministic one — albeit one characterized by a probabilistic determinism that can only be studied and understood statistically. The irony of this frequent creationist misrepresentation of modern evolutionary theory as "only chance" is that the most important evolutionary process that makes modern evolutionary theory "Darwinian" is precisely the same process that prevents it from being exclusively random. A completely random process could never generate the diversity, adaptation, and complexity we observe in living organisms (as has been well documented by creationists!).

Behe's suggestion that ID can be tested by taking flagella-less bacteria and growing them for thousands of generations to see if they evolve flagella without "intelligent" modification of their genes was superbly audacious, but deliberately deceptive. A proper test of ID would involve its making some prediction about a biological process, event, or feature that could not, in principle, be explained by evolution but only by "intelligent design". Not only have there been no *successful* tests of ID reported in the scientific literature, there have been no tests of ID reported there *at all*, indicating the essentially nonscientific nature of the enterprise.

Behe also repeated the ID motto — the evidence shows design in living organisms, but "ID leaves the identity of the designer open". His colleague William A. Dembski also uses this disingenuous disclaimer, saying that ID research points to

"generic design", not necessarily supernatural design. It is scientifically (and epistemologically) absurd to accept these claims. Contrary to Behe and Dembski, there is *no* evidence for *any* true design in the structure of living organisms — in the sense of a purposeful planning of outcomes — but there *is* excellent and well-known evidence for natural selection as the cause of their apparent design.

Deborah Owens-Fink, a member of the Ohio State Board of Education (OBE), also appeared on the program. She did a remarkable job of pretending to be unbiased and positive about this issue, saying that "we need to be very careful that we don't get into the issue of religion, but yet, at the same time, that we also do not censor ideas that might go against what some elite scientists believe with respect to evolution ... explaining the total diversity of life and origins of life." Owens-Fink, in reality, is one of the main proponents on the OBE in support of including ID in the state science standards. Without knowing Owens-Fink (a marketing professor at the University of Akron), I strongly suspect that her motives are religious. In my experience, no legitimate scientists or informed and unbiased laypeople are clamoring to include ID in science standards; only religiously motivated politicians and other non-scientists want to do this.

Behe's sophistic and misleading claims and his responses to arguments against ID might be convincing to many — perhaps most — listeners. It was the responsibility of the legitimate science supporter on TOTN, David Haury (Professor of Science Education at the Ohio State University), to refute Behe's pseudoscientific arguments, but he failed to respond adequately to them. This often occurs when creationists get valuable public exposure in the mainstream media. Haury truly has impressive credentials and a background in science education, so he should have done better; however, experienced and knowledgeable university professors are frequently unprepared for the specious arguments and rhetorical tricks that creationists use to promote their agenda, and thus are often ineffective against them.



I sent Haury an early version of this essay, and in defense of his efforts he told me that he tried to steer the conversation to the educational issues, remarking, "What is not...obvious to folks in general is that there are school issues that go beyond science, and I was hoping to move on to those issues more quickly by simply noting that [ID proposals] do not come to us from within the scientific community, are not embraced by scientists, and fail all tests of being identified as science. I did not want to waste air time getting immersed in debating his absurd ideas point by point." Haury was of course right to want to avoid debating irreducible complexity with Behe, but unfortunately he was not able to steer Behe away from the minutiae of his anti-evolutionism and to the broader issues surrounding science education.

Haury made one notable rhetorical mistake on the program, saying, "that the idea of 'intelligent design' and the theory of evolution do not talk about the same things. ... [ID is about] how it all got started, [while evolution is] about how things change over time. ... It makes no statement about the origins [of life]". He appeared to reason that, since evolution is indifferent to the way in which life originated, positing an "intelligent" force at the origin of life would not diminish evolution in any way. However, ID purports to explain *both* the origin of life *and* the generation of diversity, and both of these explanations conflict with well-established scientific theories — the abiogenic origin of life by chemical evolution and the generation of diversity by biological evolution. Thus Haury's statement seemed to allow that ID was a legitimate scientific theory about the origin of life; this mistake was unfortunate, since in such discussions it is important not to muddle the distinction between ID and science.

It was a pleasure to hear from the fourth guest, Ernan McMullin, a distinguished historian and philosopher of science at Notre Dame University and a person whom I admire for his historical insight and fairness on the creation/evolution controversy. He understood the issue perfectly, saying that "the motive behind this proposed measure in Ohio ... is clearly one which

would advance religion." *Of course* the efforts to politicize science education by requiring legislative oversight of evolutionary topics (a honor never bestowed on gravity, thermodynamics, or planetary revolution!) and to force ID into state science standards are politically and religiously motivated by the desire to include God and religion in the public school science classroom. There is no other credible reason for anyone to make such an effort. Clearly the reason is not to improve science education; otherwise the politicians would let the scientists and science educators write the standards themselves without political interference!

The callers to TOTN were wonderful: they asked questions that really put Behe on the defensive. Steve of Danville, California, asked the guests to address the "God-of-the-gaps" approach to science, correctly observing that ID was an example of this approach. Behe tried to turn the argument back against itself by preposterously claiming that "ID has grown stronger as we have learned more about science". He alleged that the God-of-the-gaps objection does not apply to irreducible complexity arguments for ID because we have learned that cells are *more* complex than we knew in the 19th century, when evolution was proposed to explain adaptive complexity in nature. He ignored the fact that the "irreducible complexity" is not the same as the *degree* of complexity; what is at issue is not complexity itself, but whether complexity is used to claim ultimate ignorance and the uselessness of further study. Behe responded with a warning against a "naturalism of the gaps" — a mistaken and specious characterization of the naturalistic methodology of science.

Mark of Columbus, Ohio, was especially perceptive about the issue. He wanted to know how the idea of "intelligent design" gave stu-

dents a better understanding of how the world works. This, of course, is one of the major ironies of ID studies: unlike science, ID is a question stopper, not a question generator. Behe's response? He conceded that "Darwinian theory" works for some things, but for "other things it doesn't work at all. ... I'm not going to say any more than when we drive past Mt Rushmore, we just throw up our hands and say because we can't understand how wind and rain did this, then it must have been designed." I think that this response is as good an example of the vacuity of ID ideology as anything could possibly be.

The next caller was Cynthia of Phoenix, Arizona, who agreed with McMullin about his characterization of the motive of ID advocates in Ohio. Behe replied that, in his opinion, topics like ID are mistakenly excluded from the public schools because people believe they have "religious implications". The real reason ID is excluded is because it is lousy science!

Irreducible complexity — one of the pillars that supports "intelligent design" — is an argument from ignorance. No real scientist would ever say, "this is so complex that it can never be explained by evolution, so I give up." Instead, a scientist would continue to formulate hypotheses to explain it and then test the hypotheses. Behe suffers from a very unscientific failure of curiosity, creativity, and nerve. Not only does he promote willful ignorance and pseudoscience, he encourages people to repress their intellectual curiosity — a moral lapse for a scientist!

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Creationism and Geocentrism Among Orthodox Jewish Scientists

Alexander Nussbaum

I recently taught courses in statistics and experimental psychology at a branch of Touro College, which owes its genesis to the opinion that Yeshiva University (the oldest institute of higher education under Jewish auspices in the US) was too secular. Because many job sectors require college and advanced degrees, however, it was necessary to create a "kosher college" in which very religiously observant Orthodox Jews — the *frum* — could obtain degrees while avoiding the forbidden, such as sitting in the same room with members of the opposite sex, or taking courses in which sex or "heretical" philosophies are discussed.

While I was teaching statistics, I mentioned that Sir Ronald Fisher, inventor of the analysis of variance, was a founder of modern evolutionary genetics. "You believe in evolution!" a number of students exclaimed with a mixture of horror, curiosity, and surprise. For most of the students, I was the only person they had ever met who accepted evolution. But it would not be accu-

rate to say that the students never heard about evolution — they had, in the course of being systematically indoctrinated with a litany of standard creationist lies.

My statement that evolution is true beyond any doubt led to an invitation by a comparative psychology professor to debate the issue in front of his class. Realizing full well that it is pointless to debate creationists, I nevertheless reluctantly agreed to the debate for two reasons. One was to make it clear to the students that creationists are looked upon by legitimate scientists in the way the *frum* look upon Reform rabbis. The other was to confirm that Touro's professors taught creationism and that they would openly advocate it in front of me. I had no doubt that Touro's rabbis condemned evolution, but would Touro's science professors admit to being creationists in front of someone not on the "inside"?

Yes indeed. The comparative psychology professor repeatedly demanded that I explain on the spot exactly how the first cell arose. He insisted that there could be no transitional forms because (he rhetorically asked) "how could an animal live with half a heart?" I explained that real scientists had documented a 55-million-year history of the evolution of the horse family. But such appeals to scientific research made no impact in the audience, because the students' Orthodox upbringing left them completely unable to consider any information that would endanger their religious views. Not exactly impartial, the audience concluded that the *frum* professor proved the

superiority of "Torah Science".

When I informed my opponent in the debate that he was making Touro look reactionary and unscientific, he replied, "What do I care what the *goyim* [non-Jews or non-Orthodox Jews] think?" Indeed, my experiences at Touro as well as subsequent research show that, as Orthodox Judaism has moved to the right over the last 30 years, Orthodox scientists no longer perceive any need even to pretend to accept what secular science tells us about the age, origin, or structure of the universe or life.

THE ORTHODOX CHRONOLOGY

About 90% of organized Judaism is made up of Reform or Conservative denominations that have no problems at all with, and fully endorse, evolution. The other 10% are the Orthodox congregations, which range from Modern Orthodox to Ultra-Orthodox. In general, Modern Orthodoxy seeks to obey orthodox laws while also respecting the way of the world in regard both to scientific knowledge and to moral values; Modern Orthodoxy is the most likely to tolerate other religious positions. Centrist Orthodoxy permits secular information and concepts, but only when modified so as not to conflict with their beliefs. Ultra-Orthodoxy bans all contact with secular ideas, actively seeking to eradicate any trace of what it sees as secular influence. In recent years, Modern Orthodoxy has become all but extinct; its former adherents have largely become Centrists. It is the Centrists and the Ultra-Orthodox who refer to themselves as being *frum*, that is, observant.

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For the Orthodox Jewish community, the scriptural chronology of the universe is not open to doubt. Indeed it is believed with such fervor that almost no secular belief can compare. Publicly expressing doubt about any part of this chronology is likely to have severe social consequences to skeptics who are members of that community — whether they be college professors or janitors.

In this chronology, the universe was created 5762 years ago in the space of 6 days. Adam was born in the year 1 and died in 930; Noah was born in 1056 and died in 2006. Exactly 10 generations separate Adam and Noah; lifespans were long enough then that there were people who knew both and could pass on details of the Creation to Noah. The Noachian Flood occurred in 1656 (about 2104 BCE); all land animals after the Flood descended from those aboard the Ark. The Tower of Babel was destroyed in 1996 (about 1764 BCE); all the world spoke Hebrew, the language of God, until then. Abraham (traditionally considered the first Jew) was born in 1948; he died in 2123. Exactly 10 generations separate Noah and Abraham; it is accepted that Abraham knew Noah and learned about the Flood from him.

Obviously there is no place in this chronology for evolution. Since no member of the Orthodox community, regardless of his or her academic credentials, can dare to hold views contrary to the above chronology, evolution has no place there either.

ORTHODOX ANTI-EVOLUTIONISM

Orthodox Jewish anti-evolutionism is not on the radar screen of the scientific community for a number of reasons: because scientists tend to view the rejection of evolution to be solely a US Protestant fundamentalist phenomenon, with most other religious traditions accepting Darwinism evolution; because Reform and Conservative rabbis fully endorse evolution; and because, except in Israel, the very small Orthodox community is unable to create problems for the wider population. But because of the isolation of the Orthodox from the non-Jewish population and

even from 90% of the Jewish population, they entertain some beliefs that would shame even Christian fundamentalists. (Even among the remnants of Modern Orthodoxy, there is an active campaign to purge the last vestige of accommodation with evolution.)

The late Menachem Mendel Schneersohn, the Lubavitcher rebbe (rabbi), was the most powerful Orthodox leader in centuries. He was so admired that to this day he is still referred to by a large percentage of the Orthodox as *melech bamoshiach*, that is, king messiah. In 1962, Schneersohn wrote to a correspondent who was worried about reconciling the Torah with the scientific view about the age of the earth:

If you are still troubled by the theory of evolution, I can tell you without fear of contradiction that it has not a shred of evidence to support it. On the contrary, during the years of research and investigation since the theory was first advanced, it had been possible to observe certain species of animal and plant life of a short lifespan over thousands of generations, yet it has never been possible to establish a transmutation from one species into another much less to turn a plant into an animal. Hence such a theory can have no place in the arsenal of empirical science (Schneersohn 1962).

Schneersohn's views on the feasibility of evolution are echoed by David Hasofer, a statistician at the University of Sydney, who was profiled in *L'Chaim*, a publication of the Lubavitch Youth Organization in Brooklyn. Hasofer "claims that according to all of his computations, there is absolutely no chance, within the time frame given by evolutionary theory, that even one level of species would develop, not to mention the development of the human species" ([Anonymous] 1990).

Like the young-earth creationists at the Institute for Creation Research and Answers in Genesis, the *frum* have to dismiss all scientific results — not just evolution —

that conflict with their received chronology.

At the Fourth International Conference on Torah and Science, held in 2001, physicists, biologists, and mathematicians came together

to debunk not only evolution but also radioactive dating in light of the scientific ideas of the Lubavitcher Rebbe, that is to say, Schneersohn ([Anonymous] 2001). Thus, for example, Lee Spetner, the author of *Not by Chance! Shattering the Modern Theory of Evolution* (Brooklyn [NY]: Judaica Press, 1998) spoke about the impossibility of evolution, while Yaacov "Jack" Hanoka

(who holds a PhD in physics) debunked radioactive dating, concluding its results could be explained away "without requiring a world that is a million times older than what the Torah says" (Hanoka 2001).

In a sign of increasing rejection of mainstream science among the Orthodox, the Fourth International Conference on Torah and Science included participants from Yeshiva University, which has long been the example of Orthodoxy's acceptance of science. Rabbi Moshe Tendler of Yeshiva's biology department, for example, spoke; in January 2002, Tendler expressed anti-evolutionary views on the Channel One News — a daily, televised, 10-minute newscast that is beamed via satellite during the school year to 12 000 schools.

Similarly, the Association of Orthodox Jewish Scientists — the largest and most important group of its kind, boasting over 1000 members, including medical doctors, clinical psychologists, chemists, physicists, and computer scientists — apparently regards mainstream science as dispensable. According to executive director Joel Schwartz,

**Thus we have
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who now glory in
rejecting everything
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Copernicus**

"We are strictly from the Orthodox point of view ... that there was no big bang. God created the world in six days and that's that" (Weiss 1997).

Thus we have an entire collection of Jewish scientists with extensive education, and in some cases extensive achievement, who now glory in rejecting everything secular science has discovered since Copernicus.

ORTHODOX GEOCENTRISM

We tend to regard the claim that the sun orbits the earth as all but extinct, serving today only as a prime example of an absurd view. Even some creationists are happy to say that evolution is as outdated a scientific belief as geocentrism. And who among us who have had to stand up for evolution have not heard ourselves say that evolution is in as much doubt as heliocentrism?

That is one of the arguments I used in debating the creationist psychology professor at Touro College.

To my surprise, my opponent responded that my belief that the earth orbits the sun only proves that I do not know science; the Copernican theory, he claimed, has been discredited by current science. A little research proved that

geocentrism is currently the enforced Truth in certain circles of Orthodox Judaism — even among Orthodox with advanced degrees. Forty or so years ago, it was losing ground to interpretations of the Torah that accommodated its earth-centered passages to contemporary science. Today, it has made a remarkable comeback in the Orthodox community; many Orthodox Jews trace what they regard as the evils of today, including biblical criticism, the sexual revolution, humanism, and evolution, to heliocentrism.

A powerful boost to this comeback is the work of Schneersohn. In a letter written specifically to counter what he considered the heresy of Jews' accepting the heliocentric view, he wrote:

I find it incomprehensible and regrettable that some of our Orthodox Jewish scientists still evince an apologetic attitude vis-à-vis science and certain scientific theories.... If a century ago, when scientists still spoke in terms of absolute truths, it was "understandable" why a person who wished to adhere to his faith might have been embarrassed to challenge "scientific" claims, this is no longer the case in our day and age. Contemporary science no longer lays claim to absolutes; the principle of probability now reigns supreme...

Need one remind our Orthodox Jewish scientists, who still feel embarrassed about some "old-fashioned" Torah truths, in the face of scientific hypotheses, that Heisenberg's "principle of indeterminacy" has finally done away with the traditional scientific notion that cause and effect are mechanically linked. The 19th-century dogmatic, mechanistic, and deterministic attitude of science is gone. The modern scientist no longer expects to find Truth in science... (Schneersohn 1971).

My opponent's insistence that modern science had disproved the Copernican model turns out to be the current view of many Orthodox Jewish scientists. For example, Yirmiyahu (Herman) Branover, who holds a PhD in physics, is the author of over 250 articles, and heads the Center for Magneto-Hydrodynamic Studies at Ben-Gurion University, writes:

Thirty years ago, in connection to the supposed contradiction between Torah and science, the Rebbe [Schneersohn] spoke about the Rambam's contention in the *Yad Hachazakah* that the earth is the center of the universe, as opposed to the prevailing notion that the earth revolves around the sun. For hundreds of years the Torah was the object of scorn and derision as the source of an

antiquated world-view that had been superseded by science. When Einstein came along some 80 years ago and formulated his famous theory of relativity, the entire problem was solved. Today, the entire scientific community admits that the Rambam was right (Branover 2002).

(The Rambam is the medieval Jewish philosopher Rabbi Moses ben Maimon [1135-1204], whose name is Latinized as Maimonides.)

SHUNNING SCIENTIFIC FACTS

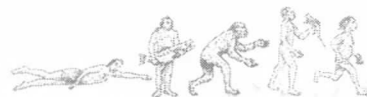
In the *frum* community there is pressure to avoid the secular media, which is considered *znus*, that is, lasciviousness. Members of the community differ in the extent to which they consider it acceptable even to view the secular media: one young man told me that he is skilled at reading articles in *The New York Times* while avoiding looking at ads. With this in mind, I designed a research project for an experimental psychology class that was to examine whether members of the *frum* community differed in their scientific knowledge and knowledge of popular culture, depending on the extent to which they were exposed to television, secular newspapers, and the internet.

The participants in the surveys were 50 students who attended one of the yeshiva *gedolas* (schools for scriptural or religious studies for college-age students). Two surveys were administered: one was the National Science Foundation's (NSF) quiz on scientific knowledge, and the other was a survey of my own construction designed to measure "cultural" as well as scientific knowledge, such as knowing who Britney Spears is.

The pressure to avoid television and the secular media is evidently successful. Of the 50 participants, 25 did not read secular newspapers, 23 did not use the internet for entertainment, 12 watched television less than once a month, and only 29 watched television once a week or more.

One of the items on my survey was the open-ended question "Which living animal evolved from dinosaurs?" Of the 50 respondents, only 6 answered "birds", the correct

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Why Science Should Warm Our Hearts

Colin Tudge

I love science. It is what I have always done. I remember the warmth I nursed for weeks when, at age 13, I qualified for form Science 3A, already specializing at that tender age. I can still get the same thrill from some books and laboratories, when ideas are neat and properly decorated.

Science is not an innately arrogant pursuit. Newton said that science was for the glory of God — the God-given intellect dedicated to the glorification of God's works. We need not embrace the theological language of the 17th century, but the sentiment is precisely right. It is

shared by many a modern scientist: that the true purpose of science is not to change the universe or to make it more comfortable, but to appreciate it more fully. Science has risen gloriously to the challenge: the universe that is now revealed, and the creatures within it, are infinitely more various and intricate than human beings ever conceived of without the help of science, and best of all is the realization that so much is still to be done.

Science, in short, should be heart-warming, encapsulating precisely that love of scholarship for its own sake (or, as Newton and many a rabbi and mullah would say, for God's sake) that runs through all civilization.

Other people do not see it like this. Science has a macho, gung-ho image. Understanding is not for its own sake, but is presented as the means to "conquest" — of the stars, of disease, of whatever. It comes across as a nuts-and-bolts pursuit: regrettably necessary, but posing various threats to the human spirit through its intemper-

ate attacks on traditional beliefs and through its ruthless rationality. We are still locked in the battle of *Dionysus v Apollo*, with Apollo now cast as a blend of nerd and Strangelove. Schoolchildren turn away from science, and teachers must be bribed to take it up. For all this, scientists blame the media for their hype and general mischief (although the science correspondents are excellent); "the public" for its fecklessness and "ignorance"; and the subject itself, because it is too difficult and can properly be understood only by the officially initiated subsection of the intelligentsia.

What I want to suggest — in a spirit of friendliness — is that most of the fault lies with the scientists themselves and, in particular, with those who have striven hardest to be its advocates. Too often, they make it seem arrogant, macho, threatening, pompous but, in the end, naive: all those qualities that non-scientists say they find most repellent. Attempts to lighten it up frequently come across as clown-

answer. Two items from the NSF survey were the following true or false items: "Human beings as we know them today evolved from earlier species of animals" and "The earliest human beings lived at the same time as the dinosaurs". Only 8 of the 50 (16%) answered the first item correctly, but 29 of the 50 (58%) answered the second item correctly, which compares favorably to the 48% answering correctly in the NSF survey.

At first this may seem as a perplexing contradiction — the respondents evidently think that humans were created simultaneously with all other animals yet also think that humans did not live at

the same time as dinosaurs. But the most common *frum* solution to the dinosaur problem is simple: dinosaurs never existed. God created their fossils simultaneously with the creation of the earth in order to provide a test for faith! This seems to contrast with the prevalent Christian creationist position that dinosaurs were on Noah's ark and survived into historic times.

The NSF quiz was designed to test knowledge, but there is a difference between knowing what secular science claims is true and believing what secular science claims. The students who administered the quiz reported that numerous participants said that they knew that sci-

ence says humans evolved, but they considered it a lie. Because the participants did not believe that dinosaurs ever existed, many correctly responded that human beings and dinosaurs never coexisted because they rejected the very existence of dinosaurs — not because they knew that dinosaurs became extinct about 65 million years before the first humans appeared.

SCIENTIFIC RESPECTABILITY

In mainstream US colleges today, while some academics unravel the human genome, others consider genes to be part of our cultural myth. It is trendy at colleges to see independent reality as a Western

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ishness — a dangerous quality to link to such obvious power. To some extent, this is just bad PR: there is no need for scientists to attack Christianity or Islam, for example. But the flaw runs deeper. It cannot be put right with a course in media training. The startling truth is that some of the most conspicuous advocates for science horribly misrepresent it: what it is, what it is like, what it can helpfully comment upon, and where it should be silent. They have, in fact, misconstrued the nature of their own craft.

THE NATURE OF SCIENCE

What science is was beautifully summarized by the philosopher Karl Popper. An idea can belong to science, he said, only if it is testable. Science is thus composed of testable hypotheses. He went on to say that hypotheses can, in principle, be shown to be false, but cannot be shown unequivocally to be true: so “testable hypothesis” became “falsifiable hypothesis”. Various philosophers have taken him to task for this — pointing out that it can be just as hard to falsify as to verify. But “testability” wins through.

This idea is simple but far-reaching. It suggests immediately that science is not anchored, as many perceive it to be, in subject matter: it is not just the sum of chemistry, physics, and biology. Rather, it is a method, an approach, that can include the psychology and behavior of human beings or the policies of a government. Everything is with-

in the compass of science, provided it is testable.

From Popper's notions, too, science emerges as an innately humble pursuit. Science is not an edifice of truth, built stone by stone. It is a landscape painting, never finished: each addition, each fresh handcart and bathing goddess, changes the balance of the whole, sometimes beyond rescue so the whole must be started again. Science's perceived arrogance is doubly unfortunate: it drives people away and it misrepresents the subject. Even if we reject Popper's strict principle of falsifiability, we see that the “truths” of science, its theories, must always be both partial and provisional. Every idea, no matter how satisfying and complete it seems, is waiting to be knocked off its perch, or at least improved upon. We can be certain at any one time only that there is more to know. All suggestions in the past that such-and-such a subject has been sewn up were invariably followed by the rudest of shocks. Michelson measured the speed of light in the late 19th century and declared that physics was over but for the dotting of *is*; in a decade or two came Einstein and then Planck, leading on to quantum mechanics, and then the whole universe was up for grabs, as it still is.

At any one time, it is logically impossible to know how much is not known — whether science has already lit up the universe like a football stadium, or merely laid a

trail or two across the darkness. Non-scientists who fear that God's mystery has been forever compromised need have no fears; in the end, there is always mystery. Those who suggest that it is blasphemous to probe God's intentions are themselves guilty of blasphemy. God is not a conjuror, whose tricks seem tawdry when exposed. The more you see, the more wondrous it all becomes.

In short, as Newton and most of his contemporaries saw (including Galileo, who was a good Catholic), it is remarkably simple to reconcile excellent science with religion. Professor Richard Dawkins has made this very point: “If it is religious to perceive the universe with awe”, he has said (although I paraphrase), “then I am religious.” Much of the essence of religion is to experience first the awe, and then the sense of reverence that should follow from it. Science inspires in just this way.

ARE SCIENCE AND RELIGION INIMICAL?

Why, then, does science allow itself to be seen as the natural enemy of religion, and thus antagonize so many people for no good reason at all? Yes, there are some serious conflicts. The clash between Darwin and Genesis, for example, lies not in the details of geology, for Genesis can be seen as a good first draft, made in the virtual absence of data (or any inkling of “testable hypothesis”). The clash is as Daniel Dennett

social construct and science as the Western cultural myth, no more true or valid than the myth of any other culture. The usefulness of such trendy relativism is not lost on Orthodox Jewish academics. They do not see a conflict between faith and science, as the two are on such unequal standings: their faith claims absolute truth, and, by contrast, science cannot claim certainty (and is considered a myth even by some gentiles).

When I began to teach experimental psychology at Touro College, I wanted to introduce students gently to the primacy of experimental evidence. I thought that I could stimulate them to exam-

ine their own beliefs by discussing anti-science that goes on in mainstream colleges. One example involved dogmatic radical environmentalism, and the students saw immediately that it is irresponsible to twist science to serve ideology. “But isn't this similar to your ideas that science can find nothing that contract the Bible?”, I asked. Perhaps extremists are more likely to recognize extremism in others, while remaining oblivious to their own extreme views.

Evidence is not enough to change the minds of such dedicated creationists. (Although the deputy chairman of psychology for all branches of Touro College, a mem-

ber of the Ultra-Orthodox community and a staunch creationist, told me that he would have no problem accepting evolution if only there were any evidence for it, my feeling was that I would have no problem accepting him as a scholar if only there were any evidence for it.) But their institutions crave, claim, and take pride in the prestige of scientific academia, despite despising the principles upon which scientific academia is built — that of the uncensored pursuit of knowledge and the primacy of objective evidence. The scientific community, when confronted by institutions that teach contempt for science and its methods, should articulate clear-



describes it in his book *Darwin's Dangerous Idea* (New York: Simon & Schuster, 1995). Orthodox Christians of the 19th century argued, as John Locke had done in the 17th, that intelligent beings could not be made except by an even more intelligent Creator already in place; but natural selection shows how, in principle, life and then intelligence can emerge from simple beginnings, with no overseer at all. But religion as a whole does not rest on that one piece of theology; and in general, given that religion is innately untestable, it remains outside the purview of science. There can be spats, but there is no mortal conflict in which to engage.

Why, then, has Dawkins, outstanding thinker and writer that he is within his own field, gone to such lengths to brandish his atheism, and so derisively? His attacks have not been worthy of either his own scholarship or his victims'.

And why was Professor Lewis Wolpert so keen to emphasize the differences between religion and science in this year's Michael Faraday lecture (which might have made Faraday himself, a serious Christian, turn in his Sandemanian plot in Highgate Cemetery)? Wolpert is a Fellow of the Royal Society, former chairman of its Committee for the Public Understanding of Science, a prodigal broadcaster, and thus widely perceived as an official spokesperson. In prestigious lectures, what he

says matters. And he told his audience that, whereas we have an evolved propensity for religion, with an innate tendency to believe in God, the scientific way of thinking is "unnatural", the antithesis of common sense. He has written a book on this: *The Unnatural Nature of Science* (Cambridge [MA]: Harvard University Press, 2000).

That human beings do have an evolved predilection for religion seems entirely plausible, and for the reasons Wolpert presented. We need to make sense of our environment, and "sense" in this context implies a feeling for cause and effect. Many religions are rooted in the entirely forgivable idea that nothing happens unless somebody makes it happen, and on the grand scale this "somebody" must be God. Furthermore, Wolpert might have added, societies cohere better if everyone subscribes publicly to a common belief, whatever that belief may be. Each needs to know what the others think, or they cannot trust each other.

Yet on Radio 4 a few days earlier, Wolpert spoke of religion as a "delusion". We are led to infer that belief in religion in general and God in particular is delusory because it is an evolved survival strategy. This "because" is a resounding *non sequitur*. What we are or are not evolved to believe in tells us nothing whatever about its reality. We are evolved to perceive light, but we do not con-

clude that light is delusory. Some theologians, quite independently of any Darwinian gloss, have argued that God must exist because otherwise we would not believe in Him. That argument is obviously fatuous, but so is its Wolpert-style antithesis.

Is science really unnatural? One can see that even Galileo's idea that light objects fall just as quickly as heavy ones has a counterintuitive quality, and quantum mechanics is off the scale of everyday conception. But the basic method of science as identified by Popper — make a guess and then test it — is the essence of all thinking. You do it, I do it, cats do it, even worms do it. For day-to-day purposes, there is no other way to get a feel for whatever is going on. Seen in this light, science emerges as the most natural process of all. The unnaturalness (if such it is) of science lies only in its explicitness: that it lays out problems for inspection, while our own commonsensical brains, bent on survival, draw lightning conclusions from fleeting impressions and are content with imperfection, provided it works.

Wolpert is also prone (and is far from alone in this) to emphasize the difficulty of science, and to conclude from this that it is best left to experts like, er, himself. At best, this view discourages, which is not a good thing for a teacher to do. At worst, it repels. It is an affront to democracy and, worse, to human dignity.

ly the intellectual bankruptcy of their methods. No rational argument, no amount of evidence, can breach the mental fortresses of such dogmatists, but it needs to be made clear that creationism in academia will not be certified kosher.

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COMMUNICATING SCIENCE

Science can indeed be very hard — but for many different reasons, and it is important to distinguish them. It is hard because there is so much of it, and different bits depend on other bits, so it takes a long time to get into. But then, the same is true of any subject, from music to Spanish conversation. It is esoteric — meaning you have to know the background before you can get to grips with the matter in hand. Again, this is true of everything. Much of science, such as immunology, is complicated. But so is gardening — yet it is not innately difficult. Some science, such as quantum mechanics, is truly counterintuitive. But scientists, too, have difficulty with this: as Niels Bohr said, if you think it is easy, you haven't understood the problem. Or as a professor of physics once told me when I asked him how he pictured a nine-dimensional universe: "You don't. You just do the math." Math is always a problem, because the human brain is not geared to it. We are nature's wordsmiths. But some spectacularly good scientists have also been spectacularly bad mathematicians. Darwin regretted his own innumeracy. Faraday, a visionary physicist, pleaded forlornly for "plain words". There are very few Newtons around, able to invent a new form of math (calculus, in his case) when the traditional kinds prove inadequate.

In short, scientists also have trouble with the problems in science that are really hard. Most of them, like most of us, see only as far as the geniuses allow them to see. Indeed, take away the top 20 geniuses from the past 400 years and we would still be living in the 17th century, with the clever but stilted physics of Robert Boyle and John Ray's natural history. On the other hand, once the big ideas are explained, then some of them at least — including those of biology, which impact most directly on our lives — are actually rather easy. Natural selection can be explained in five minutes (although it has taken 140 years so far to work through the consequences), and Mendel's experiments with peas, the basis of all subsequent genetics, seem so simple that we may wonder what the fuss was about. In fact, Mendel's

was the simplicity of genius. But we lesser mortals can wallow in his vision, just as we do in Mozart and Picasso. We do not have to belong to a special club to take part. Wolpert's insistence on the difficulty looks very like an attempt to protect the high priesthood. But those who build walls invite graffiti.

Scientists must loosen up. It is false, for example, to suggest, as they sometimes have, that people who do not practice science have no right to comment at all, and get it wrong when they do. The corollary, that scientists can be relied upon to get it right, is equally false. To be sure, there would be no science at all without scientists; but that does not mean that science belongs to them, any more than art belongs to artists, or politics to politicians. Science's greatest quality is that it does not rely upon authority, at least in principle. Its ideas are explicit, laid out for universal scrutiny. Only religion is arcane, and can make a virtue of this. To insist on the specialness of scientists, and to appeal to their authority, is to adopt the methods of religion at its most pristine, where all ideas must be filtered through the chosen few. If everyone comments on science, then many silly things will be said. But that is what it means for a subject truly to be part of culture.

When they are drawn into public debate, scientists, like all of us, should tell the truth, the whole truth, and nothing but the truth. Their presentations throughout the debates on "Mad Cow" Disease and genetically modified organisms have, on the whole, been woeful. We have been treated again and again to the stock phrase: "There is no evidence that...." I have never heard anyone add: "But absence of evidence does not mean evidence of absence." Without that codicil, we do not have the whole truth. I did not hear even one scientist explain in a public place why they took exception to the claim by the Aberdeen-based biologist Dr Arpad Pusztai that genetically modified potatoes had strange effects on rats. They had plenty of airtime, but they used it to complain that Pusztai had spoken to the press before apprising his peers. This was a fair complaint. But what really matters?

People's well-being and enlightenment, or the dignity of scientists? When scientists ask me how to talk to the public, I ask them: "Have you ever tried behaving like a human being? Would you palm your Granny off with an unqualified, 'There is no evidence that....'?" It is not media-training that is needed, but a sense of citizenship.

Science needs a new image. Its Apollonian rationality is wonderful at its best, clear and pure. Beware, though, what has lately been called "the rationalistic fallacy". That it is rational does not make it right, or good, or necessarily better than some impassioned, if badly articulated, instinct. Besides, science has a romantic face, too. It is methodical, but it does not simply grind to its conclusions. Creativity matters at least as much as in the arts: huge leaps of imagination that come from nowhere. British students of English learn about Blake's antipathy to science and Thomas Gradgrind's obsession with "facts" ("A horse, Sir: a graminivorous quadruped"), but many English artists were inspired by science and technology: Turner, Ruskin, George Eliot, Gerard Manley Hopkins. Early 19th-century Germany gave us the buttoned-down end of modern biology, from cell theory through genetics (Mendel was German-speaking) to biochemistry. For much of that time, however, it was steeped in the literally "romantic" notions of *Naturphilosophie* and of vitalism, and in its turn the science inspired German Romanticism. All this seems to get written out of the act.

All in all, we need much more than committees and professors for the public understanding of science, lectures *de haute en bas*. We need a different kind of science education. Science should not be taught simply as an apprenticeship — which, more often than not, remains the case — but as a significant slice of cultural history and a way of looking at the world.

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BOOKREVIEWS

[There are a number of recent books that explore the dialog between science and religion — many highly technical and specialized. Biologist Kenneth Miller has produced one of the most readable and personal of these in *Finding Darwin's God*. The potential impact on a wide audience has prompted us to run two different book reviews of Miller's book — one from the perspective of a high-school science teacher and one from the perspective of a historian of science. This is the first of those reviews. —Ed.]

FINDING DARWIN'S GOD: A SCIENTIST'S SEARCH FOR COMMON GROUND BETWEEN GOD AND EVOLUTION

By Kenneth R. Miller. New York:
HarperCollins, 1999. 323 pages.

Reviewed by Larry Flammer

As a high school biology teacher myself, I highly recommend this book to all biology teachers. The first half is especially useful. It is devoted to revealing the myths surrounding popular perceptions about both science in general and evolution in particular. The second half addresses the supposed conflicts between evolution and belief in God. In the course of attempting to provide resolution to those conflicts, Miller offers many interesting insights.

Several parts of the book are particularly noteworthy and successfully deal with recurring issues in the public arena. On the age of the earth, Miller informs the reader about the pattern of half-lives of natural nuclides and explains how this information is used in radiometric dating (including the issue of isochron "adjustments"). These topics were beautifully explained and described in the briefest, simplest,

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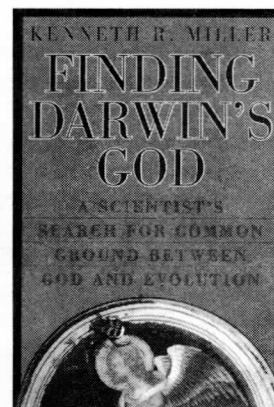
clearest writing I have ever seen on the subject. The presentation was very compelling, and included sufficient information for it to serve as a basis for classroom exercises.

On the vexed relationship between punctuated equilibria and gradualist models of speciation, Miller recounts the confusion, and then resolves the apparent contradictions with characteristic clarity and simplicity. He puts to rest the supposed conflict between macroevolution and microevolution that anti-evolutionists often raise in opposition to evolutionary theory.

One of the most interesting sections is the one that addressed the "intelligent design theory" charade. Miller addresses the claims of proponents of "intelligent design" creationism such as Phillip Johnson and Michael Behe and disassembles the "theory" piece by piece. Once again, the material in this section could serve as the basis from which informative classroom lessons could (and should) be developed. They would provide exactly the sort of "critical thinking" activity that many in the ID movement are calling for.

In addition, throughout *Finding Darwin's God*, Miller provides a picture of the nature of science much more accurate than that held by the general public (including too many science teachers). These sections are a must-read for anyone interested in promoting science literacy, and could also be a valuable classroom resource.

However, the second part of the book is a little less satisfying. Miller offers an extensive and fascinating philosophical defense of the idea of evolution as God's tool for creating



the diversity of life, with all its uncertainty and free choice (springing from the basic uncertainty of quantum mechanics), and therefore a deep justification for a theistic explanation for evolution. I have my doubts, however, that this approach will satisfy either fundamental biblical literalists or nonbelievers.

Miller's efforts to resolve the basic concern of many creationists that evolution eliminates morality were even less compelling. This was mainly because Miller's God, though a "personal" God in the Judeo-Christian tradition, somehow seems too remote to satisfy the immediate needs of literal creationists. In addition, the book did not address the humanist position — that a highly moral society can exist without positing a divine origin of morals or relying on threats of Hell.

Finally, and unfortunately, there was little attention paid to how evolution might be more effectively presented in the public schools — not to mention university classrooms. I had high hopes that Miller, a highly regarded biology lecturer and biology textbook author, would have some solid suggestions on this matter. Perhaps that will be the subject for his next book; I hope so.

In spite of my few disappointments with Miller's book, it does offer valuable and useful information for the interested reader, and especially for the biology teacher. It also offers interesting insights into a strategy for reconciling evolution and religious beliefs — an approach that teachers can offer students who may be having difficulties with doing so. I recommend *Finding Darwin's God* very highly.

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FINDING DARWIN'S GOD: A SCIENTIST'S SEARCH FOR COMMON GROUND BETWEEN GOD AND EVOLUTION

by Kenneth R Miller
New York: HarperCollins, 1999.
323 pages.

**Reviewed by Edward B Davis,
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The first American Darwinian, Harvard botanist Asa Gray, was also an outspoken defender of the "compatibility" — that was the word he chose — of evolution and a very traditional type of Christian theism. Addressing the student body of the Yale Divinity School in 1880, he identified "the essential contents of that Christianity which is in my view as compatible with my evolutionary conceptions as with former scientific beliefs", as being "briefly summed up" in the Apostles' and Nicene Creeds, classic statements of faith used as touchstones of Christian orthodoxy since the 4th century (Gray 1880: 108-9). When about 45 years later in the mid-1920s Princeton embryologist Edwin Grant Conklin, himself once a traditional Christian, lectured a Philadelphia audience on "The Religion of Science", he identified the essential contents of his faith quite differently by denying a personal God, miracles, supernatural revelation, personal immortality, and the efficacy of prayer.

Since the early years of the 20th century, American scientists have followed Conklin more often than Gray when interpreting the religious significance of science — at least privately if not also when writing and speaking to popular audiences, the primary mode of discourse for conversations of this

kind. Public statements are often much less contentious and far more nebulous, affirming either the broad congruence or (more commonly) the complete independence of two undefined entities called "science" and "religion". Thus it is interesting in itself when an excellent scientist, a professor of biology at Brown University and coauthor of leading high school and college textbooks, writes a book for the general public that not only affirms vague "common ground between God and evolution" (his subtitle), but goes on to argue specifically that "evolution is the key to understanding our relationship with God" (p 291).

This claim arises out of Miller's analysis of a long-standing theological problem based in mechanistic science: if all events in the universe are determined by unbreakable laws, then how can God or human beings have genuine freedom to make genuine choices? Although I refer to this as a theological problem (which it is), it is also a deep philosophical problem that confronts atheists no less than theists: if (as Jacques Loeb, Clarence Darrow, and others have claimed) an impersonal universe is completely deterministic, then how can persons act freely and responsibly within it? Indeed, how can they be "persons" at all? (The chilling consequences of linking psychological determinism with evolution are well illustrated for Darrow's case by Larson [1997: 70-1]).

Miller finds his answer in such places as the contingency of evolution and the randomness of quantum events, both of which point (in his opinion) to a God who endowed the creation, including human beings, with genuine autonomy and freedom. Miller's interpretation of contingency (correctly) contradicts that of Michael Shermer (2000, ch 10), who somehow imagines that the contingency of human existence poses a serious problem for theology. "A biologically static world", Miller tells us, "would leave a Creator's creatures with neither freedom nor the independence required to exercise that freedom. In biological terms, evolution is the only way a Creator could have made us the creatures we are — free beings in a world of authentic and meaningful moral and spiritual

choices" (p 291). Citing the final paragraph in the 6th edition of the *Origin of Species*, where Darwin refers to life "having been originally breathed by the Creator into a few forms or into one", Miller glibly concludes, "I believe in Darwin's God" (p 292). The complex question of the evolution of Darwin's religious views from theism to agnosticism cannot be examined here, but Miller's implicit attribution of his own type of theism to Darwin is highly questionable.

Now Miller is a Roman Catholic, and Catholics have for many centuries emphasized the need for sinners to cooperate with God in order to obtain salvation; in other words, free persons can accept, resist, or reject God's grace. The agreement between this traditional theological point of view and Miller's interpretation of evolution as required for human freedom leads me to call this a Catholic book, but its appeal may be more catholic (in the sense of being universal), since most contemporary Protestants no longer think of God in quite the same way as did Martin Luther or John Calvin, who understood divine sovereignty to extend even to choosing, before the foundation of the world, exactly who would be saved and who would be lost. Indeed, the "free-will defense" is a popular answer to the problems that the existence of suffering poses for theism, and this has often been linked with belief in an evolving creation.

The significance of Miller's book, then, arises less from what it says — which, though important and potentially helpful to many, is not as deep as some other books making similar claims — than from who is saying it, and to whom. When Miller tells his students (as he does) that he actually believes in the traditional Christian God himself, and that his belief is actually reinforced (rather than challenged) by evolution, he is (as he notes) defying their expectations of a biologist at a major research university. And those expectations reflect a highly polarized American conversation about evolution and religion, a polarization that is only encouraged by the rhetoric of two genuinely opposing camps, about whom Miller writes four of his nine



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chapters. With each camp Miller associates a certain view of God.

Varieties of anti-evolutionism fall under the heads "God the charlatan" — a reference to the young-earth creationist view that God made the world with apparent age; "God the magician" — on Phillip Johnson's implicit position that a "great designer" God made many types of animals by "magical" acts of special creation; and "God the mechanic" — against Michael Behe's claim that the "irreducible complexity" of certain cells cannot be explained by natural selection alone, but had to be assembled directly by a divine mechanic. In these three chapters, Miller deftly confronts claims about the inadequacy of Darwinian evolution as an explanation of life's history, and for many *RNCSE* readers, this part of the book will get the heaviest use.

But what he says in the chapter on "the Gods of disbelief" is no less important, for it provides a large part of the relevant context for understanding why anti-evolutionism remains so prevalent today. Breaking ranks with some of his professional colleagues, Miller shows how scientists and philosophers such as Douglas Futuyma, Richard Dawkins, William Provine, Daniel Dennett, Edward Wilson, and Richard Lewontin have used evolution to promote an atheistic worldview, and he calls attention to the way in which a highly secular professorate has arrogantly assumed that "religious belief is something that people grow out of as they become educated", so that there is "a fabric of disbelief enclosing the academic establishment" (p 184-5).

This in my view goes right to the heart of the matter. Ironically, Phillip Johnson would undoubtedly agree with Miller on this very point. Yet here we find a greater irony that also goes to the heart of the matter: This is a very good book, despite some historical errors and misconceptions that I lack space to enumerate — a book that I would really want to use with (say) an advanced biology class of high school juniors or seniors (assuming I taught such a class), for they would learn some things about the nature of scientific reasoning and its limits which cannot be taught effectively with traditional text-

books. They might actually get the point that science is not done in a cultural vacuum and the really crucial point (which eludes several of the scientists named above) that highly competent scientists simply do not agree on how to interpret science metaphysically. Yet I would probably not be allowed to use it in a public school — at least not the final 3 chapters on evolution and religion, arguably the best part of the book. I say "probably", because although it might perhaps be permissible within current legal precedent to use all of this book in a public school, I doubt that most school districts would allow it, given typical policies toward such things as singing Christmas carols and reading religious texts. Until we recognize that secular education as widely practiced is not in fact neutral toward religion, then creationist families will have legitimate reasons to oppose the teaching of evolution, and books like Miller's that deal constructively and effectively with interpretive issues that scientists themselves have raised will remain on a functional equivalent of the Index of Prohibited Books.

[Excerpt of unpublished manuscript by Edwin Grant Conklin printed with permission of the Princeton University Library.]

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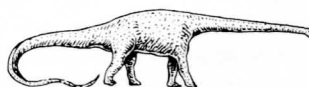
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CAN A DARWINIAN BE A CHRISTIAN? THE RELATIONSHIP BETWEEN SCIENCE AND RELIGION

By Michael Ruse
New York: Cambridge University Press, 2001. 242 pages.

Reviewed by John F Haught

Few scholars have written more voluminously and more interestingly about Charles Darwin than the philosopher Michael Ruse. For many years a professor at Guelph University and now at Florida State, Ruse continues to produce a steady flow of books and articles on the implications of Darwin's revolution. He was an expert witness at the famous Arkansas creationism trial and for many years has been a delightfully irrepressible presence at gatherings of scholars interested in the relationship of science and religion. A professed agnostic, he remains fascinated by religion and is always willing to engage in dialog — in good humor and without an ounce of condescension — with theologians whom he is quite happy to call his friends.

Ruse may be the only living human who could write a book as unusual as this one. In *Can a Darwinian Be a Christian?* he wants us to understand, as always, that he remains not only an agnostic, but a materialist and reductionist to boot. As far as he is concerned, the existence of life and its diversity can be explained quite adequately in purely naturalist and even materialist terms. There is no need to invoke the idea of God. And yet, as he argues here in a series of chapters on various doctrines of Christian faith, it is not unreasonable or silly for Darwinians to be prayerful Christians as well. As a matter of fact, a lot of them have been, and apparently without experiencing any inconsistency. Ruse points out, for example, that among the "top ten" evolutionists since Darwin we will find such ardent Christians as Theodosius Dobzhansky and Ronald Fisher. And

John F Haught, author of *God after Darwin* (Boulder [CO]: Westview, 2000), teaches theology at Georgetown University, in Washington DC.

This book is far from a dispassionate account by a professional historian. Rather, the author, currently completing a PhD in biology at the University of Illinois, is producing in line with the "Wedge" strategy of the group of "intelligent design" theorists associated in various ways with the Discovery Institute's Center for the Renewal of Science and Culture. This group is led by Phillip Johnson, and includes Michael Behe, William Dembski, and Stephen Meyer, all of whom have lauded the book on its dust cover. According to Johnson, Hunter brilliantly argues that Darwinism is a mixture of metaphysical dogma and biased scientific

Reviewed by Donald Nield

By Cornelius G Hunter
Grand Rapids (MI): Brazos Press,
2001. 192 pages.

DARWIN'S GOD: EVOLUTION AND THE PROBLEM OF EVIL

[Originally published in *Commonweal* 2001 Mar 9 and reprinted with permission. Copyright © 2001, Commonweal Foundation. For subscriptions, call toll-free: 1-888-495-6755]

He is certainly aware of this distinction, but he does not always seem as willing as one would expect in a book of this nature to let Darwinism, as science, slip out of the materialist clothing it has often worn. Ruse is entirely correct in rebuking Plantinga for insisting that methodological naturalism inevitably leads us down the slippery slope to metaphysical materialism. But by referring to Darwinism as a "materialistic theory" he only adds credibility to Plantinga's spurious claim. Apart from this puzzling inconsistency, Ruse's fine book contributes significantly to the contemporary dialogue of science and religion. Filled with useful information and sparkling wit, it will provide scientists, theologians, and lay readers the opportunity to think in fresh ways about God, Christianity, and evolution.

The author's own philosophical stance has itself evolved somewhat over the last decade or so. He seems to have pulled back from the debunking of ethics and religion that he had earlier expressed in an often-cited joint essay with sociobiologist EO Wilson. Arguing that our genes have led us to devise beliefs conducive to good behavior and hence to the survival of our genes, they had exclaimed that "the way our biology enforces its ends is by making us think that there is an objective higher moral code, to which we are all subject." Although Wilson would continue to view Darwinism as a definitive demonstration of the illusory character of our most cherished beliefs, Ruse would not. Distancing himself significantly from Wilson, he now advances the more temperate view that "not all explanations of why or how we got to believe things are necessarily such as to debunk the veracity of the belief systems." Ruse is good to see him say it so explicitly here.

And yet a major difficulty carries over. The author continues, at least verbally if not intentionally, to fuse Darwinian science with philosophical materialism. Thoughtful believers, and not just the academically embattled defenders of "intelligent design", will find such an alloy logically incompatible with any genuinely religious sense of God. As long as Darwinism is taken to be as ineradicably materialistic as it appears to Ruse, it will remain logically irreconcilable with Christianity. Only if Darwinian science can be more carefully distinguished from materialist ideology can a Darwinian be a Christian.

Such a distinction was difficult even for Darwin to make, and it seems no less the case with many of his disciples. It is almost habitual for some Darwinians to refer to evolution as a "materialist" theory. Ruse refers to the "naturalistic philosophy" that underlies evolutionary science, by which he means, unconsciously, that evolution is subject to laws of nature. But then, much more provocatively, he goes on to say that Darwinism is "the apothecosis of a materialistic theory".

One would hope that Ruse means "methodologically materialistic" and not necessarily "metaphysical" and not necessarily "materialistic".

Among the Christian thinkers Ruse admires most is Ernan McMullin, a philosopher at the University of Notre Dame who has often argued that evolution is consistent with Saint Augustine's vision of a divine plan unfolding over the course of time from a seminal potential given in the creation of the world. Perhaps out of caution Ruse has decided to comment mostly on traditional interpretations such as "the Augustinian Option", and he avoids encounters with the many other more adventurous theological perspectives on evolution now available. He strategically steers away from processes theologically, for example, which long ago made peace with evolutionary biology. He is content to deal only with rather centrist theological understandings of Christian faith, and he finds that Darwin's ideas can live quite comfortably even in this setting.

Ruse, however, has little use for the work of another Notre Dame philosopher, Alvin Plantinga, who, along with Phillip Johnson, William Dembski, and other anti-Darwinian Christians, dismisses fundamental tenets of evolutionary biology as incompatible with "intelligent design". Ruse is telling the "intelligent design" theorists not to be afraid. Even an entrenched agnostic evolutionist can see how Darwin and Christianity may get along, so why cannot they?

Ruse still confesses that he agrees with the philosophical assumptions of Richard Dawkins and other evolutionary materialists. However, this may be hard to believe after reading such a sincere defense of classic Christian theology's logical compatibility with Darwinian science. The book's respectful and sympathetic treatment to Dawkins's own notorious tantrums about the stubborn persistence of theology in the face of all the Darwinian evidence against it. Although Ruse realizes that the most prominent Darwinians profess to be either agnostic or atheist, he argues here that it is not at all dishonest for scientifically educated people to embrace Christian faith and still be good Darwinians.



ic observation, that “at its core, evolution is about God, not science”. According to Behe, Hunter argues perceptively that the main supporting pole of the Darwinian tent has always been a theological assertion: “God wouldn’t have done it that way.”

In chapter 1, Hunter writes “Darwin’s concern with the problem of natural evil is apparent in his notebooks and in his published works” (p 14). However, Hunter does not document his claim, either here or elsewhere in his book. (In fact, Hunter gives very few direct quotations from Darwin, and almost all of these refer to scientific matters.) There is, however, one famous quotation from Darwin, that Hunter actually includes twice in his book — a quotation from a letter to Asa Gray (referred to via Stephen Jay Gould and David Hull), namely: “I cannot persuade myself that a beneficent and omnipotent God would have designedly created the Ichneumonidae with the express intention of their feeding within the living bodies of caterpillars.”

Chapters 2, 3, and 4, on comparative anatomy, small-scale evolution and the fossil record, respectively, follow a common pattern. Hunter gives an outline of evidence for evolution, then discusses the problems he sees with the evidence, and finally talks about metaphysical arguments.

In chapter 5, Hunter looks at the works of five evolutionists who saw fit to continue with Darwin’s long argument, namely Joseph Le Conte, HH Lane, Arthur W Lindsey, Sir Gavin de Beer, and Verne Grant. Hunter says that his survey shows that evolutionists who have attempted to prove their theory rigorously have routinely resorted to nonscientific claims. Hunter says that the arguments put forward in support of evolution “are either arguments for the mere plausibility of evolution or arguments against the doctrine of divine creation. Over and over we find arguments about why God wouldn’t have done it that way, which work only with a certain concept of God” (p 113).

In chapter 6, Hunter asks and answers the question, how did the evolutionists’ notion of God become so popular that it needed no justification? Hunter says that

the answer lies in the history of religious thought, and after discussing the ideas of Descartes, Burnet, Halley, Whiston and Leibniz, he points out that one’s view of evil is profoundly influenced by one’s view of God. Hunter next turns to the theodicies of Milton, the Cambridge Platonists, Leibniz, Grew and Hume (a theodicy is a defense of the attributes of God against objections resulting from the existence of physical and moral evil). These writers moved away from the view that God creates and controls the world and toward a view that God must be separated from evil, and Hunter argues that Darwin followed the same theodicies and just filled in the details.

In chapter 7, Hunter examines how the modern doctrine of God influenced early 19th-century thought and Darwin’s formulation of evolution. However, Hunter says remarkably little about Darwin, other than the quote from the letter to Asa Gray mentioned above. In the following chapter, Hunter gives a brief survey of divine sanction and intellectual necessity in evolutionary thought and how the acceptance of evolution has influenced our current metaphysics. Hunter gives another extract from a letter of Darwin to Asa Gray. With reference to a man killed by lightning and a gnat snapped up by a swallow, Darwin wrote; “If the death of neither man nor gnat are designed, I see no good reason to believe that their first birth or production should be necessarily designed.” Hunter says that it was reasonable for Darwin to argue that God would not be personally involved in the swallow’s attack on the gnat — not because of any finding of modern science but because of the persistence of Gnosticism into modern times, and given such a premise it was then reasonable to conclude that God is altogether removed from the world.

In a final chapter titled “Blind Presuppositionalism”, Hunter discusses theistic evolution as expounded by Theodosius Dobzhansky, BB Warfield, Terry Gray, Howard van Till, Kenneth Miller, and John Haught. We are told that “like Gray and van Till, Miller professes to be a Christian”, and “like Miller, Haught professes to be

a Christian” (p 170, 172). According to Hunter, all these people except Warfield “accept and even rely on the Darwinian type of metaphysical arguments against the view that a divine hand is active in creating and sustaining the world.” Hunter goes on to say:

Darwin ... believed that God could not be responsible for nature’s carnage and inefficiency, so he proposed a purely naturalistic explanation. Evolution was a theodicy, and keeping this in mind helps explain the different responses to evolution, including those critics such as Hodge and the theistic evolutionists. This perspective also helps explain how those who accept evolution wholeheartedly can be content with evidence that establishes merely the plausibility of evolution (p 173-4).

Hunter quotes a statement from the National Academy of Sciences that “No body of beliefs that has its origin in doctrinal material rather than scientific observation, interpretation and experimentation should be admissible as science in any science class”, and he concludes that on this criterion evolution should not be taught in science classes because it includes religious presuppositions outside of science. His final sentence is: “Ultimately, evolution is about God” (p 175).

The question now is whether Hunter has made his case or whether his book should be regarded as a revisionist reading of history in line with the “Wedge” doctrine of the “intelligent design” movement. There is no doubt that Darwin was concerned with the religious implications of evolution, but was he driven by religious considerations? To help to answer this question, I have studied the book *Charles Darwin and the Problem of Creation* by Neal C Gillespie (Chicago: University of Chicago Press, 1979). The author was Professor of History at Georgia State University. Hunter gives eight inconsequential references to Gillespie’s book, but does not seriously engage its ideas. Gillespie (p 135) wrote:



There can be no real doubt as to Darwin's theism during the years that he prepared for and wrote the *Origin*. Aside from the strong evidence in his writing, he tells us in his *Autobiography* that the need for postulating an intelligent First Cause as initiating the universe — a belief implied in the theological arguments in the *Origin* — “was strong in my mind about the time, as far as I can remember, when I wrote the *Origin of Species*.” When Dr Pusey seemed to accuse him of having written the *Origin* as an attack on religion and not as science, Darwin replied indignantly that Pusey was “mistaken in imagining that I wrote the *Origin* with any relation whatever to theology” (not exactly the case, as we have seen), and that “when I was collecting facts for the *Origin*, my belief in what is called a personal God was as firm as that of Dr Pusey himself.”

Theodicy is not listed in the index of Gillespie's book. In light of this, I find Hunter's thesis difficult to accept. Elsewhere (p 133) Gillespie notes that later in his life, in the passage that concludes *The Variation of Animals and Plants under Domestication*, Darwin presents us with the quandary that he himself never resolved: if God is omnipotent and omniscient then it is hard to see why he is not also irrational and even immoral in producing superfluous laws of nature and waste of life. “Thus we are brought face to face with a difficulty as insoluble as that of free will and predestination.” Darwin certainly recognized that his work involved the problem of theodicy, but that is completely different from Hunter's claim that it was consideration of theodicy that led Darwin to advance his theory of evolution.

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DEFENDING EVOLUTION: A GUIDE TO THE CREATION- EVOLUTION CONTROVERSY

By Brian J Alters and Sandra M Alters. Boston: Jones and Bartlett Publishers, 2001. 261 pages.

Reviewed by Eugenie C Scott
NCSE Executive Director

Defending Evolution will seem an odd title to many readers not familiar with anti-evolutionist activism. One would not title a book *Defending Gravitation* or *Defending Heliocentrism*, but, in North America, defending evolution is necessary because teachers are pressed either to downplay evolution or to introduce various forms of creationism. It is a struggle to keep evolution in state and local science education standards and, when publishers feel economic pressure to drop or reduce it, in textbooks. Although evolution is taught matter-of-factly at most four-year colleges and universities in the USA, there is evidence that anti-evolution pressure is increasing against faculty at community (two-year) colleges. *Defending Evolution* is therefore a timely book for teachers at both the secondary and postsecondary levels.

Brian Alters has joint appointments at McGill and Harvard schools of education, and heads the McGill Evolution Education Research Centre. Sandra Alters is a biologist and a writer of college-level biology textbooks. *Defending Evolution* reflects a constructivist approach, a teaching strategy recognizing that students' preconceptions and misconceptions need to be addressed before solid learning can take place. Too often a teacher merely temporarily overlays erroneous knowledge with accurate information, which is rapidly forgotten after the end of the class. A true change in student understanding will not take place unless students construct a new understanding for themselves by intellectually and sometimes even emotionally engaging new material in the context of the old ideas. Only then can they incorporate new views — ideally,

jettisoning incorrect information *en route*. By describing the worldview, motivations, and misconceptions of religiously conservative students, Alters and Alters help teachers to understand where such students are coming from, and suggest practical approaches to assist students to construct an understanding of evolution. They persuasively argue that student anti-evolutionism will not be solved just by piling on more scientific facts.

Conservative Christian students comprise a substantial proportion of American Christians, up to 30–35% according to most polls. Everything — including science — is filtered through the lens of Bible-based religion. This is quite a different world view than that of either less conservative religious people or secularists. In the USA, where the First Amendment demands neutrality towards religion in the public school classroom, teachers are obliged not to try to change students' religious views. However, it is legal and appropriate to inform students about other religious views and to illustrate how other religious filters can lead to other conclusions. Conservative Christian students rarely have been previously exposed to the range of Christian views on evolution; Alters and Alters present a useful taxonomy of these views, which can be used to broaden students' theological horizons. Students who learn that there is not a strict dichotomy between creationism and evolution find it easier to learn evolution — regardless of whether they come to accept it.

It is not surprising that students from biblically literalist traditions are anti-evolutionists, but even mainline Christian students — whose denominations do not hold literalist views and whose theology actually accepts evolution as the method used by God to create — may harbor anti-evolution views. “Study Bibles” and other religious materials used by both conservative and mainstream Christian students may be strongly anti-evolutionary; wisely, the authors recommend that teachers avoid Bible verse-slinging contests with literalist students, but they do suggest some lines of argument that could be presented to them.





Students cite not only religious reasons for rejecting evolution, but also scientific ones. Teachers are often baffled by these usually obscure "scientific evidences against evolution" ("evidences" in the plural being a term from Christian apologetics) and have difficulty finding the answers. *Defending Evolution* organizes responses to scientific and educational challenges encountered by teachers in "FAQ"-type chapters. Much information is presented succinctly, accompanied by references for additional information. Such "FAQs" and answers range over several areas, including the nature of science, the science of evolution, religion, and science education. They include Darwin's alleged deathbed confession, the creationist argument about the second law of thermodynamics as a supposed disproof of evolution, "what good is half a wing"-type design arguments, and many others. Explaining how scientists use the concepts of theory, fact, and proof is necessary to show that evolution is not "just a theory". *Defending Evolution* also takes on the critically important argument of why it actually is not "fair" to present "equal time for both views", as anti-evolutionists encourage.

Defending Evolution is an eminently useful reference. Keep it on your bookshelf: you will probably need it some day.

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EVOLUTION'S WORKSHOP: GOD AND SCIENCE ON THE GALÁPAGOS ISLANDS.

By Edward J Larson
New York: Basic Books, 2001. 302 pages.

Reviewed by Michael J Chapman
College of the Holy Cross

Evolutionists and clergymen are fallible; they perceive their data or their God as through a glass darkly; yet their pronouncements can change history. The Galápagos Islands have occupied a central position in history of evolutionary thought, but how were these uninhabited islands perceived by the first

Christians to visit them? Devout adherents to natural theology, 16th- and 17th-century Pacific explorers dithered over the presence of bizarre giant tortoises, marine iguanas and other animals on the Galápagos Islands; the animals must have traveled there from Noah's ark, but then how to explain their total absence in the Old World? Perhaps the Galápagos were an accursed place, or a purgatory for sinners. But when Charles Darwin visited the islands, he saw nature at work. Based largely on observations during his 1835 *Beagle* voyage, Darwin formulated his theory of evolution by natural selection — and sparked a conceptual revolution like no other, a revolution which shook the foundations of Christianity. And now, as no other historian has done, Edward Larson has delineated the history of the world-famous archipelago in both scientific and religious contexts.

Larson, who currently chairs the history department at the University of Georgia, is the 1998 recipient of the Pulitzer Prize in history. His works on the American creation-evolution controversy is well-known to *RNCSE* readers; *Evolution's Workshop* is his first work focused outside the continental United States. It is a thoroughly enjoyable read, filled with vivid descriptions of the Galápagos. These truly oceanic islands are volcanic outcroppings several hundred miles off the Ecuadorian coast, inhabited by outlandish creatures such as the famed giant tortoises (Galápagos is Spanish for "tortoises"), marine and land iguanas, and of course Darwin's finches.

The Galápagos tortoises, so far isolated from the mainland yet clearly unable to swim, were difficult to fit into classical European concepts of natural history prior to Darwin's time. William Paley's natural theology, the dominant paradigm of 19th-century European science, described all species as immutable creations of a munificent God, intended for beautification of the earth and for exploitation by man. Certainly the Galápagos, whose only edible fauna consisted of blue-footed boobies and the plug-ugly tortoises, were an embarrassment to God, or perhaps, as Herman Melville portrayed them, a penal colony for fallen souls.

In the chapter entitled "What Darwin Saw", Larson elegantly lays out the central questions posed by

the Galápagos and how they led Darwin to his theory of evolution by natural selection. Some such questions are as follows: If all species are immutable, intended for the service of mankind, why should God bother to put multiple varieties of finch, iguana, and so on, on uninhabited islands isolated hundreds of miles out to sea? Why should the many species of Galápagos finch, for example, bear clear anatomical relationships to mainland species, yet occur in a much wider variety of forms than on the mainland? And if Genesis is correct about the Noachian flood, how did the giant tortoises, helpless nonswimmers, ever arrive there? It turns out that the patterns of speciation on the Galápagos are repeated again and again on oceanic islands all over the world; ever since Darwin, considerable study has been devoted to the phenomenon of adaptive radiation in populations of plants and animals isolated on such islands.

In short, Darwin recognized that species are neither immutable nor particularly intended for anything other than propagation of their own offspring and that islands like the Galápagos are ideal places for the evolution of new species from isolated founder populations. On the mainland, there are many genera of birds filling all available niches: woodpeckers, thrushes, snail darters, and other birds compete with finches for food resources and nesting sites. But when an early founder population of finches arrived on the Galápagos, perhaps blown there by a storm, they found an absence of competition from other birds. Hence the finches were free to evolve large and sharp fruit-piercing beaks and tree-, shrub- and ground-nesting habits. The ensuing adaptive radiation led to the remarkable diversity noted by Darwin. Small wonder that on his return, he waited 20 years to publish the dangerous implications of his findings.

The world has never recovered from what Daniel Dennett called "Darwin's Dangerous Idea" and, understandably enough, Darwin's association with the Galápagos has eclipsed all others in the popular imagination. Yet Darwin's work inevitably drew others to the archipelago — David Porter of the United States Navy; Louis Agassiz, premier American naturalist of the 19th cen-

tury and founder of the Harvard Museum of Natural History; bizarre English plutocrat Lord Walter Rothschild, and multiple expeditions from the California Academy of Sciences (CAS) visited the Galápagos between the mid-19th and early 20th centuries. Larson deftly introduces us to each character in his turn. We learn that Agassiz, an adherent of natural theology, was obsessed with the islands as evidence against Darwin's theory of evolution and returned there on multiple expeditions, undeterred by failing health and mishaps including loss of all his specimens at sea. Rothschild and the CAS competed for the largest, most impressive collection of giant tortoises — the former brought an even gross of them to his estate at Tring Park, and ordered more and more expeditions to fill in "gaps" in his collection on learning of new acquisitions in California. The overall impression one is left with after reading these chapters is one of plunder — the philosophy of manifest destiny inspired the Californians to "stake their claim" in the Galápagos, and like Rothschild, they were determined to "save species for Science" even if it meant driving them to extinction in their native habitats. Accompanying photos document the backbreaking labor it took to move some of the last giant tortoises, many of which weighed a quarter ton, from their inland refuges down to the boats.

Predictably enough, the early 20th century did not bring with it a respite from plunder of the Galápagos fauna. Theodore Roosevelt inspired a generation of young men to adventurism and "taming of the wilderness"; some of these were tycoons such as Vincent Astor, Marshall Field, and Harrison Williams, who built a financial empire in the 1920s on the electrical power boom. Millionaires' yachts were converted to scientific collection vessels such as the *Noma*, which carried explorer William Beebe on a much-publicized expedition to the Galápagos in 1923. The *Noma* was equipped with specially heated tanks to house live specimens for the return trip; Beebe's collection went to the New York Zoological Society.

The turning point in human attitude towards the Galápagos seems to have come with World War II. The

United States established an airbase there, and bored GIs conducted iguana races and taunted the native goats; of even greater ecological impact were the mainland introduced species such as mice, which overran the island of Baltra. The presence of the military base, with its 1000 personnel, stimulated the economy of the local Ecuadorian colony and swelled the islands' human population; despite the wartime stimulus, however, the desperately poor settlers often needed to slaughter tortoises and other native fauna for food. The burgeoning science of ecology came to the rescue: following the war, ecologists such as Iranäus Eibl-Eibesfeldt and Robert Bowman visited the archipelago and publicly condemned the extinction of native species from Baltra and other islands.

The prominent British evolutionist Julian Huxley soon became involved in efforts to establish a permanent scientific research station on the Galápagos. His efforts within UNESCO (United Nations Educational, Scientific, and Cultural Organization) soon accomplished that goal, and the Charles Darwin Foundation for Galápagos Research was created in 1959, in time for the centennial of the publication of the *Origin of Species*. Ecuadorian officials had realized the archipelago's value as a tourist commodity and underwrote conservation efforts through the establishment of strict environmental laws in the resident human colony.

The latter half of the 20th century, thankfully, has seen some recovery in populations of endangered species on the larger islands: giant tortoises, for example, still reside in the highlands of Indefatigable, and one can see marine iguanas in the remote bays. Larson traces in detail scientific debates of this more recent period, such as the one between Bowman and ornithologist David Lack on the evolutionary basis for adaptive radiation in Darwin's finches: Lack held that interspecies competition had contributed to speciation, while Bowman stressed differences in food as the only necessary selective force. Canadian finch researchers Rosemary and Peter Grant later published results indicating somewhat of a middle ground: all finch populations exhibited selection for and against specific food types; however, the non-

random occurrence of particular combinations of species on certain islands strongly suggested interspecies competition.

Grant quoted geneticist JBS Haldane during a 1977 lecture as follows: "There are still a number of people who do not believe in the theory of evolution. Scientists believe in it, not because it is an attractive theory, but because it enables them to make predictions which come true." Of course creationists still see things differently, even on the Galápagos: Larson quotes a contributor to the *Creation Research Society Quarterly* as follows: "The birds are all still finches, and there is no evidence of change of the magnitude which macroevolution would require." Christian evolutionists such as David Lack and Alister Hardy labored to reconcile nonscientific believers with their discipline; for them, as Larson quotes Stephen Jay Gould, God and science were "non-overlapping magisteria". Darwin himself is quoted on God: "I feel most deeply that the whole subject is too profound for the human intellect. A dog might as well speculate on the mind of Newton. Let each man hope and believe what he can."

While the creation-evolution debate continues into the 21st century, both sides clearly value the archipelago for their own ends. Conservation efforts have been aided immeasurably by Ecuadorian national park status and publicity including visits by journalists Annie Dillard and Richard Atcheson. The present volume itself has helped to raise consciousness about the Galápagos, and preserve their flora and fauna for study by future generations.

In sum, Larson's book is a thorough, meticulously annotated history of what Loren Eiseley has called "actually the most famous islands in the world". This book will also engage the casual reader, particularly those interested in the science-religion dialog on human origins. This evolutionist accords *Evolution's Workshop* his highest recommendation.

[This review originally appeared on January 9, 2002, in Metanexus [VIEWS], hosted by Metanexus: The Online Forum on Religion and Science <<http://www.metanexus.net>>.]

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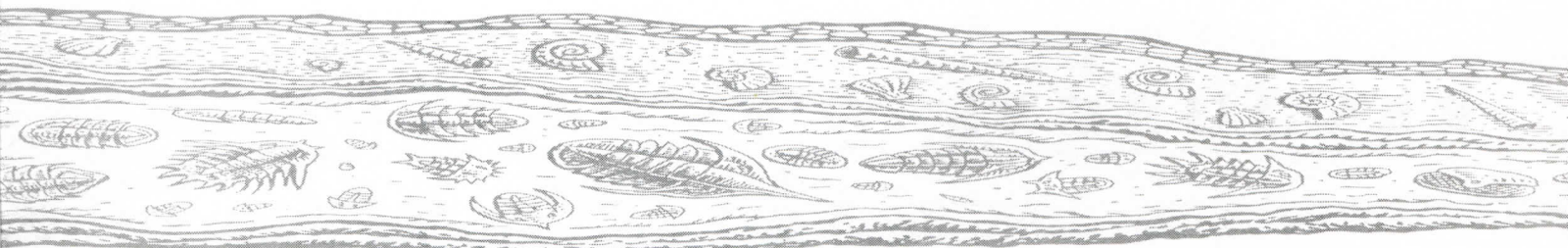
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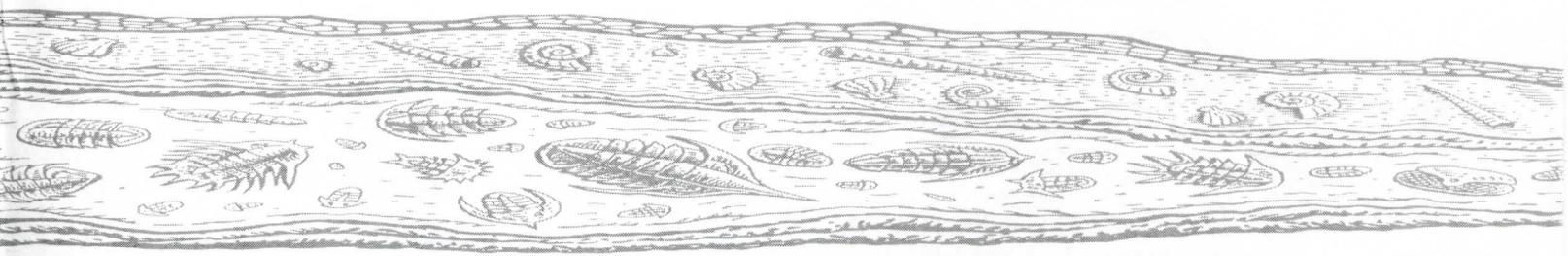
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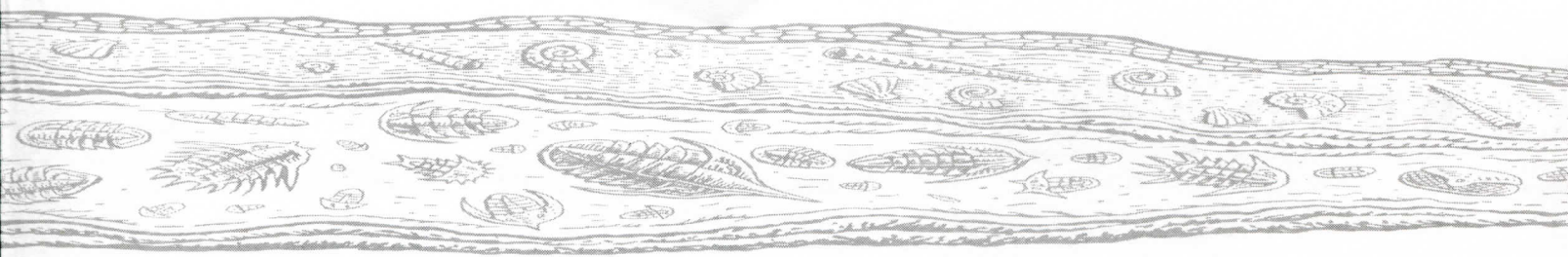
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Letters to the Editor

There appears to be a substantial gap between what the official voices of various religious traditions *say* they believe about evolution and what their congregants tell pollsters that *they* believe. NCSE's *Voices for Evolution* (Matsumura 1995, or <<http://www.ncseweb.org/voicindex.htm>>) contains numerous statements from Christian and Jewish religious traditions that accept the truth of evolution. Even though these denominations all recognize the validity of the Bible's first book, Genesis, the great majority of denominations in the US would also seem to support sound science education — including evolution.

In light of this widespread official acceptance of evolution, one might assume that the opposition comes from a small, but highly vocal, minority. However, a number of surveys suggest that anti-evolution sentiments are far more widespread. For example, Wilson reports that 55% of his students believe that Adam and Eve were the first humans and that another 14% say they are unsure (RNCSE 2001; 21 [1-2]: 9-13).

The disagreement between what these religious denominations *say* about the compatibility of their doctrines with evolution and what many of their congregants *say they* believe about evolution suggests another area where better education is needed. Organizations like NCSE that support good science education need to help these communities to instruct their members about evolution and the nature of science in the context of their denominations' view about the nature and meaning of scripture. To be effective, it would also be helpful for supporters of evolution to learn more about the interpretation of scripture in different denominations and faith traditions and how it relates to evolution.

The current scholarly consensus is that the Pentateuch (the first five books of the Bible) was formalized from earlier forms and sources around the 5th century BCE. Most scholars agree that the text shows evidence of multiple authorship, as evidenced in differences in terminology, imagery, and emphasis and by technical and factual inconsistencies among and within specific accounts. For example, there are two stories of the creation, one after the other, that differ in style and emphasis, and in details about the order of appearance of plants, animals, and humans. In the cases of the Noachian flood, it is interesting that there are two flood stories that appear to be interwoven.

Many denominations understand that the purpose of the Scripture was to provide a moral and cultural narrative for a particular faith community as a way to reinforce social values and to support the moral code. In this view, the value, authenticity, and even *truth* of the text does not lie in its historic (or scientific) accuracy. For most clergy in the US, this view of Scripture is not news, but still close to half the respondents in polls place their religious beliefs in opposition to evolution. Opposition to teaching evolution might decline significantly if religious and scientific organizations worked together to educate congregations about the Bible and its real meaning for understanding the natural world.

Peter Kane
Rushville NY

In Molleen Matsumura's piece "Answers to Ten Common Questions" (RNCSE 2001; 21 [3-4]: 23), she addresses the question "Isn't it true that by teaching 'survival of the fittest' evolution is used

to justify cruelty?" Although I have no argument with what she wrote, she does not answer the question!

Herbert Spencer (*Principles of Biology*, 1864) coined the phrase "survival of the fittest", and Darwin accepted it uncritically in chapter 4 of later editions of *On the Origin of Species by Means of Natural Selection*. The epithet containing the superlative form "fittest" became a slogan, although the whole basis of evolution by natural selection is comparative, that is, the survival of, or better reproduction by, the *fitter*. Darwin got it right first time, but changed, for example, "This principle of preservation, I have called, for the sake of brevity, Natural Selection" (1st edition, 1859) to "This principle of preservation, or the survival of the fittest, I have called Natural Selection".

It is important to remember that an individual could be the fittest only in a particular space and time; move a meter away or wait ten minutes, and a different individual could well be the fittest. When introducing the concept of survival of the fittest, Spencer himself gave a fine example of the distribution of fitness characters among individuals. "...a healthy existence cannot be secured by a large endowment of some one power, but demands many powers. ... As fast as these faculties are multiplied, so fast does it become possible for the *several members* [my italics] of a species to have various kinds of superiorities over one another. While one saves its life by higher speed, another does the like by clearer vision, another by keen scent, another by quick hearing. ...". Clearly this is an argument based on the comparative and not the superlative.

If we need an epithet, let us use "survival of the fitter". I repeat: Darwin got it right first time!

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NEWS

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OWNER	NCSE
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LAST VISIT	March 19, 2002
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OWNER	Cleveland <i>Plain Dealer</i>
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TOPIC	Echoes of Oz?
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TOPIC	Farewell to the Santorum Amendment?
OWNER	US House of Representatives
LOCATION	< http://edworkforce.house.gov/issues/107th/education/nclb/conference/stateofman/title1pa.htm >
LAST VISIT	March 19, 2002
TOPIC	Updates (Washington)
OWNER	Washington State Legislature
LOCATION	< http://www.leg.wa.gov/pub/billinfo/2001-02/Senate/6500-6524/6500_01182002.txt >
LAST VISIT	March 19, 2002

FEATURES

TOPIC	Michael Behe on NPR
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Kuban GJ. Sea-monster or shark? An analysis of a supposed plesiosaur carcass netted in 1977. 1997; Available from <<http://members.aol.com/paluxy2/plesios.htm>>. Last accessed March 28, 1997.

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Waters IC, Rivers HI, and others. Swept away in a flood of enthusiasm [editorial]. *Reports of the National Center for Science Education* 1995 Jan-Feb; 1015 (1): 22-9.

Zubrow E. *Archaeoastronomy*. Orlando (FL): Academic Press, 1985.

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