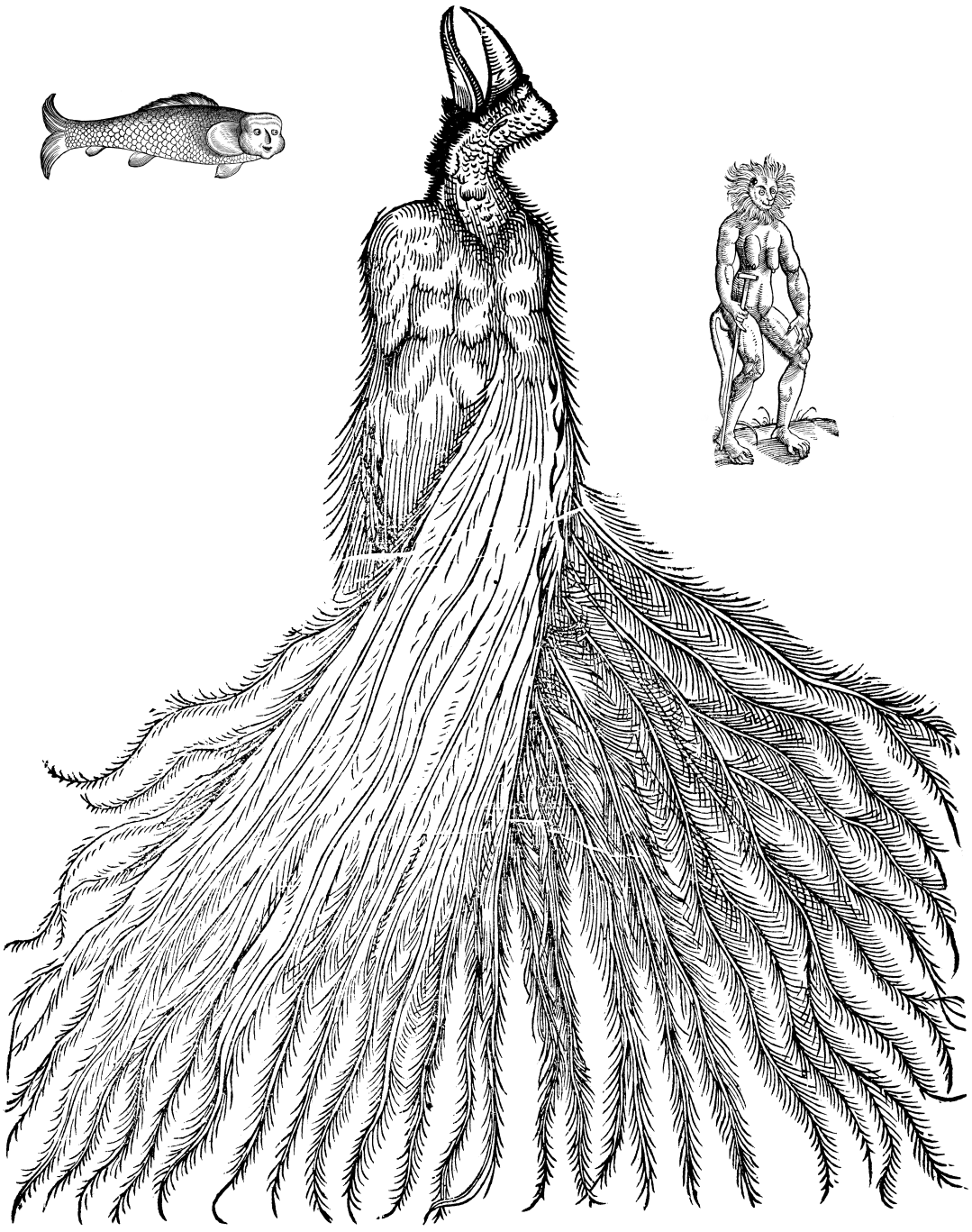
REPORTS OF THE NATIONAL CENTER FOR SCIENCE EDUCATION

DEFENDING THE TEACHING OF EVOLUTION IN THE PUBLIC SCHOOLS

Volume 25, Numbers 3-4 **MAY-AUG, 2005**

CONTINUES *NCSE REPORTS* & *CREATION/EVOLUTION*



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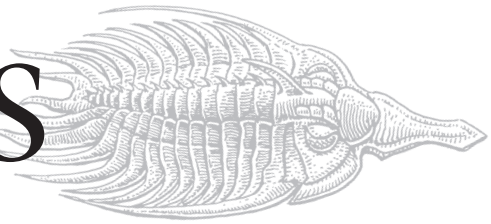

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Cover: Sixteenth-century woodcuts from Konrad Gesner's *Historia Animalium*.

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For more information on Ray's work explore his website at <www.trollart.com>.

One of the main pillars of our understanding of the history and diversity of life is that evolutionary change is both caused and recorded by genetic change. It is perhaps a truism that everything about living things is related in some way to their genes. As natural selection acts, some individuals succeed in passing on their genes to future generations, and others do not. As a result, the "gene pool" in subsequent generations is altered by this differential success.

However, it is often a significant challenge to connect specific genes with specific selective advantages, especially for complex traits. Therefore, it should come as no surprise that a research focus meant to elucidate the genetic underpinning of the evolution of behavior would be the subject of quite a bit of disagreement.

The still-maturing field of evolutionary psychology (EP) is based on a reasonable premise — that behaviors can have selective consequences, and thus it is likely that the genetic basis of behavior is subject to the same selective pressures as that of any tangible biological feature.

In this issue, we present several features that explore the implications of evolutionary psychology for our understanding of behavior and its importance to evolutionary studies. David Barash shows how EP models help us to understand common tendencies in human behavior, even if we do not like or condone them. While James Miles agrees with the basic premise, he is concerned that EP theorists stop short of the logical outcome of their studies with respect to the evolution of behavior. And finally, Douglas Allchin explores the ways in which the evolutionary study of behavior might give clues to what we humans regard as "moral behavior" — that one aspect of humanity that creationists often claim cannot be a product of evolution by natural selection. In our members' pages, we excerpt a classic NCSE brochure penned by Bill Thwaites, "Would We All Behave Like Animals?", which looks at what our evolutionary roots mean for modern behavior and morality.

The other main theme in our features section revolves around recent statements by President Bush on science, including his recent call to include "intelligent design" in public school classes. A commentary reprinted from *Indian Country Today* worries about the impact on science of this administration's policies. Other commentaries in this section show how important evolution is for biotechnology, vaccine development, and control and prevention of disease.

IN THE NEWS

To the surprise of many, things are heating up in California. Creationists are suing the state university system over its refusal to recognize certain texts and instructional materials as valid for the preparation of students for higher education. And a small town in northern California celebrates the work of pseudoarchaeologist Carl Baugh.

Marshall Berman and David Thomas report the outcome of an attempt by "intelligent design" advocates in New Mexico to re-interpret the actions of the committee reviewing science educations standards. In a cunning move, these proponents tried to get their interpretation of the board's actions read into the record. These efforts were rebuffed, but this did not stop "intelligent design" advocates from around the country from declaring victory anyway.

And Utah is the site of an on-again–off-again effort by a state legislator to introduce a bill requiring "divine design". At press time, the bill was introduced and approved by committee. We also present updates from events in California, Idaho, Indiana, Michigan, Pennsylvania, and Texas. And the plaintiffs triumphed in *Kitzmiller v Dover*!

IN PRINT

Look to our book reviews section for an assessment of a variety of interesting publications. Two new books that combine wide-ranging ideas and materials into unique pseudoscientific conglomerations are Giuseppe Sermonti's *Why is a Fly Not a Horse?* and the late Vine Deloria Jr's *Evolution, Creationism, and Other Modern Myths.* Sermonti is a current darling of the "intelligent design" crowd, while Deloria was popular among a variety of intellectuals and public officials.

Norman Johnson reviews *Speciation* by Jerry Coyne and Allen Orr. It may be slow going, but Johnson says that the book is worth the effort to be brought up to date on the history and current status of models of speciation.

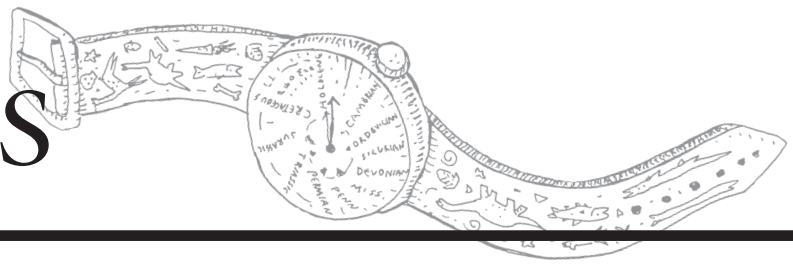
Robert Park reviews Chris Mooney's *The Republican War on Science*. It is not just scientific illiteracy, but an intentional disregard for science that should concern us, Park says.

Francis Beckwith's *Law, Darwinism, and Public Education* is another in a recent string of books trying to shift the First Amendment debate over "alternatives to evolution" in science education to allow for "intelligent design". Reviewers Todd Mollan, Bradley Consentino, and Jason Williams write that Beckwith only succeeds by redefining key terms and concepts in non-standard ways.

All this and more ... in this issue of *RNCSE*.

RNCSE 25 (3-4) was printed in February 2006.

NEWS



New Mexico's Science Standards Do not Support the Concept of "Teach the Controversy"

Marshall Berman and David E Thomas

On August 21, 2005, *The New York Times* published an article entitled "Politicized scholars put evolution on the defensive." This otherwise excellent article unfortunately contained several errors that resulted from treating some false information from the Discovery Institute as accurate. One major error was accepting the claim that New Mexico has "embraced the institute's 'teach the controversy' approach." This is absolutely false, as the following evidence will show.

New Mexico Standards Development Process and History

New Mexico's Public Education Department states on its website (<http://www.nmlites.org/standards/science/index.html>), "The Science Standards, Benchmarks, and Performance Standards revision process began in 2002. Writing teams consisting of educators and scientists developed draft standards, which were reviewed by teachers, scientists, parents, and other community members; over 200 responses were received during the review process."

Marshall Berman is founder of New Mexico's Coalition for Excellence in Science and Math Education and a former member of the New Mexico state Board of Education. David E Thomas is president of New Mexicans for Science and Reason.

On August 28, 2003, the New Mexico State Board of Education unanimously (13–0) approved a new set of public school science standards that had been strongly supported by scientists, science teachers, the New Mexico Conference of Churches, and dozens of other state and national organizations (see *RNCSE* 2003 Sep–Dec; 23 [5–6]: 9–12).

New Mexico Intelligent Design Network Intervention and Distortion

The evolution portions of these standards had been opposed by the New Mexico Intelligent Design Network (IDnet–NM; <http://www.nmidnet.org/>) for many months, and they continued to propose massive wording changes right up to the day of the vote.

Four days before this vote, on August 24, IDnet–NM capped months of intense lobbying of state education officials by publishing a full-page ad (<http://www.nmidnet.org/IDNet.pdf>) in the Sunday *Albuquerque Journal*, saying that "the goal of completely objective language has not yet been met," and pleading for people to get involved.

What was the "objective language" that "intelligent design" promoters wanted? IDnet–NM posted a document on its website in the summer of 2003, entitled "IDnet–NM Proposal for Alternative and Added Language to the 2003 Field Review Draft Science Standards, dated May 27, 2003, Submitted to the individual members of the New Mexico State Board of Education, July 21, 2003."

In the proposal, IDnet–NM objected to the following draft standard as being "dogmatic":

> Examine the data and observations supporting the conclusion that one-celled organisms evolved into increasingly complex multi-cellular organisms.

IDnet–NM formally asked the State Board to replace that statement with this one:

> Evaluate the data and observations that *bear on the claim* that one-celled organisms evolved into increasingly complex multi-cellular organisms.

And what was finally adopted? Here's the statement the State Board approved 13–0 on August 28, 2003:

> Understand the data, observations, and logic supporting the conclusion that species today evolved from earlier, distinctly different species, originating from the ancestral one-celled organisms.

There were sixteen other changes proposed by IDnet–NM, and *none* of those was accepted by the Board of Education. IDnet–NM's plea to the board to delete the phrase "Explain how natural selection favors individuals who are better able to survive, reproduce, and leave offspring" was denied, as were all the rest of their suggestions. (For details, see the article "Do NM's science standards embrace intelligent design?" available on-line at <http://www.nmsr.org/embrace.htm>.)

However, just prior to the board vote, and to the shock and dismay of most of the audience and the board, Joe Renick, executive director of IDnet–NM, used his final opportunity for public comment to try to trick the Department of Education staff — Steven Sanchez and Sharon Dogruel in particular — into expressing support for his views and to try to "place on the record" his false interpretation of the board's support for the standards. This display of arrogance and disregard for the staff and the board was halted by board member Flora Sanchez. As reported by

IT'S OVER IN DOVER

The decision in *Kitzmiller v Dover* was issued on Tuesday, December 20, 2005, and the plaintiffs triumphed. In his 139-page decision, Judge John E. Jones III concluded, "The proper application of both the endorsement and Lemon tests to the facts of this case makes it abundantly clear that the Board's ID Policy violates the Establishment Clause. In making this determination, we have addressed the seminal question of whether ID is science. We have concluded that it is not, and moreover that ID cannot uncouple itself from its creationist, and thus religious, antecedents."

The Associated Press reports (December 20, 2005) that Pepper Hamilton's Eric Rothschild, the lead attorney for the families who challenged the Dover Area School Board's "intelligent design" policy, described the ruling as "a real vindication for the parents who had the courage to stand up and say there was something wrong in their school district." NCSE agrees, and congratulates the plaintiffs and their lawyers from Pepper Hamilton, the ACLU of Pennsylvania, and Americans United for Separation of Church and State, for their well-deserved victory. Expect further details of the tremendous victory in future issues of *RNCSE*.

For the Associated Press story (via CNN), visit: <http://www.cnn.com/2005/LAW/12/20/intelligent.design.ap/index.html>.

For Judge Jones's decision (139-page PDF), visit: <http://www2.ncseweb.org/kvd/main_docs/kitzmiller_342.pdf>.

And for NCSE's collection of information on *Kitzmiller v Dover*, visit: <http://www.ncseweb. org/kitzmiller>.

Diana Heil of the *Santa Fe New Mexican* (2003 Aug 29), "Board member Flora Sanchez put a stop to mixed messages, though. She clarified this point:The state is not asking teachers to present all the alternatives to evolution and 'put them on an equal footing.'"

Renick then reversed himself. The *Albuquerque Journal* reported (2003 Aug 29): "Joe Renick, executive director of the New Mexico branch of the Intelligent Design Network Inc, on Thursday reversed course and recommended that the board adopt the science standards without changing the language on evolution. 'All we wanted to do was have an opportunity to state our concerns,' Renick said after the board vote."

The IDnet–NM "intelligent design" strategy then metamorphosed into a different public relations approach to turn their defeat into victory.Two other members of IDnet–NM, Rebecca Keller and Michael Kent, wrote a letter to the *Albuquerque Journal* (2003 Sep 4) extolling the standards, but inserting once again their distorted view of what the standards say: "There must be an opportunity to analyze the data critically from an open philosophical view.This is an area where it is necessary to present the evidence and the arguments for and against, and let the students decide for themselves what to believe."

Renick then further advanced this propaganda in a piece for the the website of the Center for Reclaiming America, which describes itself as a project of D James Kennedy's Coral Ridge Ministries which enables Christians "to defend and implement the Biblical principles on which our country was founded" (<http://www.reclaimamerica.org/pages/NEWS/newspage.asp?story=1416>). Disregarding the actual text in the standards, Renick bragged about his success, and considered his rude interrogation as "for-the-record" support for his misrepresenting the standards.The article reported:

> While much language in the standards was not changed, an important caveat was added which stated in part, " ... these standards do not present scientific theory as absolute. ...
>
> Further, "for-the-record" questions posed by ID-net confirmed that the SDE's [State Department of Education] intent for the new standards was that (1) evolution would not be taught as absolute fact and (2) teachers would be allowed to discuss problems with evolution.
>
> Renick's final evaluation of the situation: "If there is ever a dispute over intent and meaning of the Standards in the area of biological evolution, these policy statements may be referenced for clarification ... [and] will essentially neutralize the impact of the remaining dogmatic language.

WHAT THE STANDARDS ACTUALLY SAY ABOUT EVOLUTION

Here is the only portion of the New Mexico standards (available on-line at <http://www.nmlites.org/standards/science/index.html>) directly relevant to this issue:

> Strand III, Content Standard V-A, Benchmark 9–12.16:
>
> "[Students shall] [u]nderstand that reasonable people may disagree about some issues that are of interest to both science and religion (e.g., the origin of life on earth, the cause of the big bang, the future of earth)."

Even the word "controversy" does not appear anywhere in the standards.

Here are some of the other standards related to evolution:

> K-4 Benchmark II: Know that living things have similarities and differences and that living things change over time.
>
> 5-8 Benchmark II: Understand how traits are passed from one generation to the next and how species evolve.
>
> 9-12 Benchmark II: Understand the genetic basis for inheritance and the basic concepts of biological evolution.

and:

> Strand II, Standard II, 5–8 Benchmark II:
>
> **Biological Evolution**
>
> 7. Describe how typical traits may change from generation to generation due to environmental influences (e.g., color of skin, shape of eyes, camouflage, shape of beak).

8. Explain that diversity within a species is developed by gradual changes over many generations.

9. Know that organisms can acquire unique characteristics through naturally occurring genetic variations.

10. Identify adaptations that favor the survival of organisms in their environments (e.g., camouflage, shape of beak).

11. Understand the process of natural selection.

12. Explain how species adapt to changes in the environment or become extinct and that extinction of species is common in the history of living things.

13. Know that the fossil record documents the appearance, diversification, and extinction of many life forms.

and:

Strand II, Standard II, 9–12 Benchmark I:

Biodiversity

8. Understand and explain the hierarchical classification scheme (i.e., domain, kingdom, phylum, class, order, family, genus, species), including:

classification of an organism into a category

similarity inferred from molecular structure (DNA) closely matching classification based on anatomical similarities

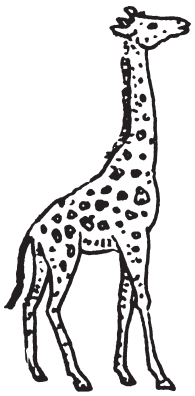
similarities of organisms reflecting evolutionary relationships.

9. Understand variation within and among species, including:

mutations and genetic drift

factors affecting the survival of an organism

natural selection



and:

Strand II, Standard II, 9–12 Benchmark II:

Biological Evolution

8. Describe the evidence for the first appearance of life on Earth as one-celled organisms, over 3.5 billion years ago, and for the later appearance of a diversity of multicellular organisms over millions of years.

9. Critically analyze the data and observations supporting the conclusion that the species living on Earth today are related by descent from the ancestral one-celled organisms.

10. Understand the data, observations, and logic supporting the conclusion that species today evolved from earlier, distinctly different species, originating from the ancestral one-celled organisms.

11. Understand that evolution is a consequence of many factors, including the ability of organisms to reproduce, genetic variability, the effect of limited resources, and natural selection.

12. Explain how natural selection favors individuals who are better able to survive, reproduce, and leave offspring.

13. Analyze how evolution by natural selection and other mechanisms explains many phenomena including the fossil record of ancient life forms and similarities (both physical and molecular) among different species.

Benchmark 9 above may be (deliberately?) misinterpreted by suggesting that "critically analyze" means "criticize" or "reject", when in fact it is intended to have the students apply the scientific method. Both Benchmarks 9 and 10 include the phrase "supporting the conclusion", with no suggestion that the conclusion is not, in fact, well-supported. The phrase "critically analyze" appears several times in the standards on other topics ranging from technology and scientific knowledge to ecology. It appears to be misused only by the "intelligent design" movement with reference to evolution.

Renick's "for-the-record" Claim

So the standards themselves disprove the "intelligent design" propaganda. But the Center for Reclaiming America's article, which clearly relied on Renick, said that his "for-the-record" *cross-examination* "confirmed that the SDE's intent for the new standards was that (1) evolution would not be taught as absolute fact and (2) teachers would be allowed to discuss problems with evolution." His public attack was directed at two Education Department officials who managed and led the standards revision effort: Steven Sanchez and Sharon Dogruel. What do the victims of his interrogation say about this episode?

Steven Sanchez, former Director of Curriculum, Instruction, and Learning Technologies, notes:

> From the beginning of the development of these science standards to their adoption by the State Board of Education, we were guided by two principles. First, important content should be introduced in early grades and strengthened year after year, so that our students will be scientifically literate when they leave high school. Since evolution is the only accepted scientific theory of the history and unity of life on earth, it is unambiguously central to our life-science standards, beginning in middle school and with increasing sophistication in high school. Second, students should understand the process of scientific inquiry in addition to specific scientific content, so our standards require that students learn to use scientific thinking to develop questions, design and conduct experiments, analyze and evaluate results, make predictions, and communicate findings. In a classroom where those standards are met, students will understand that scientific methods produce scientific knowledge that is continually examined, validated, revised, or rejected, and they will understand the difference between scientific knowledge and other forms of knowledge.
>
> Mr Renick tried to use our scientific-inquiry standards to attack our life-science standards when he addressed the

Board of Education on the day of their final deliberations. However, the members of the New Mexico Board of Education saw science as a unified whole, not as a house divided against itself, and unanimously adopted the standards without modification or caveat.

Sharon Dogruel, Program Manager, Curriculum, Instruction and Learning Technologies, said:

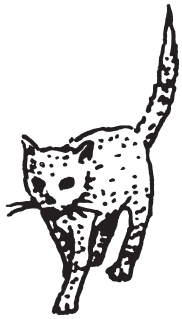
> Over 14 months, members of the science standards writing team worked diligently to craft standards in which science content, scientific thinking and methods, and societal and personal aspects of science were integrated into a coherent framework for exemplary science education. Members of this team considered all issues at great depth and, in the area of biological evolution, they were confident that the standards respected the backgrounds and beliefs of all students while remaining perfectly true to science. Based on the extensive development and thorough public review process completed for the science standards, coupled with the strong support from New Mexico teachers, and the praise and congratulations from numerous state and national science organizations, the team and the Department recommended that the New Mexico State Board adopt the standards without further modification.
>
> The board was poised for [its] final vote when Joe Renick attempted to distort the intention of the standards by suggesting that teachers had to treat evolution according to his own perspective. Using a tactic that focused on student inquiry, he tried to manipulate the meaning of scientific inquiry, as elaborated in the standards, into a discussion of a controversy that may be political, philosophical, or even religious, but is not scientific. The writing team was clear: There is no controversy regarding the principles of evolution as presented in the standards. Mr Renick's attempt to undermine the standards failed.
>
> I was appalled at this attempt to discredit the hard work of so many educators, scientists, parents, and the public, including Mr Renick's fellow members of [IDNet–NM]. Any statements that the New Mexico science standards open the door to "alternatives to evolution" or that science instruction in New Mexico should cast doubt on the principles of evolution are completely false. New Mexicans can be extremely proud of their science standards, and it is unfortunate that some people continue to advance misrepresentations at a time when we need support for strong science education.

It appears that Renick and the people he interrogated disagree about whether his comments reflected any reality in the standards. In our view, his behavior was boorish and his conclusions are disingenuous.

Official Public Education Department Clarifications

As the "intelligent design" advocates continued to misinterpret the standards and even conduct teacher workshops to promote this misinformation, the Public Education Department issued two memoranda to all the state's school districts, describing in no uncertain terms how the department interpreted the standards; in addition, Berman also received a third memorandum. Excerpts from these three memoranda, written by Richard Reif, science consultant for the department, follow:

> The Public Education Department requires all school districts to align their curricula to the New Mexico Science Content Standards, Benchmarks, and Performance Standards. Therefore, all science teachers in New Mexico should be teaching about evolution in the appropriate grades and courses, according to their districts' curricula.
>
> Further, because of the Establishment Clause in the First Amendment to the Constitution of the United States and a wide-reaching United States Supreme Court case, New Mexico public schools are not permitted to endorse a particular religion, teach religion, or teach "creation science" or any of its variations that advance the religious belief that a supernatural being created humankind.
>
> … Third, the state must remain neutral in matters pertaining to religion. In no way do the science standards support the teaching of notions of intelligent design or creation science or any of its variations.
>
> Fourth, fundamental to science and the New Mexico science standards is the role of inquiry in learning about the world.There is no place in science instruction for the teaching of notions that are not or have not been investigated through rigorous scientific means or that are not consider by the mainstream scientific community to be consistent with sound scientific inquiry.



So far, nothing that the "intelligent design" movement has produced meets the criteria of acceptance by mainstream science or is consistent with sound scientific inquiry.

Conclusion

The claim that New Mexico's science standards support the teaching of "intelligent design" or any other alternative "theory" to evolution, or encourages teachers "to present the "evidence and the arguments for and against" evolution, is baseless and false.

Nevertheless, this disingenuous and/or self-deluding misrepresentation has been widely circulated, including by the Discovery Institute, which has published similar claims on its website. These misrepresentations have infected such outlets as the *Washington Post*, which claimed (2005 Mar 13) that "Alabama and Georgia legislators recently introduced bills to allow teachers to challenge evolutionary theory in the classroom. Ohio, Minnesota, New Mexico and Ohio [*sic*] have approved new rules allowing that," and *The New York Times*.

New Mexico is not the only state to have been misrepresented in "Politicized scholars put evolution on the defensive" (*The New York Times* 2005 Aug 21), which (like the *Washington Post*'s article) claimed, "Ohio, New Mexico and Minnesota have embraced the institute's 'teach the controversy' approach. In Ohio, as Patricia Princehouse of Ohio Citizens for Science explained (*RNCSE* 2004 Jan/Feb; 24 [1]: 5–6), the problem was not primarily with the standards but with the "secret process ... used to build the model curriculum in 2003, incorporating creationist mischaracterization not only of the content, but also of the process of science itself." As for Minnesota, Glenn Branch of NCSE reports that on seeing the story, he alerted a public relations official in the Minnesota Department of Education, who promptly e-mailed the *Times* to request a correction with regard to his state.

A correction of sorts followed in the August 24, 2005, edition of the *Times*, reading: "The article also referred incorrectly to recent changes in science standards adopted by Ohio, Minnesota and New Mexico. While those states encourage critical analysis of evolution, they did not necessarily embrace the institute's 'teach the controversy' approach."

If there's anything to be learned from the saga, it's that claims from proponents of "intelligent design" ought to be taken, as we used to say in Latin class, *cum grano salis* — with a grain of salt.

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Carl Baugh ... Archaeologist?

Christopher O'Brien

As NCSE executive director Eugenie C Scott recently suggested in an article for *California Wild* ("In my backyard: Creationists and California", *California Wild* 58 [2]: 6–11), blue state California is not immune to creationist chicanery, particularly in the rural counties. In the northeastern California town of Susanville, I recently responded to articles appearing in the *Lassen County Times* highlighting a recent visit from none other than "Dr" Carl Baugh of the Creation Evidences Museum.

Although Baugh and others from the museum gave the usual creationist spiel to small partisan church audiences (and discussed Baugh's newest discovery: a "fossilized" human leg bone within a cowboy boot), the local paper focused less on creationism than on Baugh's 2004 expedition to the Holy Land. Baugh's group, including two local Susanville residents, reportedly conducted excavations at the Pool of Siloam, where Jesus is said to have healed a blind man.

In a series of articles earlier this year, the *Lassen County Times*, citing Baugh and two locals who accompanied him, portrayed the trip as a legitimate archaeological expedition, directed by Baugh and other professional archaeologists, and "commissioned" by the Israeli Antiquities Authority. Local residents were clearly left with the impression that Baugh's group held professional credentials and were invited to participate with Israeli scholars to conduct official archaeological research. Ultimately readers were told that under the auspices of Baugh's team, science is continually validating the Bible as historically accurate.

This was not simply a local newspaper objectively reporting the experiences of local residents. The *Times* has a history of reporting in the style of Christian apologetics, prompting many in the community to complain that it reads more like a church bulletin than a newspaper. At best, the *Times* staff failed to check into the professional credibility of Baugh and his group of Christian "scientists" before presenting their views to the community.

In an opinion piece published following Baugh's visit and more recently in a letter to the editor, I corrected erroneous reporting of science in general and archaeology specifically, and challenged the professional legitimacy of Baugh and his team as depicted by the local paper. In researching the issue, I also contacted professional archaeologists in Jerusalem, who claimed no knowledge of Baugh's group and insisted they would not have "commissioned" the Creation Evidences Museum to conduct archaeological excavation.

That Baugh and his cohorts would attempt to paint themselves as professional archaeologists and trot out fake creationist evidence for an uncritical audience will not be a surprise to NCSE members. For me, the surprise (and the bigger story) is the incredible positive reinforcement I received on a personal level from people in a conservative rural county, including educators, parents and students. Fully expecting to be a lone voice crying in the desert, I instead found a strong undercurrent of support for efforts to challenge local creationists and other pseudo-scientists directly. I received numerous phone calls, personal visits, and e-mails thanking me for standing up to the fraudulent claims of Baugh and others.

The larger lesson is that rural counties are not as uniform in their culture as the media would suggest: a single voice can awaken long-silent sentiment. A significant proportion of rural county residents is trying to find a voice in opposition to the pseudoscientific claims from pretenders who would wrap themselves in the cloak of science, and NCSE members can lend a helping hand.

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Christopher O'Brien is Forest Archaeologist for the Lassen National Forest and an adjunct professor of anthropology at California State University, Chico. He is preparing a detailed report on Baugh's visit to Susanville for Reports of the NCSE.

Divine Design in Utah?

Glenn Branch
NCSE Deputy Director

From June 2005 on, Utah was abuzz with the news that a state senator plans to introduce legislation to teach "divine design" in

the state's public schools.

Not so long ago, a piece on evolution education in Utah referred to "Utah's non-war over evolution." Writing in the *Deseret Morning News* (2005 Mar 19), Elaine Jarvik observed:

> One might suppose, given that Utahns tend to be both conservative and religious, that evolution would be a contentious topic in Utah's schools; but yet another legislative session has passed with no mention of Charles Darwin. And Brett Moulding can count on his fingers the number of anti-evolution phone calls he's gotten in the past 10 years, first as science education specialist and then as curriculum director for the Utah State Office of Education.

Part of the lack of controversy may be due to the fact that in Utah, as elsewhere, teachers frequently succumb to pressure to downplay or omit evolution. Additionally, Jarvik wrote, "Utah students often don't believe what they've been taught anyway, because they've learned something different from teachers in LDS Church seminary classes," although it is disputed whether or not the Mormon faith in fact rejects evolution. The article concluded by reporting Gayle Ruzicka, president of the Utah Eagle Forum, to have plans "to tackle evolution" — and so she did.

According to a story in the *Salt Lake Tribune* (2005 Jun 5), Senator Chris Buttars (R–West Jordan), with the support of the Utah Eagle Forum, promised "to lead the fight for instruction of divine design in Utah public schools" when the Utah state legislature reconvened in January 2006. "Divine design," according to Buttars, "doesn't preach religion. ... The only people who will be upset about this are atheists. ... It shocks me that our schools are teaching evolution as fact." The Eagle Forum's Ruzicka explained her motivations for supporting the proposed legislation: "What an insult to teach children that they have evolved from a lower life to what they are now, and then they go home and learn that they are someone special, a child of God. ... This is not right." But Brett Moulding, the curriculum director for the state board of education, explained, "We don't teach religion in school," and Scott Berryessa, president of the Jordan Education Association, representing about 2100 Utah teachers, lamented, "Teachers wish that our Legislature would stop micromanaging the process of education — especially when it comes to issues as personal as these."

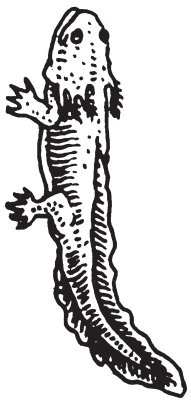
A pointed editorial in the *Salt Lake Tribune* (2005 Jun 6) criticized Buttars's proposal as not only wrong but also counterproductive: "Except for his new label for an idea called 'intelligent design' — itself a euphemism for the oxymoron 'creation science' — the proposal from the West Jordan Republican is an echo of battles that are already being fought in Kansas, Missouri, Georgia and Alabama, battles that consume a great deal of the oxygen that ought to be expended solving real problems, from health care to poverty to war." It concluded, "Forcing religion to stand in for science does no favor to religion, to science, or to our children. How wonderful it would be if Utah understood that." And a similarly trenchant editorial in the *Ogden Standard-Examiner* (2005 Jun 9) also ridiculed Buttars's coinage of "divine design" before deploring how, "[b]y trying to inject religious indoctrination into the schools, Buttars and his fellow supporters of 'divine design' are inviting state control over matters now exclusively left to parents and families."

Then Buttars reconsidered. On July 15, 2005, the Associated Press reported that "after talks with the state Superintendent of Public Instruction Patti Harrington, he's comfortable — at least for now — with what Utah classrooms are teaching." According to Buttars, Harrington told him that "we should not be teaching human evolution of any kind," while Harrington herself was quoted as saying, "There is not evidence yet to claim how the earth was created and no evidence to connect the family of apes with the family of man." In a subsequent article in the *Salt Lake Tribune* (2005 Jul 17), Buttars was quoted as saying, ominously, that his conversation with Harrington assured him that teachers who teach human evolution "will be dealt with". If not, he added, he would reconsider introducing his "divine design" legislation in the 2007 legislative session.

But Brett Moulding told the *Tribune* that although teaching human evolution is not specifically mandated by the state science standards, it is not prohibited either, adding that no action would be taken by the state against teachers who taught human evolution. Moulding suggested that Harrington's remarks quoted by the Associated Press were misunderstood; she was unavailable for comment. University of Utah professor Dennis Bramble was aghast at the very idea that teachers might be penalized for teaching human evolution: "I think the job of public schools is to present modern science as we know it and inform students about how science works," he said. "The genetic similarity between modern apes and modern humans is extremely high. ... That combined with an increasingly complete fossil record ... is compelling."

The *Tribune* subsequently noted in a July 18, 2005, editorial that "the Utah public schools have a state board, a state superintendent and officials, and experts of various specialties seeking to do what is, under the best of circumstances, a difficult job. What Utah schools clearly do not need is a Grand Inquisitor, no matter how badly state Sen Chris Buttars wishes to secure the position." The editorial also argued that while the state standards mandate "the teaching of evolution as exactly what it is, 'central to modern science's understanding of the living world,'" they also stress that "'[s]cience is a way of knowing,' not the way of knowing, and thus the necessary understanding of evolution should not be seen to challenge any religion or other belief system." The *Provo Daily Herald* (2005 Jul 16) was briefer: it awarded a "buffalo chip" to Buttars "for mucking around where religion doesn't belong — in the public school curriculum."

In the following month, Buttars enjoyed a brief burst of national publicity, when his op-ed "Evolution lacks fossil link" appeared in *USA Today* (2005 Aug 8). Emphasizing supposed gaps in the fossil record ("There is zero scientific fossil evidence that demonstrates organic evolutionary linkage between pri-



mates and man"), Buttars was anything but coy about the religious underpinnings of his position, writing, "The argument over classroom discussion of evolution vs divine design is just the latest attack on everything that would mention a belief in God." *USA Today* may have regarded his op-ed as a counterbalance to its editorial "'Intelligent design' smacks of creationism by another name" (also 2005 Aug 8), which noted that "intelligent design" "ascribes creation to a vaguely undefined cosmic force that sounds a great deal like the God of Genesis but usually isn't named as such," opined that "intelligent design" "isn't science. It can't be tested with rigorous experimentation. It is at best a philosophical concept, or a matter of faith," and concluded, "creationism, by whatever name, doesn't belong in a science class."

At its meeting on September 2, 2005, the Utah state board of education unanimously adopted a position statement that described evolution as "a major unifying concept in science and appropriately included in Utah's K–12 Science Core Curriculum" (see below). The statement, according to the *Deseret Morning News* (2005 Sep 3), was prepared at the behest of board chairman Kim Burningham "by a group of 22 scientists, professors and community members, including members of the Coalition of Minorities Advisory Committee and the Catholic Diocese" in reaction to the ongoing controversy over evolution education across the country. Buttars, who attended the meeting, requested that the board defer its vote until he presented a two-hour exposition of "intelligent design"; the board declined his request. The *Morning News* quoted Buttars as telling the board that evolution "has more holes than a crocheted bathtub" (a line he used in his *USA Today* op-ed as well).

According to the *Salt Lake Tribune* (2005 Sep 2), only Buttars and two supporters protested the adoption of the statement, while about a dozen scientists in attendance endorsed the statement, telling the board that "intelligent design" is not good science. Duane Jeffrey, a professor of biology at Brigham Young (and NCSE board member) compared "intelligent design" to astrology and pyramid power, while Gregory Clark, a professor of bioengineering at the University of Utah, told the board, "'Intelligent design' fails as science because it does exactly that — it posits that life is too complex to have arisen from natural causes, and instead requires the intervention of an intelligent designer who is beyond natural explanation. Invoking the supernatural can explain anything, and hence explains nothing."

In its editorial "Resisting temptation: Board stands on firm scientific ground" (2005 Sep 7), the *Salt Lake Tribune* praised the board for its vote, writing, "The board was not only correct, but also refreshingly quick and unanimous, in approving last Friday a new position statement affirming that evolution is, indeed, 'a unifying concept in science' and 'a necessary part of science classroom instruction.'" The editorial also criticized Buttars for dismissing "evolutionary theory as 'a theory, not a

Utah State Board of Education Position Statement on Teaching Evolution

The Theory of Evolution is a major unifying concept in science and appropriately

This position is consistent with that taken by the National Academy of Sciences, the American Association for the Advancement of Science (AAAS), and most other scientific and educational organizations. The Utah State Board of Education and these organizations affirm science as an essential way of understanding for all students and the importance of evolution as a unifying concept in science.

Science: A Way of Knowing

Science is a distinctive way of understanding the natural world. Science seeks to increase our understanding through empirical evidence. As a way of knowing, science assumes that anything that can be measured or observed is amenable to scientific investigation. By the very nature of scientific inquiry, there are infinite possibilities for further refinement of current knowledge and understanding.

Understanding may be derived from sources and perspectives other than science such as historical and logical analyses, art, religion and philosophy. These sources rely upon other ways of knowing, such as emotion and faith. While these ways of understanding and creating meaning are important to individuals and society, they are not amenable to scientific investigation and thus not appropriate for inclusion in the science curriculum. Science relies nearly exclusively on observation and empirical evidence. Since progress in the modern world is tied so closely to this way of knowing, scientific literacy is essential for a society to be competitively engaged in a global economy.

Evolution: A Unifying Concept

Evolution in the broadest sense can be defined as the idea that the universe has a history and has changed over time. Observation of the galaxies, stars, planet earth, and life on earth clearly demonstrates that significant changes have occurred. There is abundant and consistent evidence from astronomy, physics, biochemistry, geochronology, geology, biology, anthropology, and other sciences that evolution has taken place. This evidence is found in widely divergent areas, from the geologic fossil record to DNA analysis.

Evolution is an ongoing process with crucial implications for disciplines such as medicine, agriculture and conservation biology. The theory of evolution provides a unifying basis upon which the elements of life are understood and upon which predictions can be made. Moreover, viewing present-day organisms as products of evolution provides the most productive framework for investigating and understanding their structure and function. As such, evolution is a uni-

fact,' when scientifically literate people know that theories are models for describing facts, not mere shots in the dark," adding, "Shots in the dark such as intelligent design."

At the meeting, Buttars told the board that he intended either to introduce legislation calling for the teaching of "intelligent design" or arrange for there to be a referendum on next year's ballot. He told the *Deseret Morning News* that his "Academic Freedom Act" would "enhance the effectiveness of science education while at the same time ensuring that students are given credible alternative explanations for the origin of life on earth"; the newspaper quoted the act as saying, "We believe that excluding recent scientific discoveries simply because they run counter to the Darwinian model of origins is not good educational policy."

It was then unclear how much support Buttars's bill would enjoy if introduced. Previously, Utah governor Jon Huntsman Jr (R) was reported in the *Salt Lake Tribune* (2005 Aug 29) as disagreeing with President Bush's apparent endorsement on August 1 of teaching "intelligent design" in the public schools (see p 13). "It is a *science* class," he told the *Tribune*. "Our schools are largely secular institutions. ... I would expect my kids in *science* class to be instructed in those things that are somewhat quantifiable and based on thorough and rigorous empirical research" (emphasis in original). Huntsman said that he had no objection to "intelligent design" as a topic for a sociology or a psychology class.

Nevertheless, in a November 15, 2005, post on the Utah senate majority's blog, Buttars wrote, "I'm asked on an ongoing basis if I plan to introduce a bill concerning the Utah State Board of Education's position on teaching evolution. The answer to that question is yes. I've opened a bill file and I'm currently working on the language. The bill text is not yet public and will remain private until I'm satisfied that 1) the intent of the bill is clear, 2) how it will be administered is also clear, and 3) it can withstand a court challenge" (<http://senatesite.com/blog/2005/11/teaching-evolution.html>).

Subsequently, Buttars filed Senate Bill 96 on January 4, 2006. If enacted, SB 96 would direct the Utah state board of education to require "that instruction to students on any theory regarding the origins of life, or the origins or present state of the human race, shall stress that not all scientists agree on which theory is correct" and to "ensure that all policies and positions of the State Board of Education relating to theories regarding the origins of life or the origins or present state of the human race: (i) do not endorse a particular theory; and (ii) stress that not all scientists agree on which theory is correct." SB 96 was approved by the Senate Education Committee by a 4–2 vote along party lines on January 17, 2006.

NCSE continues to monitor the situation and to provide advice to concerned Utahns. Expect further details in the next issue of *RNCSE*.

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included in Utah's K–12 Science Core Curriculum.

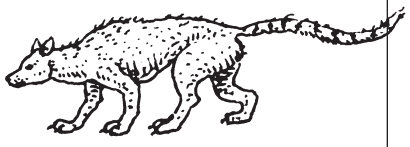
fying concept for science and provides the foundation for understanding nature. The National Science Education Standards from the National Academies of Science and Benchmarks for Science Literacy from the American Association for the Advancement of Science identify evolution as a unifying concept across the major disciplines of science. Scientific disciplines with strong historical components — such as astronomy, geology, biology, and anthropology — rely upon the concepts of evolution to understand the nature of changes that have occurred or can be predicted.

There is little or no debate among credible scientists about whether evolution has taken place. However, since our understanding is still incomplete, there is considerable and productive debate about processes of evolution. Research questions remain, and scientists often disagree about their explanations, as they should. The nature of science encourages ongoing and meaningful investigation of all assertions made by science. Scientific conclusions are tested by experiment and observation as all scientific theories are subject to continued evaluation.

While some describe the principle of evolution as "just a theory," the scientific definition of a theory is far more rigorous than may be commonly understood. In science, a theory is a systematic explanation of observed phenomena. It must be consistent with all natural laws and withstand the scrutiny and inquiry of the scientific community. The National Academy of Sciences has stated, "Evolution is one of the strongest and most useful scientific theories we have." As a fundamental scientific concept, evolution is a necessary part of science classroom instruction, and it will continue to be taught and progressively refined as a key scientific principle.

Student Beliefs and Teaching Evolution

Teachers should be aware that students bring with them a set of beliefs. Teachers and students should respect and be nonjudgmental about students' beliefs, and teachers should help students understand that science is an essential way of knowing. Teachers should encourage students to discuss any seeming conflicts with their parents or religious leaders. Science teachers should make available to interested parents their planned instruction and the context for that instruction.



Creationists Sue the University of California

Glenn Branch
NCSE Deputy Director

Creationism is prominent in a recent lawsuit — *Association of Christian Schools International et al v Roman Stearns et al* — that charges the University of California system with violating the constitutional rights of applicants from Christian schools whose high school coursework is deemed inadequate preparation for college. (The lead defendant, Roman Stearns, works in the university system's Office of Undergraduate Admissions.)

The complaint (available on-line at <http://www.acsi.org/webfiles/webitems/attachments/007875_2.%20ACSI%20CA%20Complaint.pdf>) was filed in federal court in Los Angeles on August 25, 2005, on behalf of the Association of Christian Schools International (ACSI), the Calvary Chapel Christian School in Murrieta, California, and a handful of students at the school. Representing the plaintiffs are Robert H Tyler, a lawyer with a new organization called Advocates for Faith and Freedom, and Wendell R Bird of the Atlanta law firm Bird and Loechl.

Bird is no stranger to litigation over creationism. As a law student in the late 1970s, he published a student note in the *Yale Law Journal* (87 [3]: 515–70), sketching a strategy for using the free exercise clause of the First Amendment to secure a place for creationism in the public school science classroom. Bird later worked at the Institute for Creation Research, where he updated its model "equal-time" resolution. The ICR's resolution eventually mutated, in Paul Ellwanger's hands, to become model "equal-time" legislation. A bill based on Ellwanger's model was passed in Arkansas in 1981 and then ruled unconstitutional in *McLean v Arkansas*.

Although Bird was not able to participate in the *McLean* trial — he sought to intervene on behalf of a number of creationist organizations and individuals, but was not allowed to do so — he was involved in *Aguillard v Treen*, which became *Edwards v Aguillard*. Named a special assistant attorney general in Louisiana, Bird defended Louisiana's "equal-time" act all the way to the Supreme Court, where in 1987 it was ruled to violate the Establishment Clause. His *The Origin of Species Revisited*, which compared evolution and "abrupt appearance," was subsequently published in two volumes (New York: The Philosophical Library, 1989).

At issue in the present suit are the guidelines set by the University of California system to ensure that first-year students have been adequately prepared for college in their high schools. The complaint cites a policy of rejecting high school biology courses that use textbooks published by Bob Jones University Press and A Beka Books as "inconsistent with the viewpoints and knowledge generally accepted in the scientific community." Such a policy, the complaint alleges, infringes on the plaintiffs' rights to "freedom of speech, freedom from viewpoint discrimination, freedom of religion and association, freedom from arbitrary discretion, equal protection of the laws, and freedom from hostility toward religion."

Robert Tyler told the *Los Angeles Times* (2005 Aug 27), "It appears that the UC system is attempting to secularize Christian schools and prevent them from teaching from a [Christian world] view." But creationism is a matter of theology, not of science, Robert John Russell of the Center for Theology and Natural Science told the *Oakland Tribune* (2005 Aug 31). "It's almost ludicrous anyone would even take this seriously," Russell said. "It seems absurd that a student who had poor biology would meet the same standards as a student with 'good' biology. ... This has nothing to do with First Amendment rights."

A spokesperson for the University of California system would not comment on the specific allegations leveled in the complaint, but told the *Los Angeles Times* that the university was entitled to set course requirements for incoming students, adding, "[t]hese requirements were established after careful study by faculty and staff to ensure that students who come here are fully prepared with broad knowledge and the critical thinking skills necessary to succeed."

In its fall 2005 newsletter (available on-line at <http://www.acsi.org/webfiles/webitems/attachments/007875_1.%20Overview%20of%20ACSI%20Law%20Suit.pdf>), ACSI expresses concern that the University of California system's "secular intolerance might spread to other institutions and to other states. ... If this discrimination is allowed to continue unchallenged, it is only a matter of time before secular institutions in other states will join the bandwagon." Interviewed by *Education Week* (2005 Sep 7), however, a spokesperson for the American Association of Collegiate Registrars and Admissions Officers expressed the opposite concern, reportedly worrying "about the potential implications of asking a university to ignore its course requirements — which had been shaped by experts in various fields — in favor of a 'free-for-all,' in which any interest group is allowed to shape policy."

The lawsuit was subsequently criticized in a trenchant editorial published in the *San Jose Mercury News* (2005 Oct 3). Mincing no words, the author of the editorial argued, "The suit appears to be baseless — a case of substandard academics hiding behind a false cry of religious persecution," but warned that the suit must be taken seriously "because a victory by Calvary Chapel Christian would weaken UC's ability to require strong curriculums and would open the door to more bad science and sectarian courses in high schools."

Commendably, the author took the trouble to examine one of the textbooks at issue, Bob Jones University Press's *Biology for Christian Schools*, which the University of California system regards as not providing students with "knowledge generally accepted in the scientific and educational communities and with which a student at the university level should be conversant." Accompanying the

editorial was a sidebar with excerpts from the textbook, such as "Many current scientific observations, therefore, are open to various interpretations. We can be sure, though, that anything that contradicts the Word of God is wrong."

"The issue is not whether religious and private schools should be able to teach religion or other courses tied to the core mission of their schools," the author of the editorial emphasized. "They have a right to. The issue is what can be used for college entrance requirements." And the editorial concluded by exhorting the University of California system to resist pressure to compromise those requirements: "The suit against UC is part of a campaign by religious conservatives to put public educators on the defensive and insinuate their beliefs into the classroom. UC must stand firm, in defense of students who need to be taught objective content and critical thinking."

A hearing on the defendants' motion to dismiss the charges was scheduled for December 12, 2005, but then cancelled; the judge is expected to rule on the motion without the benefit of oral argument. As always, NCSE is monitoring the situation.

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President Bush Addresses "Intelligent Design"

Glenn Branch
NCSE Deputy Director

During a press conference with a group of Texas reporters on August 1, 2005, President George W Bush responded to a question about teaching "intelligent design" in the public schools. The reporter referred to "what seems to be a growing debate over evolution versus 'intelligent design'" and asked, "What are your personal views on that, and do you think both should be taught in public schools?" In response, Bush referred to his days as governor of Texas, when "I said that, first of all, that decision should be made to local school districts, but I felt like both sides ought to be properly taught ... so people can understand what the debate is about." (It is noteworthy that Bush tacitly equated "intelligent design" and creationism.) Pressing the issue, the reporter asked, "So the answer accepts the validity of 'intelligent design' as an alternative to evolution?" Bush avoided a direct answer, construing the question instead as a fairness issue: "You're asking me whether or not people ought to be exposed to different ideas, and the answer is yes."

Although there was nothing unexpected about Bush's response, which is consistent with his previous statements on the topic, the present heightened awareness of issues involving evolution education ensured a media frenzy. NCSE was widely consulted for comment. *The New York Times* (2005 Aug 3) quoted NCSE's Susan Spath on the specious appeal to fairness: "It sounds like you're being fair, but creationism is a sectarian religious viewpoint, and 'intelligent design' is a sectarian religious viewpoint," she said. "It's not fair to privilege one religious viewpoint by calling it the other side of evolution." NCSE's Glenn Branch concurred, telling the *Los Angeles Times* (2005 Aug 3) that because "[t]he question was presented to him as a fairness issue," it was not surprising that Bush expressed the view that "both sides ought to be taught." Branch also told the *Financial Times* (2005 Aug 3) that "Bush would have done better to heed his White House science adviser, John Marburger, who [has] said that evolution was the 'cornerstone of modern biology' and who has characteri[z]ed ID as not even being a scientific theory."

When interviewed by *The New York Times*, Marburger reiterated that "evolution is the cornerstone of modern biology" and that "intelligent design is not a scientific concept." According to the *Times*, Marburger — who is Science Adviser to the President and Director of the White House's Office of Science and Technology Policy — suggested that it would be "over-interpreting" Bush's remarks to endorse equal treatment for "intelligent design" and evolution in the public schools. Instead, he said, Bush's remarks should be interpreted as recommending the discussion of "intelligent design" as part of the "social context" in science classes. Marburger's charitable interpretation was not shared, however, by Richard Land, the president of the ethics and religious liberties commission of the Southern Baptist Convention, whom the *Times* quoted as construing Bush's remarks as supportive of the view he favors: "if you're going to teach the Darwinian theory as evolution, teach it as theory. And then teach another theory that has the most support among scientists" — presumably alluding to "intelligent design."

The scientific community rushed to deplore Bush's remarks. The American Geophysical Union issued a press release (2005 Aug 2) in which its executive director Fred Spilhaus stated, "President Bush, in advocating that the concept of 'intelligent design' be taught alongside the theory of evolution, puts America's schoolchildren at risk." In its press release (2005 Aug 4), the American Physical Society accepted Marburger's interpretation of Bush's remarks, but emphasized that "only scientifically validated theories, such as evolution, should be taught in the nation's science classes." The American Institute of Biological Sciences issued a press release (2005 Aug 5) in which its president Marvalee Wake stated, "'Intelligent design' is not a scientific theory and must not be taught in science classes." And in a letter to President Bush dated August 5, 2005, Robert Kirschner, the president of the American Astronomical Society, commented that "intelligent design has neither scientific evidence to support it nor an educational basis for teaching it as science."

The education community expressed its concern, too. According to a statement dated August 3, 2005, the National Science Teachers Association, the world's largest group of science educators, was "stunned and disappointed that President Bush is

Q&A on ID with POTUS

Q I wanted to ask you about the — what seems to be a growing debate over evolution versus "intelligent design". What are your personal views on that, and do you think both should be taught in public schools?

THE PRESIDENT: I think — as I said, harking back to my days as my governor ... Then, I said that, first of all, that decision should be made to local school districts, but I felt like both sides ought to be properly taught.

Q Both sides should be properly taught?

THE PRESIDENT: Yes, people — so people can understand what the debate is about.

Q So the answer accepts the validity of "intelligent design" as an alternative to evolution?

THE PRESIDENT: I think that part of education is to expose people to different schools of thought, and I'm not suggesting — you're asking me whether or not people ought to be exposed to different ideas, and the answer is yes.

[*From the transcript posted on the* Washington Post*'s website, August 2, 2005.*]

endorsing the teaching of intelligent design — effectively opening the door for nonscientific ideas to be taught in the nation's K–12 science classrooms" (see p 38). In a statement dated August 4, 2005, the American Federation of Teachers, with over 1.3 million members, described Bush's remarks as "a huge step backward for science education in the United States," adding that "[b]y backing concepts that lack scientific merit, President Bush is undermining his own pledge to 'leave no child behind.'"

On editorial and op-ed pages, Bush's remarks took a hammering. The *Washington Post*'s editorialist wrote (2005 Aug 4), "To pretend that the existence of evolution is somehow still an open question, or that it is one of several equally valid theories, is to misunderstand the intellectual and scientific history of the past century." Referring to "intelligent design," the *Baltimore Sun*'s editorialist wrote (2005 Aug 4), "It's creationism by another name, and if it makes its way into schools at all, it should definitely not be part of science classes." In its editorial (2005 Aug 4), the *Sacramento Bee* connected the dots between Bush's remarks and the Wedge strategy for promoting "intelligent design," commenting, "America's children deserve a first-rate education in science in public school and not a false, politically motivated 'Teach the Controversy' debate between science and religion." And in his August 5, 2005, column in *The New York Times*, the economist Paul Krugman perceptively remarked, "intelligent design doesn't have to attract significant support from actual researchers to be effective. All it has to do is create confusion, to make it seem as if there really is a controversy about the validity of evolutionary theory."

Nevertheless, two prominent Republican politicians subsequently echoed Bush. According to the Associated Press (2005 Aug 18), Senator Bill Frist (R–Tennessee), the Senate majority leader, told reporters in Nashville that students ought to be exposed to different ideas, including "intelligent design": teaching "intelligent design" alongside evolution, he said, "doesn't force any particular theory on anyone. I think in a pluralistic society that is the fairest way to go about education and training people for the future." According to the *Arizona Daily Star* (2005 Aug 24), Senator John McCain (R–Arizona) "told the *Star* that, like Bush, he believes 'all points of view' should be available to students studying the origins of mankind."

Senator Rick Santorum (R–Pennsylvania), who as the Senate Republican Conference Secretary is third in the Republican leadership, took a different tack, however. Speaking on National Public Radio (2005 Aug 4), he said, "as far as intelligent design is concerned, I really don't believe it has risen to the level of a scientific theory ... that we would want to teach it alongside of evolution." Santorum's reaction represents a departure for him: writing in the *Washington Times* (2002 Mar 14), for example, he stated, "intelligent design is a legitimate scientific theory that should be taught in science classes." Like Frist and McCain, Santorum is reportedly contemplating a run for the presidency in 2008.

A welcome congressional response appeared in the following month. Writing as a guest columnist on the popular TPMCafe blog (2005 Sep 8; available on-line at <http://houseoflabor.tpmcafe.com/story/2005/9/8/183216/1039>), Representative Rush Holt (D–New Jersey) — one of the very few research scientists who serve in Congress — contributed a piece entitled "Intelligent design: It's not even wrong." "As a research scientist and a member of the House Education Committee," Holt wrote:

> I was appalled when President Bush signaled his support for the teaching of 'intelligent design' alongside evolution in public K–12 science classes.Though I respect and consistently protect the rights of persons of faith and the curricula of religious schools, public school science classes are not the place to teach concepts that cannot be backed up by evidence and tested experimentally.

He added, "It is irresponsible for President Bush to cast 'intelligent design' — a repackaged version of creationism — as the 'other side' of the evolution 'debate.'" His incisive essay ends with the sobering thought, "When the tenets of critical thinking and scientific investigation are weakened in our classrooms, we are weakening our nation. That is why I think the President's off-hand comment about 'intelligent design' as the other side of the debate over evolution is such a great disservice to Americans."

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UPDATES

California: Speaking at the Los Angeles Natural History Museum on September 28, 2005, State Superintendent of Public Instruction Jack O'Connell declared that "intelligent design" was unwelcome in California's public school science classes. "The introduction of 'intelligent design' theory in natural science courses would be a blow to the integrity of education in California," O'Connell said. "Our state has been recognized across the country and around the world for the quality and rigor of our academic standards. Just like I will fight tooth and nail to protect California's high academic standards, I will fight to ensure that good science is protected in California classrooms."

In studies of state standards conducted by the Fordham Foundation, California was among only a handful of states to earn the grade of A, for both its science standards in general and its treatment of evolution in particular. From Pennsylvania, where the trial in *Kitzmiller v Dover* was ongoing (see *RNCSE* 2004 Sep/Oct; 24 [5]: 4–9), NCSE's executive director Eugenie C Scott commented, "California's unsurpassed state science standards treat evolution appropriately: as the central, powerful, unifying principle of the biological sciences that it is. I am gratified that Superintendent O'Connell recognizes the need to defend the teaching of evolution against religiously motivated and scientifically unwarranted attacks."

O'Connell also said, "The goal of public education is for students to gain the knowledge and skills necessary for California's work force to be competitive in the global, information-based economy of the 21st Century. ... We also want to give students the tools to become critical thinkers and to be able to discuss and reflect on philosophical questions. But, the domain of the natural sciences is the natural world. Science is limited by its tools — observable facts and testable hypothesis. Because religious beliefs are based on faith, and are not subject to scientific test and refutation, these beliefs should not be taught in the realm of natural sciences." His statement is available on-line at <http://www.cde.ca.gov/nr/ne/yr05/yr05rel118.asp>.

Idaho: In a statement issued on October 4, 2005 (available on-line at <http://www.president.uidaho.edu/default.aspx?pid=85947>), the president of the University of Idaho, Timothy P White, articulated the University's position on evolution. "As an academic scientific community and a research extensive land-grant institution," he wrote, "we affirm scientific principles that are testable and anchored in evidence." Hence only evolution, and not supposed "alternatives" to it, is taught in the university's science classes, he explained. White noted that such views might be appropriately discussed in "religion, sociology, philosophy, political science, or similar courses," and that the university respects the right of individuals to hold such views, but emphasized that they are inappropriate for the science classrooms. President White's statement appeared at a time when the University of Idaho was taking a special interest in the issue, as the Associated Press noted (2005 Oct 6). Scott Minnich, a professor in the university's Department of Microbiology, Molecular Biology, and Biochemistry, and a Fellow of the Discovery Institute's Center for Science and Culture, was shortly to testify for the defense in *Kitzmiller v Dover*, the first legal challenge to teaching "intelligent design" in the public schools. Moreover, NCSE's executive director Eugenie C Scott was shortly to speak at the university on October 12, 2005, in the Randall Seminar Series, on "Why scientists reject intelligent design."

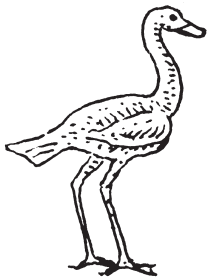
Indiana: The *Indianapolis Star* (2005 Nov 3) reported that a group of Republican state representatives is preparing to introduce "intelligent design" legislation when the legislature reconvenes in early January 2006. A questionnaire including a question about whether there should be equal time for "intelligent design" in science classes was circulated by 36 of the 52 Republican state representatives to their constituents. The *Star* noted that House Speaker Brian Bosma (R–Indianapolis) and a few of his colleagues solicited help from Carl Baugh, who runs the Creation Evidences Museum in Glen Rose, Texas. Baugh, of course, is notorious for accepting claims rejected even by fellow young-earth creationists, such as the presence of human footprints in the Cretaceous limestone of the Paluxy River basin in Texas.

Although interest in such legislation is apparently strong in the House of Representatives, Senate President Pro Tempore Robert Garton (R–Columbus) was lukewarm. The executive director of the Indiana School Boards Association told the *Star* that the legislature ought to defer to the state board of education. And Fran Quigley, executive director of the Indiana Civil Liberties Union, said that the ICLU would oppose any such legislation as violating church/state separation. Governor Mitch Daniels (a Republican) expressed reservations, too, saying, "I'd have to think hard about a bill that would require any particular curriculum or assignment" (Associated Press, 2005 Nov 5).

Editorial reaction in the state's newspapers was also negative. The *Star* (2005 Nov 4) expressed opposition to the idea of legislatively mandating "intelligent design" in the state's public schools, although, disturbingly, it described the Discovery Institute's "teach the controversy" approach as "reasonable." The *Fort Wayne Journal Gazette*'s editorial (2005 Nov 4) was more astute, describing "intelligent design" as "the Trojan horse that critics of evolution push to avoid the clearly unconstitutional practice of teaching creationism in science class," criticizing Bosma for taking advice from "such a source for advice on Indiana's academic standards" as Carl Baugh, and firmly stating that "[a]dopting science standards that include instruction in intelligent design — ideas reject-

ed by mainstream scientists — would seal the state's backwater reputation."

A subsequent story in the *Star* (2005 Nov 13) reported that initial responses to the questionnaires circulated by the Republican state representatives were positive, with 53% and 63% of respondents in two districts favoring the idea of teaching "intelligent design" alongside evolution. It also reported a split of opinion about whether "intelligent design" would be a "wedge" issue in Indiana politics: Representative Ed Mahern (D–Indianapolis) described it as "their Pledge of Allegiance or Ten Commandments issue for 2006," while Representative Luke Messer (R–Shelbyville), the executive director of the Indiana Republican Party, disagreed. Gary Belovsky, who teaches biology at the University of Notre Dame, told the *Star* that evolution was good science and not antithetical to faith and God, and lamented, "This shouldn't even be an issue."



Michigan: On September 29, 2005, Michigan House Bill 5251 was introduced and referred to the House Committee on Education. If enacted, HB 5251 would require the state board of education to revise the state science standards to ensure that students will be able to "(a) use the scientific method to critically evaluate scientific theories including, but not limited to, the theories of global warming and evolution [and] (b) Use relevant scientific data to assess the validity of those theories and to formulate arguments for or against those theories."

Michigan Information & Research Service reported (2005 Oct 1) that the lead sponsor of the bill, Representative John Moolenaar (R–Midland), introduced the legislation in part in reaction to Barbra Streisand's characterization of the recent spate of hurricanes as due to global warming. He was quoted as explaining, "If we, as a society, didn't pursue the truth on scientific theories we'd still believe the earth was flat and bloodletting was an effective cure for the common cold … Current events such as the hurricanes or evolution lead to great teachable moments. We must make sure students are given the tools to critically evaluate the world around them."

"While critical and deductive reasoning is essential to the scientific method," responded Gregory Forbes, "this bill singles out two theories for special attention that Representative Moolenaar happens to find objectionable to his personal views: global warming and biological evolution. Since Michigan's science standards already require that students to be able to think scientifically and to use scientific knowledge to make decisions about real-world problems, it's clear that the only point of HB 5251 is to lead students to believe that evolution and global warming are somehow less scientific than other scientific theories. In fact, evolutionary theory is the most critically tested and robust theory in modern science." Forbes is Professor of Biological Sciences at Grand Rapids Community College and serves as the Education Director for the Michigan Scientific Evolution Education Initiative and as the National Course Director for the National Science Foundation's course on evolution. He is also on the board of the grassroots group Michigan Citizens for Science.

Moolenaar was a cosponsor of previous anti-evolution legislation in Michigan in the previous (2003–2004) legislative session: HB 4946, which would have amended the state science standards to refer to "the theory that life is the result of the purposeful, intelligent design of a Creator," and HB 5005, which would have allowed the teaching of "the design hypothesis as an explanation for the origin and diversity of life" in public school science classes. Both bills were opposed by the Michigan Science Teachers Association; both seem to have died in committee.

In October 2005, the Michigan Science Teachers Association issued a statement (available online at <http://www.msta-mich.org/positions/evolution2.php>) denouncing HB 5251, noting that, because the Michigan state science standards "already require students to 'use scientific knowledge to make decisions about real-world problems' and to be 'able to make informed judgments on statements and debates claiming to have a scientific basis,'" there is apparently "no valid reason for legislative intervention that would modify the existing standards as developed and adopted by the MDOE working in collaboration with Michigan's professional science education community."

Additionally, noting that "global warming and evolution are the only two theories selected for mandatory 'critical evaluation' in HB 5251," the MSTA statement observes that the proposed revision "may suggest to students and the public that these theories are somehow less robust or less scientific than are other scientific theories that were not selected for mandatory evaluation … in clear contrast to the preponderance of scientific evidence supporting both of these theories and would represent a dishonest and unprofessional approach to the sciences and science education in Michigan."

Gregory Forbes reports that the MSTA statement was subsequently endorsed by the Michigan Earth Science Teachers Association, the Michigan Science Education Leaders Association, and the National Association of Biology Teachers.

Michigan, Gull Lake: According to the *Kalamazoo Gazette* (2005 Jun 14), the Gull Lake Community Schools Board decided that although "intelligent design" might be appropriate for elective classes in political science, humanities, or philosophy at the high school level, it is not appropriate for biology classes in high school or for any classes at the middle school level. The decision agrees with the recommendation of a committee appointed to study the question of whether and how to teach "intelligent design" in the district's schools, in the wake of a controversy involving two middle school science teachers who were using *Of Pandas and People* and other creationist material in their science classes (see *RNCSE* 2004 Sep/Oct; 24 [5]: 12–15 and 2004 Nov/Dec; 24 [6]: 12–14). "This is a very emotional issue, and the committee did a good job of taking emotion out of it and looking at the

NCSE NEWS

News from the Membership

Glenn Branch, NCSE Deputy Director

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

Responding to the threatened "divine design" legislation in Utah (see p 8), **David F Bailey** contributed an op-ed column to the *Salt Lake Tribune* (2005 Jun 16). "As a Mormon," he wrote, "I definitely believe that our world was created by an intelligent designer. Indeed, it seems to me that an open-minded philosophy of this sort is entirely consistent with modern scientific knowledge. But I find that on almost all specific issues, I disagree with the 'intelligent design' (ID) movement, and I do not believe this material has any place in public schools." After

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facts," school board president Deb Ryan told the Gazette. In a story published in the *Detroit News* (2005 Jul 24), superintendent Richard Ramsey added, "We couldn't find a science department in any public university in Michigan that thought [teaching 'intelligent design'] was a good idea."

Pennsylvania, Dover: Just days after the close of testimony in *Kitzmiller v Dover*, the first legal challenge to the constitutionality of teaching "intelligent design" in the public schools (see *RNCSE* 2004 Sep/Oct; 24 [5]: 4–9), the Dover electorate voiced its opinion at the ballot box in the November 8, 2005, election. Opposing eight pro-"intelligent design" incumbents on the Dover Area School Board were eight candidates — Bernadette Reinking, Terry Emig, Bryan Rehm (one of the plaintiffs in *Kitzmiller*), Herbert "Rob" McIlvaine, Judy McIlvaine, Larry Gurreri, Patricia Dapp, and Phil Herman — running as the Dover CARES (Dover Citizens Actively Reviewing Educational Strategies) slate. Dover CARES is bipartisan, although all of its candidates ran as Democrats because incumbent members of the board won the Republican primaries. Although "intelligent design" was not the only focus of the Dover CARES campaign, it took a firm stand on the inappropriateness of teaching "intelligent design" and related religious ideas in the science classroom: "Science class is not the proper curriculum for these concepts."

According to election returns published in the *York Dispatch* (2005 Nov 8), it was a clean sweep for the Dover CARES candidates. Ousted were board president Sheila Harkins and former board president Alan Bonsell, both of whom voted for the policy that provoked the *Kitzmiller* suit, as well as James Cashman, Sherrie Leber, Dave Napierskie, Eric Riddle, Ed Rowand, and Ron Short, all of whom were appointed by the anti-evolution majority on the board to fill vacancies that have arisen during the current term. Remaining on the board is Heather Geesey, who was not up for reelection; she voted for the anti-evolution policy. The turnover in the board's composition was not expected to affect the outcome of the *Kitzmiller* case: the ACLU's Witold Walczak told the Harrisburg *Patriot News* (2005 Nov 8) that the plaintiffs' request for a declaratory judgment and nominal damages of $1 were designed to "prevent the case from being mooted" by the election. The newly elected board's first meeting was on December 5, 2005; a ruling for the plaintiffs was issued on December 20, 2005 (see p 5).

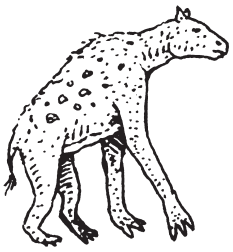
On November 10, 2005, the Reverend Pat Robertson offered a warning to Dover. "I'd like to say to the good citizens of Dover, if there is a disaster in your area, don't turn to God," Robertson advised. "You just rejected him from your city, and don't wonder why he hasn't helped you when problems begin, if they begin, and I'm not saying they will. But if they do, just remember you just voted God out of your city. And if that's the case, then don't ask for his help, because he might not be there." Reaction from Dover was reportedly cool. Newly elected school board member Larry Gurreri told the *York Daily Record* (2005 Nov 11) that Robertson's comments were desperate and radical, and added that he would pray for him. Former school board member Jeff Brown, who resigned in protest of the controversial policy, told the *York Dispatch* (2005 Nov 11), "According to sworn testimony, intelligent design has nothing to do with God ...Then Pat Robertson says if you don't support it, God will hate you. These clowns want it both ways."

Texas: House Bill 220 died in committee when the Texas legislature recessed on May 30, 2005. If enacted, HB 220 would have amended the state's education code to require that textbooks approved by the state be free from factual errors, "including errors of commission or omission related to viewpoint discrimination or special interest advocacy on major issues, as determined by the State Board of Education," and satisfy general textbook content standards to be defined by the board. Its sponsor, Representative Charlie Howard (R–Sugar Land), told the *Fort Worth Star-Telegram* (2004 Apr 22) that HB 220 would enable the board to ensure that creationism was taught alongside evolution and to remove evolution segments from science textbooks. Two similar bills, HB 973 and HB 2534, also died in committee, although neither seems to have been publicly linked to issues involving evolution education. (For background, see *RNCSE* 2005 Jan–Apr; 25 [1–2]: 12–16.)

[*NCSE thanks Heather Alden of the Texas Freedom Network, Ed Brayton, and Gregory Forbes for information used in this article.*]

detailing the similarities between "intelligent design" and its precursor, creation science, he recommended, "Leave questions of science to science. Bringing sectarian religion into scientific controversies only sows confusion and strife." Bailey is the chief technologist of the Computational Research Department at Lawrence Berkeley Laboratory.

Daryl Domning, Professor of Anatomy at Howard University in Washington DC, gave two invited talks to students at McLean High School in McLean, Virginia, in February 2005 as part of the school's "Darwin Day" observance. He spoke on the historical background and reasons for the creation/evolution controversy, fossil seacows as examples of intermediate forms in evolution, and "The 10 most extreme misconceptions about evolution." In May 2005, Domning was the keynote speaker at a day-long teachers' workshop on evolution organized by Sandra Madar of Hiram College, held in Akron, Ohio, in conjunction with the Fourth Triannual Conference on Evolution of Aquatic Tetrapods. His theme was the importance of existential concerns, rather than doubts about scientific evidence, as motivators for most people who question evolution. And in June 2005, he addressed some of these existential concerns directly in an invited lecture to the annual Cosmos and Creation Conference at Loyola College in Baltimore, Maryland. There he argued that the nature of material existence and the self-centered behavior enforced on all organisms by natural selection provide an explanation for both physical and moral evil and the Christian doctrine of original sin.



Barbara Forrest and **Paul R Gross**, the authors of *Creationism's Trojan Horse: The Wedge of Intelligent Design* (New York: Oxford University Press, 2004), teamed up again to contribute "The wedge of intelligent design: Retrograde science, schooling, and society" to *Scientific Values and Civic Virtues*, edited by Noretta Koertge (New York: Oxford University Press, 2005; Forrest and Gross's article is on pages 191–214). In it, they describe "a facet of the ID movement that has not received the scrutiny proportionate to its pivotal significant in this larger effort — national in scope — to restructure American institutions and government policy on a sectarian, theistic foundation." Also of interest in the same volume are **Michael Ruse**'s "Evolutionary biology and the question of trust" (99–119), which discusses trust and violations of trust in the history of evolutionary biology, Frederick B Churchill's "The evolutionary ethics of Alfred C Kinsey" (135–53), and Keith Parsons's "Defending the radical center" (159–71), which argues against critics of science on the left (such as Sandra Harding) and on the right (such as Phillip Johnson and Alvin Plantinga).

Ursula Goodenough reviewed Richard Dawkins's *The Ancestor's Tale* (Boston: Houghton Mifflin, 2004) for *BioScience* (2005 Sep; 55 [9]: 798–9). She was particularly impressed with the innovative narrative structure of a backward journey in time, describing it as "a most effective antidote to forward chronologies that so readily convey the sense, however unintentionally, that other species in the diagram are lower or more primitive, while humans are the apex and hence the point," adding, "[g]oing backward also allows us to experience, rather than just know about, the deep time involved." Of interest in the same issue of *BioScience* was a review of NCSE Supporter **Douglas J Futuyma**'s new book *Evolution* (Sunderland [MA]: Sinauer Associates, 2005) by NCSE Supporter **Francisco J Ayala** (801–3). Ayala described *Evolution* as "an excellent compendium of the modern theory of evolution" and praised the book's final chapter "Evolutionary science, creationism, and society" in particular, commenting, "Futuyma effectively disposes of various red herrings adduced by creationists."

Marie Greider's guest column, "Intelligent design theories unscientific, unfit for school," was published in the August 23, 2005, issue of *The Advocate* of Newark, Ohio. Responding to a previous column in the paper as well as to President Bush's remarks seeming to endorse the teaching of "intelligent design" in the public schools, Greider commented, "Evolution is taught in our public schools as an essential science subject for students to understand the complexity, the close intertwining relationship and the history of the living world. ... In contrast, ["intelligent design"] is based on a recent Christian religious belief that a higher power must have had a hand in creation, for life is too complex to have developed through the present-day knowledge of evolution. ... Such a dogma without scientific evidence has no place in science classes of our public schools." Greider is a retired professor of pathology at the Ohio State University and Washington University in St Louis.

The July 2004 issue of *Perspectives on Science Education*, published by the New York State Science Leadership Association, recently arrived at NCSE. The issue was devoted to articles on evolution education, including **Bryce Hand**'s "Evolution, creationism, and the teaching of science" (4–7), in which Hand noted, "there's not a single creationist argument that the community hasn't heard ... again and again. Many creationist claims are so outrageous as to be laughable; others are sophisticated enough to require some advanced knowledge or a bit of careful examination for proper rebuttal. But every one of them is demonstrably spurious." After debunking a few of the most prevalent claims, he ended by suggesting, "the best classroom approach to countering misinformation of creationists may lie not in attempting to challenge their individual assumptions, but in matter-of-factly providing information to improve students' ability to assess and effectively counter claims that are clearly contradicted by scientific knowledge." Hand is Professor Emeritus of Geology at Syracuse University. [*Thanks to Jack Friedman for the news.*]

Mark Isaak's *The Counter-Creationism Handbook* (Westport [CT]: Greenwood Press, 2005) was published. Based on his invaluable "Index of creationist claims" on the Talk.Origins Archive website (<http://www.talkorigins.org/indexcc/index.html>), *The Counter-Creationism Handbook* offers a single resource listing the most prevalent creationist claims and offering succinct and scientifically accurate rebuttals with references to further discussions. In his preface, Isaak writes, "Much of the strength of creationism comes not from its having good arguments but from its creating so many arguments that educators cannot easily teach the answers to all of them."

Gregory S Paul's article "Cross-national correlations of quantifiable societal health with popular religiosity and secularism in the prosperous democracies: A first look" was published in *Journal of Religion & Society* (2005; 7: 1–17; available online at <http://moses.creighton.edu/

JRS/pdf/2005-11.pdf>). Paul argues, "Large-scale surveys show dramatic declines in religiosity in favor of secularization in the developed democracies. Popular acceptance of evolutionary science correlates negatively with levels of religiosity, and the United States is the only prosperous nation where the majority absolutely believes in a creator and evolutionary science is unpopular. Abundant data [are] available on rates of societal dysfunction and health in the first world. Cross-national comparisons of highly differing rates of religiosity and societal conditions form a mass epidemiological experiment that can be used to test whether high rates of belief in and worship of a creator are necessary for high levels of social health. Data correlations show that in almost all regards the highly secular democracies consistently enjoy low rates of societal dysfunction, while pro-religious and anti-evolution America performs poorly."

Ronald H Pine, who lives in Kansas, was invited to give a talk entitled "The clash in Kansas: Science vs religion: A report from the front," at the Center for Inquiry–West in Los Angeles on August 7, 2005. After providing an update on the situation in the Sunflower State, Pine discussed the total lack of science in "intelligent design", arguing that all its proponents have to show for their efforts is a mishmash of essays (although some are of book length). Unlike the young-earth creationists, "intelligent design" proponents have made no efforts to create a model of the earth's history. Pine presented all of the possible "models" he could think of that would be compatible with "intelligent design" and pointed out the absurdities of each. Why have proponents of "intelligent design" offered no such model? Pine suggested three reasons: the absurdities he cited, the likelihood of not achieving a consensus among ID's disparate factions, and its irrelevance to their political aims in any event. Thus "intelligent design" — or "creationism without a model," as Pine quipped — will never achieve even the broadest outlines of a consilient and predictive explanation of the facts of paleobiology.

Noticing that there were far fewer cicadas chirping in his backyard than in the previous summer, **Steve Rissing** took the opportunity to instruct the readers of the *Columbus Dispatch* (2005 Jul 5) about how cicada cycles are governed by natural selection. "Sometimes we get lulled into thinking that the dynamic and exciting aspects of nature occur only in exotic places far away," he wrote. "But then a few or 200 000 cicadas can bring us back to the reality of fundamental natural processes occurring in our own backyard." Rissing is Professor in the Department of Evolution, Ecology, and Organismal Biology at Ohio State University.

NCSE Supporter **Michael Ruse** wrote two articles for the July/August 2005 issue of *Science & Theology News*. His op-ed "Tough-minded thinking needed for today's vital topics" (7) urged scholars in the burgeoning area of science-and-religious studies to improve their understanding of the history of philosophy and theology, to "stop avoiding the science when we find it uncomfortable," and to "get serious about our theology" — "if we must get into natural theology," he pointedly remarks, "let us do this without slipping into Creationism-lite, like the ID enthusiasts." And he reviewed (64–5) NCSE Supporter **Sean B Carroll**'s *Endless Forms Most Beautiful* (New York: WW Norton, 2005), which he describes as "an attractive and accessible introduction to the field of evo-devo," adding, "If you want to understand how organisms are put together, such as how the wing of the butterfly got its spots, then this is the book for you."

Responding to a paid advertisement advocating "intelligent design" creationism in the *Sacramento News & Review*, **Kevin Schultz** (a life member of NCSE) wrote to comment, "[The advertisement] argues scientific research must be 'taught, debated, modified, discarded or proven and built upon not only in ... laboratories but in our schools.' Do we really expect students to do all that in the five days they spend learning about scientific evolution each year? And do we really expect kids to learn in a scientific environment corrupted by the politics and religion of the radical conservative religious right?" His letter was published on September 8, 2005.

Mark Terry contributed "Intelligent design, or not: Dr Strangescience, or how I learned to stop worrying and love the wedge" to the on-line quarterly journal of New Horizons for Learning, an "international network of people, programs, and products dedicated to successful, innovative learning"; his article is available on-line at <http://www.newhorizons.org/trans/terry.htm>. Noting that biology teachers frequently "refrain from dealing with evolution because of their own misunderstandings or lack of background or local religious objections," Terry offers a brief overview of how, in contrast, he and his colleagues at the Northwest School present "evolution as a central idea in biology while also looking at its cultural roots, uses, misuses and relationship to religious thought. We're able to put Pennsylvania, Georgia, and Kansas, and all the other related activities of the Discovery Institute into an already rich context, meanwhile studying good, solid, contemporary evolutionary science." He concludes with the thought, "If science educators ... sharpen up their evolution curricular offerings, we may all be able to thank the industrious Fellows of the Discovery Institute and their deep pocket donors for helping re-energize science education. The loud hammering of the Wedge may backfire on its designers."

Before Darwin: Reconciling God and Nature (New Haven: Yale University Press, 2005), by **Keith Thomson**, was published. From the jacket copy: "For 200 years before the publication of Darwin's *On the Origin of Species*, findings in the sciences of the earth and of nature threatened religious belief based on the literal truth of the Bible. This book traces out the multiple conflicts and accommodations within religion and the new sciences through the writings of such heroes of the English Enlightenment as David Hume, Robert Hooke, John Ray, Erasmus Darwin (Charles' [s] grandfather), Thomas Burnet, and William Whiston. ... Thomson finds surprising and direct connections between the anti-evolutionary writings of natural theologians like William Paley and the arguments that Darwin employed to turn anti-evolutionist ideas upside-down." A review in *New Scientist* (2005 May 14) described *Before Darwin* as "a book of sheer pleasure. Beautifully written and epigrammatic, it is full of characters of talent, disputatious skill and wit." Thomson is Professor Emeritus of Natural History at Oxford University.

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

The Ugly Underside of Altruism

David P Barash, University of Washington

"How do I love thee? Let me count thy genes."

There has been a revolution in evolution ... or, rather, in biologists' understanding of how natural selection works. This revolution derives from a new sense of what is important, what is the biological "bottom line," what is — as evolutionists put it — the appropriate "unit of selection." More and more, it has become clear that the crucial unit is the gene: not the species, nor the group, nor even the individual, but the smallest meaningful entity that can persist through evolutionary time. After all, genes are potentially immortal, whereas individuals come and go. As Richard Dawkins so brilliantly emphasized in his book *The Selfish Gene*, living things are essentially constructed by their genes, for their (the genes') benefit. And when individuals behave, such actions are "adaptive" insofar as they contribute, ultimately, to the success of those genes in promoting copies of themselves into the future. (Equally important: activities that do not contribute to genetic success are selected against.)

Accordingly, biologists had been perplexed to find animals behaving altruistically, doing things that helped others to survive and reproduce, but at some cost to the altruist, such as giving an alarm call when a predator approached (thereby aiding the listeners but at some cost to the alarm-givers, who are rendered more conspicuous), or sharing food, or simply tolerating a free-loader. The problem for altruism, and thus for evolutionary biologists, was simple: Evolution rewards selfishness. Insofar as a trait or behavior increases reproductive success, that trait or behavior should become more abundant, along with its corresponding gene(s). At the same time, any trait or behavior or gene(s) that reduced reproductive success should quickly disappear to be replaced with its selfish alternatives.

Natural selection, in short, helps those who help themselves. And it penalizes those who help others. As a result, biologists were troubled — not ethically, mind you, but as scientists — by the very fact of altruism's perseverance, since it should quickly be selected against and replaced by selfishness, which, by definition, helps itself and thus prospers. Another way of stating the problem: How to explain the endurance of traits that are, by definition, self-defeating?

But endure they do. It turns out that altruism not only astounds, it abounds. Why?

Here is where the revolution comes in. Part of the charm of the gene's-eye perspective is that it solved much of the altruism question. Thanks to English biologist William D Hamilton, the paradox of altruism was resolved by revealing that it wasn't really a paradox after all! Hamilton's crashing insight was that if individual altruists direct their benevolence preferentially toward others who are close relatives, then genes are actually benefiting themselves, and that this process is, literally, what natural selection is all about. Hamilton thus pointed out that what often appears to be altruism at the level of bodies can actually be selfishness ... at the level of genes, which benefit themselves by proxy.

Isaac Newton opened physicists' eyes to why things fall; Hamilton, in effect, opened biologists' eyes to why living things behave as they do; even what they are. Hamilton's now-classic article, "The genetical evolution of social behavior," published in 1964, is, more than any other single piece of research, the intellectual cornerstone of the modern evolutionary revolution. In effect, Hamilton's insight was to recognize that genes promote their success via copies of themselves in other bodies.

Even before Hamilton, biologists had never been troubled, interestingly, by the ubiquity of reproduction, even though *at the level of bodies*, breeding is just as altruistic as alarm-calling or food-sharing. After all, reproduction is costly. It takes time and energy. It involves risk and imposes penalties on the would-be breeder. (Think of the time and energy spent in courtship, the vulnerability associated with mating, the sheer metabolic cost of constructing a placenta, lactating, defending and provisioning one's offspring, and so on.) Reproducing, in short, benefits someone else — the offspring — while it imposes a cost on the parent.

Yet parental behavior is not normally considered altruistic; making children is not surprising, nor is it in any way counter-intuitive, or against what an evolutionary biologist — or anyone else — might expect. Quite the opposite: Most people take reproduction for granted, and biologists have long considered that successful breeding is central to evolutionary success. For decades, in fact, biologists equated breeding with "fitness." Reproduction is costly? Of course. But it would be absurd to think that as a result, reproduction would be selected against! What would replace it? All living things are the offspring of parents who successfully reproduced, costs and all. A genetic basis for non-reproduction would have a dim evolutionary future indeed.

But here's the point: At the gene level, the important thing about

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reproduction is that genes are packaging copies of themselves into new bodies, and then (in varying ways, depending on the species) trying to promote the success of these new bodies. How? By feeding them, keeping them warm, protecting them, teaching them, taking them to soccer games and the orthodontist, maybe sending them to college and paying their bills. With this new perspective, having babies and then caring for them is seen for what it is: a perfectly good route to evolutionary success. But not the only route. Hamilton's genius came in recognizing that there are other ways for genes to be successful, if not via those bodies that we call offspring, then via other bodies that we call genetic relatives, such as nieces, nephews, cousins, grandchildren, and so on.

The only difference between these more distant relatives and those that we call offspring is that the more distant the relative, the lower the probability that a gene present in any given individual is also present in that relative. This, after all, is what people mean when they talk about a "distant" relative: genetic distance, even though most of us lack the ability to calculate exactly how great the distance and precisely what genetic "distance" really means. (No matter: most of us don't understand the details of neurophysiology, either, yet are pretty good at thinking.) Hamilton went further, showing the conditions necessary for altruism to evolve. To make a long mathematical story short, "Hamilton's rule" is that altruism will be selected for in proportion as (1) the cost to the altruist is low, (2) the benefit to the recipient is high, and (3) the altruist and recipient are closely related. The first condition means that low-cost altruism — for example, taking a small risk for someone else — should be easier, and thus more frequent, than running extreme risks. The second means that all things being equal, altruists should be more likely to act in proportion as their altruism helps the individual being assisted. And the third condition means that "the more closely related, the more altruism" and conversely, "the less closely related, the less altruism." Why? Because the closer the genetic relationship, the higher the probability that any altruism-promoting gene(s) present in the altruist will also be present in the recipient.

The result is a new picture of evolutionary fitness, one that reveals how the net of natural selection is spread more widely than pre-Hamiltonian Darwinists had imagined. Previously, when biologists thought about fitness, they considered only direct reproductive success; its importance has never been in doubt. But breeding is only part of the story. The full tale, known as "inclusive fitness", is more, well, inclusive. It includes not only reproductive success but also any action that increases another's survival and reproduction. But — and here is a very important point — not all "others" are equal, at least insofar as a would-be altruist is concerned. The importance of each "other" (to the altruist) is greater in proportion as he or she is more closely related ... because that means a greater probability of shared genes.

Actually, there are two noteworthy precursors of Hamilton's important insight. Both were brilliant evolutionists — in fact, they were two of the most prominent founders of the field of population genetics — but for some reason, neither carried this particular idea very far. In the late 1920s, Ronald A Fisher wondered why certain bad-tasting caterpillars were brightly colored. He acknowledged that conspicuous coloration would make it more likely that a hungry bird, for example, after eating one caterpillar, would leave the others alone. But, Fisher pointed out, such an "advantage" would come a bit late for the caterpillar who sacrificed its life in order to educate predators not to make the same mistake twice. Fisher went further, suggesting that perhaps this is why such insects tend to be found in groups: If these groups consist of brothers and sisters, then the dying caterpillar (rather, the relevant genes within the caterpillar) would be repaid — not in this life, but in evolutionary time — through the success of kin.

The other biologist who caught a glimpse of the genetics of altruism but apparently did not realize its generalizability was JBS Haldane, like his contemporary Fisher and his successor Hamilton, a British mathematics whiz. The story goes that Haldane was at his favorite pub when the conversation happened upon self-sacrificial bravery. Haldane was asked if he would give his life for his brother. No, he said, he wouldn't do that. Then he made a rapid calculation on the back of a napkin and added that he'd do so for two brothers or eight cousins! (Genes within any of us enjoy a ½ probability of occurring within a full sibling; hence, two brothers equals one self. Similarly, cousins are, on average, ⅛ genetically identical, so it takes eight cousins to comprise the genetic equivalent of one's self.)

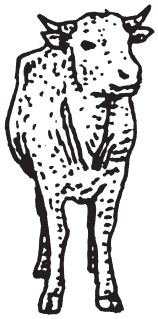
This, apparently, is as far as the realization went, until Hamilton revisited the paradox of altruism, bequeathing us a new view of ourselves and of life more generally. The result is also sometimes called "kin selection," since it speaks to a predictable bias toward kin: relatives over non-relatives, and closer relatives over more distant ones. Kin selection — or "inclusive fitness theory" — suggests that nepotism is likely to be universal, or nearly so, in the living world. It even provides a way of calculating it. Thus, one self equals two brothers, or four grandchildren, or eight cousins, etc. Faced with the question, "Save your skin or save your kin?", the balance point occurs when the likelihood of genes present in relatives equal those present in one's self.

Armed with this new view of behavior, biologists began reinterpreting the living world.

And by and large, predictions based on Hamilton's "inclusive fitness" model have been confirmed. Across a remarkable range of species and a wide array of behaviors, animals preferentially direct beneficence toward relatives over non-relatives, also favoring close relatives over distant relations. Not only that, but thinking in terms of shared genes has helped elucidate such "cross-cultural universals" as nepotism among human beings. It even refocuses basic understanding of life itself, shedding new light, for example, on why multi-

cellular bodies remain as coherent as they do. (After all, why should the liver cells uncomplainingly undertake the unpleasant task of detoxifying the blood, leaving all the evolutionary success to the gonads? Because liver and gonad cells are genetically identical, so that success for the latter leads to exactly the same triumph for all other body cells.)

There are certainly additional factors that underpin altruism, in human beings as well as other animals. Thus, reciprocity is sometimes important, and occasionally what appears to be altruism is simply selfishness — even at the personal level. Nonetheless, Hamilton's insight into the significance of shared genes and altruism has been so powerful that it can fairly be identified as one of the greatest advances in modern evolutionary theory.



I assume that most readers are with me at this point ... even though some may part company at the assertion that what's sauce for the biological goose also applies — albeit with reservations — to the human gander. But what of altruism's "ugly underside," as indicated in the title of this article?

After all, a vision of Darwinian competition without shared genes to soften the blows is far more unpleasant. In his book *The Economy of Nature and the Evolution of Sex*, marine biologist and historian of science Michael Ghiselin put it chillingly and well:

> No hint of genuine charity ameliorates our vision of society, once sentimentalism has been laid aside. What passes for cooperation turns out to be a mixture of opportunism and exploitation. ... Where it is in his own interest, every organism may reasonably be expected to aid his fellows. Where he has no alternative, he submits to the yoke of communal servitude. Yet given a full chance to act in his own interest, nothing but expediency will restrain him from brutalizing, from maiming, from murdering — his brother, his mate, his parent or his child. Scratch an 'altruist,' and watch a 'hyprocite' bleed.

By contrast, gene-based altruism seems downright delightful.

Of course, to some people, nepotism is itself ugly. That's why we have laws against carrying it too far. And to others, it is demeaning to consider that something as lofty as altruism may have an underlying selfish component. Reductionism may be the stuff of science (at least, most science), but when applied to understanding ourselves, it often fails to make the heart sing. What's really unpleasant about the biology of gene-centered altruism, however, is much more troublesome, and — if true — far more deserving of universal condemnation.

It is this. Insofar as shared genes underpin much of human altruism, the apparent absence of shared genes may well lead to altruism's nasty inverted doppleganger: intolerance, hatred, and bigotry. "How do I hate thee? Let me count thy genes."

If genes are predisposed to behave nicely toward identical copies of themselves housed in other bodies, they presumably have ways of achieving this identification. For some species, simple physical proximity may do the trick: close neighbors are somewhat more likely to be relatives. For others, behavioral cues may be available: someone in your nest, or den, or household is likely to be more closely related to you than is someone in a different social unit. (Sociologists have long been intrigued by "in-group amity, outgroup enmity"; now biologists are too.) There also remains the possibility that genes predispose their bodies to behave benevolently toward other bodies whose physical and behavioral traits give cues that they are harboring similar genes. In short, their inner selves may whisper, "Be nice toward those that resemble yourself." But at the same time, this angelic advice offered to one ear may be matched by a more subversive suggestion, whispered by a counterbalancing evolutionary devil perched on the other shoulder: "Be nasty toward those who are different."

This, then, is the ugly underbelly of kin selection: not selfishness, but racism, a special form of intolerance toward others, those who are biologically different, or, if nothing else, who look that way.

Although some people claim that the various human races are socially constructed and thus biological fictions, the reality is otherwise. To be sure, there is no simple answer to the question, "How many races are there?" or "Are such-and-such a distinct race?" And there is absolutely no doubt that all human beings are members of the same species. It is also evident that the genetic differences between human races are biologically trivial, constituting less than ⅒ of one percent of total genetic make-up. But it is also clear that Caucasians, for example, are easily recognized as distinctly different from Chinese, and that either group is different from black Africans. Moreover, there can be no doubt that such differences — superficial as they are — reflect genetic differences: After all, black parents produce black offspring, pink parents produce pink offspring, and so forth.

Let me be clear: This is not to say that "race" is a particularly meaningful characteristic, nor is there any way that the human races can be in any way ranked as better or worse, superior or inferior. Moreover, nearly all of the differences among the races are more apparent than real; there is more genetic diversity, for example, among black Africans than between Caucasians and Asiatics. Nonetheless, racial traits exist, just as eye color exists, along with earlobe shape or blood type, and at least some of the differences among the races result from differences in their genes. This recognition, although it may make some well-meaning people uncomfortable, is demanded by old-fashioned intellectual honesty.

Those physical traits that characterize the various human races are the relics of genetically isolated groups of people (tribes) who remained isolated for many generations. Australian aborigines evolved kinky hair, residents of the Mongolian steppe evolved eye-folds, and so forth. Geography was presumably the cause of this genetic isolation. Even as the races came increasingly into contact, interbreeding has been limited by cultural traditions which have generally kept individuals from marrying far

The Accidental Creationists: Why Evolutionary Psychology is Bad for the Teaching of Evolution

James Miles

Before we begin, let me declare an interest. I hold the distinction of being the only truly vocal critic of evolutionary psychology (EP) to write from within what is called the genic selection, or "selfish gene", tradition. This is the tradition that sees natural selection as operating predominately at the level of the gene, and it is the tradition to which all evolutionary psychologists profess to belong. However, this is not to say there are not many highly influential critics of EP within genic selection. In this paper I shall argue that all those who actually developed genic selection theory in the 1960s and 1970s reject the foundational assumptions of EP; it is just that, unlike me, they prefer to stay largely silent about their opposition. My contention has always been, though, that by staying silent about the serious errors of EP we do a tremendous disservice to Darwin's legacy, to science, and to important organizations like the NCSE.

Levels of Selection

In the *Origin of Species*, Darwin wrote that "natural selection can act only through and for the good

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outside their social/biological group.

What does this have to do with kin selection, or with racism? Just this. As we have seen, human beings — like other living things — may well be predisposed to behave benevolently toward close relatives over distant relatives, and to favor distant relatives over strangers, at least in part because the closer the relative the higher the probability that genes will be shared. When it comes to recognizing one's kin, it seems highly likely that physical similarity has long been important: Everyone knows that relatives tend to resemble each other. And conversely, the less the resemblance, the less the likelihood of a close genetic relationship.

Skin color, eye shape, hair texture, physical size, nose shape and other phenotypic differences among human beings reflect different ancestries. In general, the more differences, the more distant the genetic relationship. And the more differences, one can predict with some dismay, the less altruism.

The result may well be that human beings are naturally inclined — as a regrettable consequence of kin selection — to behave nonaltruistically toward others whose physical traits mark them as truly Other, that is, unlikely to be closely related. Once again, since this issue is so fraught with emotion and the potential for misunderstanding, let us be as clear as possible: Racism is in no way rendered acceptable just because it may be, to some extent, "natural". To the contrary, it is a practical and moral wrong that human beings are obligated to struggle against. But the fight against racism is not abetted by ignorance as to its possible origin.

Ironically, those racial categories that appear so prominent to so many people evidently reveal our tendency to establish social categories far more than they reflect biological reality. Nonetheless, human beings are acutely sensitive to the details of "exterior packaging" by which we identify each other as family, friends, or foe. It may be a tragic paradox that in unconscious pursuit of kin-selected benefits, we have come to exaggerate the significance of superficial differences that are just that: superficial.

In the musical *South Pacific*, a Caucasian lieutenant falls in love with a Polynesian woman. Reacting angrily to the racism of his society, he sings, "You've got to be taught, before it's too late, before you are six or seven or eight, to hate all the people your relatives hate ... You've got to be taught, to be afraid, of people whose eyes are oddly made, and people whose skin is a different shade. You've got to be carefully taught ..." Racism undoubtedly *can* be taught, and regrettably, it often is. So, fortunately, can racial tolerance and compassion. The point is that to some extent — exactly how far is unknown — people may indeed *have to be taught* tolerance, because left to their own devices, the whispers of kin-selected genes within most people seems to predispose them to a degree of bigotry that our species cannot afford.

We are children of the same mother — evolution — all of us nourished by the earth's good juices, yet our genes may well be programmed to see only narrower distinctions. To transcend ourselves, and our genes, is the uniquely human prerogative, as well as, increasingly, our responsibility.

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of each being" (1859: 84). Darwin is here being what is called an individual-selectionist; arguing that nature can select only for the benefit of the individual. But as the philosopher of biology Paul Griffiths notes (1995), Darwinian theory has gone beyond this first position and today largely boils down to a dispute between two different schools in biology and the philosophy of biology.

In 1966 George C Williams developed "the formally disciplined use of the theory of genic selection for problems of adaptation" (Williams 1966: 270). The genic selection tradition begun by Williams, further developed from the work of Hamilton (1964) and the late John Maynard Smith (1964, 1974), but popularly known after Dawkins (1976) as "selfish gene" theory, re-interprets apparent individual selection as not what is good for an individual, but as what is good for its genes. Since the fate of an individual and the fate of its genes are very closely — though not perfectly, and see for example Ridley (2000) — linked, individual selection is often for practical purposes synonymous with gene-level selection. Selfish gene-ery was also formulated in antipathy to 1960s theories of group selection, the idea that nature might select for the advantage of the group even at the cost to the individual (Maynard Smith 1964; Williams 1966; Dawkins 1976).

The other school in this debate sees things differently. If one accepts that genes must co-operate to "run" an individual efficiently, why cannot one take co-operation to even higher levels, to a hierarchy of levels? Hierarchical — also known as "multilevel selection" — theorists argue that group selection, properly understood, is an important part of the evolutionary process (Lewontin 1970; Griffiths 1995; Sober and Wilson 1999). A group consisting almost entirely of altruists can do better than a group consisting entirely of selfish individuals, because the altruism benefits the entire group. Their opponents argue, however, not that group selection is impossible, just that it is likely to be a very weak force in evolution because the conditions required are so onerous, and "lower levels of selection are inherently more powerful than higher levels" (Hamilton 1975: 134).

This seemingly esoteric disagreement has theoretical implications that it is unnecessary to detail fully here. What it is important for readers to understand is the fallout of this dispute, because unless one understands this, one will never understand where evolutionary psychology comes from and how it should be evaluated.

A History of Heresy

> But natural selection … implies concurrently a complete disregard for any values, either of individuals or of groups, which do not serve competitive breeding. This being so, the animal in our nature cannot be regarded as a fit custodian for the values of civilized man. (Hamilton 1971: 83)

Steven Pinker calls Williams's *Adaptation and Natural Selection* "the founding document of evolutionary psychology" (1997a: 56). All evolutionary psychologists profess to operate from within the genic selection tradition, "the new math" as EP popularizer Robert Wright calls it (1994: 161). In addition to vowing allegiance to the selfish-gene tradition, evolutionary psychologists have often been vocally hostile to the alternative multilevel selection tradition. "Gould and Lewontin's potshots do not provide a useful model of how to reason about the evolution of a complex trait" (Pinker 1994: 359; see also Wright 1999).

All evolutionary psychology, and the sociobiology from which it sprang, ultimately rests on the foundational belief that morality is a biological adaptation (see for example Wilson 1975; Barash 1979; Alexander 1987; Tooby and Cosmides 1992; Wright 1994). As sociobiologist and philosopher Michael Ruse summarizes: "The position of the modern evolutionist, therefore, is that humans have an awareness of morality — a sense of right and wrong … Morality is a biological adaptation" (1989: 262). But unfortunately for the evolutionary psychologists, this is not what selection at the level of the gene actually implies, or ever could imply, as Hamilton explains above. Or as Dawkins more pithily puts it: "civilized human behavior has about as much connection with natural selection as does the behavior of a circus bear on a unicycle" (Ridley and Dawkins 1981: 32; see also Maynard Smith 1988, Williams 1988). Yet while Maynard Smith, Williams, Hamilton, and Dawkins understand that selection at the level of the gene cannot produce morality, EP — with a breathtaking disregard for the underlying principles of selfish-gene theory — produces wholly misleading arguments that it can.

Where morality actually comes from and what genic selection theory truly tells us about the underlying human genetic code, I have already explained in detail elsewhere (Miles 1998, 2004). Briefly, the biggest problems with EP are that it rejects a four-billion–year pattern of evolution in favor of a more "comfortable" genetic conclusion. Orthodox selfish-gene theory concludes that selection at the level of the gene cannot produce morality. Morality is not found outside the human world; "there is no charity in nature," as the geneticist Steve Jones reminds us (1999: 160). The problem with trying to argue that nature can produce morality is that one would have to junk the entire selfish-gene theory on which the argument is supposedly built. Morality can evolve when selection is at the level of the group, but selection at the level of the group to explain complex adaptations is something selfish-gene theory vehemently rejects. To explain human large-group cohesion and co-operation as an evolved trait requires either group selection (Sober and Wilson 1999) or the evolution of forms of reciprocity seen nowhere else in the natural world, such as "indirect"

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reciprocity (Alexander 1987; Nowak and Sigmund 1998). But the problem remains; explaining the stability of such hypotheses, as "subversion from within" automatically acts to prevent the evolution of large group cohesion or morality. Furthermore, not only do the principles of contemporary selfish-gene theory rule out the evolution of morality, but also the putative evolution of morality would have required huge leaps in genetic design space (known as saltations) in order to remove much of the behavioral code we shared with the last common ancestor shared by humans and chimpanzees and to replace it with the antithetical coding sought. But saltations are a neo-Darwinian heresy. All selfish-gene theorists therefore conclude that to explain human morality we cannot look to evolution by natural selection for answers.

Strange Bedfellows

But why, if the conclusions of EP are so very different from the conclusions of the selfish-gene theory upon which EP is purportedly based, have we not heard this before? For the purposes of this paper there can be seen to be two main reasons: (a) the internal conflict within biology that has provoked in selfish-gene biologists an inclination to shield the heterodox, and (b) the largely comforting nature of the claims of EP when viewed against the more uncomfortable implications of genic selection theory.

(a) My Enemy's Enemy ...

> Maynard Smith, Williams, Hamilton, and Dawkins ... have largely eschewed the deeply unpleasant task of pointing out more egregious sins in the work of those who enthusiastically misuse their own good work. (Dennett 1995: 485)

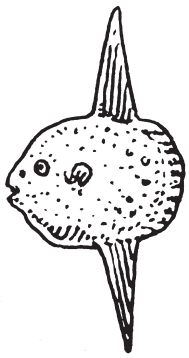
When evolutionary psychologist Helena Cronin was sent for a period by the London School of Economics to Oxford University to help her gain background for her PhD, she began to move in the tight circle of academic selfish gene-ery. The book that resulted from her PhD, *The Ant and the Peacock* (1991), has a foreword by Maynard Smith. She is gratefully thanked by Dawkins for her help in updating the second edition of *The Selfish Gene*. Williams describes her as a good friend. She is, above all, a hard-working ally in the war against the hierarchicals. Because, as the hierarchical theorist Paul Griffiths writes, "group selection is the villain of much of Cronin's book" (1995: 132).

The fear of a resurgent group-selectionism is difficult to overestimate in the minds of selfish-gene theorists. Evolutionary biology had been severely damaged in the mid-20th century by a long history of appealing, sometimes only implicitly, to "greater good-ism" and the idea that nature may select for the good of the group, local population or species. This came to a head in 1962 when Wynne-Edwards interpreted a wide range of social behaviors as adaptations for the regulation of population size. Some animals, suggested Wynne-Edwards, regulate their reproduction to control population density which otherwise "undermines the safety of the race" (1962: 20). Maynard Smith came back at Wynne-Edwards with a vengeance: "every time a group possessing the socially desirable characteristic is 'infected' by a gene for anti-social behaviour, that gene is likely to spread through the group" (1964: 1145). It was, however, to be Williams's book-length 1966 work, *Adaptation and Natural Selection,* subtitled *A Critique of Some Current Evolutionary Thought*, a plea for greater care in adaptationist thinking, that would ultimately prove to be "devastatingly effective" (Sober and Wilson 1999: 37). While noting that group selection was not impossible, Williams concluded that the adaptations cited in support of group selection could almost invariably be explained in terms of selection at levels lower than the group. Biologists did not need to appeal to group-level benefits where a lower-level benefit explained the adaptation.

The leading gene-selectionists do fear the damage that the evolutionary psychologists are doing to Darwinism, but they fear losing ground to the hierarchical tradition even more as it risks bringing back a immature understanding of group-selection theory. They worry that any public admission of the flaws of EP would be seized upon with relish by the hierarchicals and used to try to damage selfish-gene theory itself (partly in revenge: though selfish-gene theorists never actually supported EP, they never sufficiently distanced themselves from it either). To be fair though, and as I explain in Miles (2004), responsibility for the mess we are currently in lies as much with hierarchical theorists and philosophers as it does with selfish-gene theorists. There has been fault on all sides.

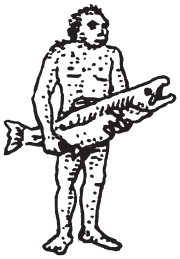
(b) A Comforting Take on Evolution

> Meanwhile, Lukaja handed the infant to the alpha male Ntologi, who dragged, tossed, and slapped it against the ground. Ntologi ... finally killed it by biting it on the face. ... Conspicuous competition for meat and meat-sharing was observed as usual. Three adult males and an adult female obtained meat from Ntologi. Two adult females, two juvenile females, a juvenile male, and an infant recovered scraps from the ground or were given scraps. At 1300h, Ntologi was still holding the skin of the carcass. (Hamai and others 1992: 152)



Why does selection at the level of the gene produce such horrific behavior as the within-group infanticide and cannibalism catalogued above in chimpanzees? Maynard Smith, pioneer of biological game theoretic modeling and father of the concept of the evolutionarily stable strategy, wrote: "Thus it would only be plausible to suggest that there are genetic reasons why anti-social behaviour should not increase if it were also suggested that selection had already produced an extreme degree of anti-social behaviour, and this is precisely what Wynne-Edwards denies. In fact, 'anti-social' mutations will occur, and any plausible model of group selection must explain why they do not spread" (1964: 1146). Selfish-gene theory

says that anti-social behavior increases until it levels out at that stable but "extreme degree" of anti-social behavior beyond which there is harm to the individual, not the group. In *The Selfish Gene* Dawkins tells us about blackheaded gulls as a paradigm of gene-selfish behavior: "It is quite common for a gull to wait until a neighbour's back is turned, perhaps while it is away fishing, and then pounce on one of the neighbour's chicks and swallow it whole. It thereby obtains a good nutritious meal, without having to go to the trouble of catching a fish, and without having to leave its own nest unprotected" (1976: 5). Or as Sarah Hrdy noted of monkey infanticide: "infanticide is adaptive behavior, extremely advantageous for the males who succeed at it" (1977: 43; see also Williams 1988).



In essence, sticking to the rules of gene-level selection we are faced with this: a human species-wide genetic code for cannibalism, infanticide, horrific violence, and perhaps even sexual eclecticism (Miles 1998, 2004). Well, that was always going to be a vote winner. What makes EP attractive is its denial of this view of our place in nature. What we are really being offered here is not so much evolutionary psychology; it is more psychologically-attractive evolution (or "PAE", perhaps?). EP simply flatly denies most human beings carry this four-billion–year genetic code, a code that evolutionary psychologists are still happy to admit exists across all other animal life. EP effectively argues that in one giant saltation 100 000 years ago on the savannas of Africa ancestral humans out-evolved this natural-world code. And in this regard, EP is not very easy to distinguish from the creationism that argues that humans were divinely created a few thousand years ago according to another unique set of rules.

"Wishful thinking at best"

As Darwin lay dying in March 1882, the last words he wrote to zoologist Thomas Huxley, his disciple of 30 years, were: "I wish to God there were more automata in the world like you" (Desmond 1997: 519). "Darwin's bulldog", as Huxley was known, had fought for Darwin in public for a quarter of a century while the reclusive Darwin stayed silent. Huxley fought to combat the idea that we were not animals, and the idea that we were not biochemical machines, the "automata" of nature. Darwinism has no room for free will; it is what Darwin called a "delusion" (see Barrett and others 1987: 608), wishful thinking akin to the belief that God made the world in six days and the earth is just 6000 years old.

But a century and a quarter after Darwin penned these final words to Huxley, evolutionary psychology appears to have resurrected free will. Despite professing to be a passionate evolutionist, Cronin is careful to delineate the Darwinian kingdom: "we should not look on free will and biological 'constraints' as pulling in opposite directions" (1991: 377). Vocal evolutionary psychologist Matt Ridley is keen to tell us there is nothing inconsistent with free will within EP (1994). Free will, says David Barash, is a "useful inconsistency" (2003: 222; see also Pinker 1997b). In Miles (2004) I described using belief in free will as the litmus test of a true Darwinian, as the litmus test to see who will cut and run from the implications of evolutionary theory. There is no room for free will in a theory which connects us in an unbroken four-billion–year chain of evolution. Even Darwin's greatest 19th-century critics, like "Soapy Sam" Wilberforce, accepted this truth: "man's free-will … [is] utterly irreconcilable with the degrading notion of the brute origin of him who was created in the image of God" (Wilberforce 1860: 258).

Yet this is another area where selfish-gene theorists refuse to challenge evolutionary psychologists, maybe because at least one influential selfish-gene theorist wants to believe in this particular self-serving delusion. In *Elbow Room: The Varieties of Free Will Worth Wanting*, Dennett tells us that the implications of rejecting the idea of free will are, for him, "almost too grim to contemplate." Consequently when testing this belief "we should be highly motivated to look on the bright side," he says, even though the arguments for free will invite the suspicion of "wishing thinking at best." "Still, what one hopes very much to be true may be true" (1984: 168–9). Not to be rude, but in what sense is Dennett's special pleading for free will in any material sense different from the creationists' apologias for a 6000–year-old Earth?

Why is free will so germane to this investigation into EP? Because it cuts to the chase. It asks just how far we are willing to go for science. Darwin called free will a "delusion". George Williams, founding father of modern evolutionary biology, described free will to me as "a stupid idea" (see Miles 2004: 155). Darwin, who tried to place humans in nature, had no time for free will. Evolutionary psychology, which seems to try in all ways to separate humans from nature, crows about our free will. Evolutionary theorizing does not need EP and its blind faith in free will, nor does it need Dennett's bland rationalization that free will is "worth wanting".

Conclusion

In *A Devil's Chaplain*, Dawkins writes that even though he and the late Stephen Jay Gould disagreed about so much, with widely publicized differences "and even animosities", at the end of 2001 they planned to co-author an open letter to the *New York Review of Books* explaining why they declined to debate creationism. To contest with creationists is to give sustenance to the belief that there is something in creationism that is genuinely worth debating; it is to give creationists "free publicity and unearned academic respectability" (2003: 221). Scientists, they both believed, are wiser just to stay silent.

I am not disagreeing with Dawkins that there may be times when it is truer to Darwin's legacy to stay silent. But this is not that moment. Evolutionary psychology gains free publicity and unearned academic respectability precisely because those with the knowledge of its limitations refuse to speak out. This is not to say that EP can not in principle, one day, merit respectability; just that currently it gains plaudits and disciples

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Would We All Behave Like Animals? A Conversation

by William Thwaites

Does a "belief" in evolution lead to a loss of morals and ethics?

No. People who fear this result from teaching about evolution are mistaken. They are confusing a philosophy called "Social Darwinism" with biological evolution. "Social Darwinism" is an oversimplified and naive extension of biological evolution to human social systems. Theorists such as Herbert Spencer (1820–1903) proposed and popularized much of what we now know as "Social Darwinism."

But doesn't evolution claim the same things as Social Darwinism?

No. Biological evolution is very different from Social Darwinism. "Survival of the fittest" is not as accurate a slogan for evolution as "survival of the fit enough," but either way, it is important to realize that biological "fitness" can be achieved in many different ways. Biological "fitness" usually has little to do with physical strength or the use of force or coercion.

Then what does "biological fitness" mean?

Biological fitness is defined as the long-term ability, compared to others, to leave offspring or descendants. There are many factors involved in the ability to leave descendants in the long run (that is, to have great-great-great-great [and so on] grandchildren.) Among humans, for example, the abilities to communicate and to cooperate have gone a long way towards making our species successful.

But doesn't evolutionary thought emphasize competition over cooperation?

No, that is another result of confusing evolution with Social Darwinism. Insects and flowering plants are just two examples of evolution's resulting in cooperative behavior. Most flowering plants use insects for pollination and the insects use the flowers as a source of food. "Cleaner" fish eat parasites off larger fish who, in turn, refrain from eating the "cleaners." The list of cooperative relationships between species is long, indeed. All, as far as we know, are the result of evolution. Furthermore, everyone knows of examples of cooperation within a species. Many social mammals will collectively defend the young, and elephants will help sick and injured members of the herd keep up. These cooperative relationships are also the result of evolution.

Competition or cooperation, evolution still teaches that we are just animals. If we think that, won't we behave like animals?

What is "behaving like an animal"? Porpoises are gregarious, intelligent, and fun-loving. Baboons are protective of the young and show cooperative group behavior. Gorillas are docile, family-oriented, and vegetarian. Chimpanzees form "bands" of more than one family, while orangutans live alone. From an evolutionary viewpoint, natural selection has produced people who behave like people. Humans, like all other species, are unique. There is no reason why we should behave the same way as some other species.

What does evolutionary thought teach us about the natural behavior of humans?

It is important to realize that we are a highly social species. Most of our behavior is learned, though influenced, but not strictly determined, genetically. We can learn behavior that will contribute to group well-being, and our long-term survival as a species. We can even "unlearn" whatever traces of instinctive behavior we may have inherited. Even if war between tribes is "natural" human behavior, we can learn not to make war. Systems of morals and ethics serve, in part, to channel our behavior away from behavior that is socially and biologically destructive.

When I was taught about evolution, we learned what you are calling "Social Darwinism." Won't the same thing happen if my children are taught about evolution?

Not if we do something to make sure that outdated and misleading information is no longer taught. Anti-evolutionists actively promote such misinformation to increase public resistance to evolution. Many science teachers receive too little formal education about evolution. And because in scientific research has led to specialization and fragmentation in college programs, a college student can sometimes get a degree in some aspect of biology without learning about evolution or ecology! Often, there is no course that will teach students in other majors, including education, about the nature of evolution and its scientific importance. Instead, much of what teachers know is derived from textbooks that give too little space to the subject.

It is vitally important to set the record straight. Evolution is the foundation principle of biology. If our children are going to understand 20th-century science, and our country is going to be ready for the 21st century, we have to end the misunderstanding and fear surrounding this important aspect of biology.

[*This summary is adapted from a longer discussion on the NCSE website. Read more at <http://www.ncseweb.org/resources/articles/5249_would_we_all_behave_like_anima_12_7_2000.asp>.*]

Evolutionary Psychology: Sic et Non

If the anti-evolutionist proponents of the "teach the controversy" slogan were genuinely interested in teaching legitimate controversies in the evolutionary sciences rather than instilling scientifically unwarranted doubts about evolution, the ongoing disputes about evolutionary psychology would provide suitable fodder! NCSE itself takes no particular position on the merits or demerits of evolutionary psychology; our staff, members, board directors, and Supporters have a wide variety of opinions. What is clear and indisputable is that humans are the product of evolution; it remains to be scientifically ascertained to what extent human behavior, especially human social behavior, is driven directly by evolutionary forces. So for books arguing for and against evolutionary psychology (and its predecessor, sociobiology), as well as a couple that seek merely to document or explain the controversy, check out the following books, all of which are now available through the NCSE website: <http://www.ncseweb.org/bookstore.asp> — look in the "In the latest *RNCSE*" section. And remember, every purchase through the website benefits NCSE!

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

Sic

The Adapted Mind: Evolutionary Psychology and the Generation of Culture
edited by Jerome H Barkow, Leda Cosmides, and John Tooby
In the introduction to *The Adapted Mind* (published originally in 1992 and a recognized classic in the field), the editors explain, "we hope to provide a preliminary sketch of what a conceptually integrated approach to the behavioral and social sciences might look like." Their approach is premised on the existence of a universal human nature, manifest primarily as psychological mechanisms constructed by natural selection to adapt humans to the way of life of Pleistocene hunter–gatherers, and the contributors use the approach in considering such phenomena as cooperation, mating and sex, parental care, and perception and language. The reviewer for the *Journal of Anthropological Research* described *The Adapted Mind* as "a critically important book."

Evolutionary Psychology: The New Science of the Mind, second edition
by David Buss
In its first edition, *Evolutionary Psychology* immediately became the standard textbook for the discipline; the second edition (published in 2003) is thoroughly revised and brought up to date. Topics covered include scientific movements leading to evolutionary psychology, the new science of evolutionary psychology, survival problems and solutions, women's long-term mating strategies, men's long-term mating strategies, short-term sexual strategies, principles of parenting, problems of kinship, cooperative alliances, aggression and warfare, conflict between the sexes, status, prestige, and social dominance, and toward a unified evolutionary psychology. David Buss is Professor of Psychology at the University of Texas, Austin; he is also the author of *The Evolution of Desire: Strategies of Human Mating.*

The Blank Slate: The Modern Denial of Human Nature
by Steven Pinker
"When it comes to explaining human thought and behavior," Pinker writes in his preface, "the possibility that heredity plays any role at all still has the power to shock." In *The Blank Slate*, he proceeds to articulate, defend, and consider — all with his trademark humor and eye for detail — the implications of "the new view of human nature and culture" that is emerging from cognitive science, cognitive neuroscience, behavioral genetics, and evolutionary psychology. Eugenie C Scott writes, "A humane and thoughtful book, *The Blank Slate* will surprise many who are fearful of the 'consequences' of a biologically informed conception of what it means to be human."

On Human Nature
by EO Wilson
From the publisher: "No one who cares about the human future can afford to ignore Edward O Wilson's book. *On Human Nature* begins a new phase in the most important intellectual controversy of this generation: Is human behavior controlled by the species' biological heritage? Does this heritage limit human destiny? With characteristic pungency and simplicity of style, the author of *Sociobiology* challenges old prejudices and current misconceptions about the nature-nurture debate. ... His goal is nothing less than the completion of the Darwinian revolution by bringing biological thought into the center of the social sciences and the humanities." *On Human Nature* won the Pulitzer Prize for general non-fiction in 1979.

The Moral Animal: Why We Are the Way We Are
by Robert Wright
In *The Moral Animal*, the popular science journalist Robert Wright — author of *Three Scientists and Their*

<http://www.ncseweb.org/bookstore.asp>

Gods: Looking for Meaning in an Age of Information and *Non-Zero: The Logic of Human Destiny* — turns his attention to the new science of evolutionary psychology. Summarizing and synthesizing a wealth of state-of-the art scientific information, Wright provocatively argues that human moral behavior was — and is — largely shaped by our adaptation to the ancestral environment. His points are cheekily exemplified with episodes from the life of Charles Darwin himself. The reviewer for *The Economist* writes, "This clever and stimulating book is destined to become a classic."

Non

Adapting Minds: Evolutionary Psychology and the Persistent Quest for Human Nature
by David J Buller
Buller, a philosopher of science, takes on evolutionary psychology, arguing that the conventional wisdom of the field is misguided: human minds are not adapted to the Pleistocene; rather, they are continually adapting, both over evolutionary time and within individual lifetimes. Elliott Sober writes, "Buller's critique of evolutionary psychology is measured, logical, and clearly developed. It is also devastating. Buller does not seek to refute the entirety of evolutionary psychology by finding a single magic bullet. Rather, he attends to the details, finding a variety of serious problems in the different arguments that evolutionary psychologists deploy. This is philosophy of science in the trenches, and it is excellent."

Why We Do It: Rethinking Sex and the Selfish Gene
by Niles Eldredge
Assaulting evolutionary psychology at one of its apparent strongholds — sexuality — Eldredge argues that life is not wholly driven by the gene's need to replicate itself. At least as important, he contends, is staying alive: he writes, "Sex is so clearly separated from pure reproduction in humans — and there is so much interplay between sex and economics, and even between economics and reproduction in human life — that this 'human triangle' of sex, reproduction, and economics makes us the very least likely creatures on the planet to conform to ... evolutionary determinism." Eldredge is curator in the Department of Invertebrates at the American Museum of Natural History and a Supporter of NCSE.

Vaulting Ambition: Sociobiology and the Quest for Human Nature
by Philip Kitcher
Published in 1985, *Vaulting Ambition* sought to "explain as clearly as possible what sociobiology is, how it relates to evolutionary theory, and how the ambitious claims that have attracted so much public attention rest on shoddy analysis and flimsy arguments." While acknowledging the scientific contributions of sociobiology, Kitcher, a philosopher of science (and Supporter of NCSE), castigated what he called "pop" sociobiology for a lack of evidential and theoretical rigor. Such a lack is particularly important, he writes, because "the true political problem with socially relevant science is that the grave consequences of error enforce the need for higher standards of evidence."

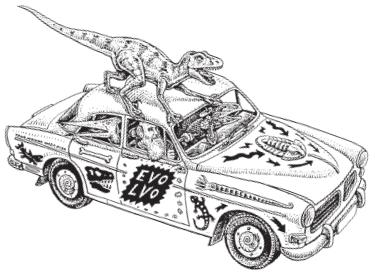
Not By Genes Alone: How Culture Transformed Human Evolution
by Peter J Richerson and Robert Boyd
From the publisher: "*Not by Genes Alone* offers a radical interpretation of human evolution, arguing that our ecological dominance and our singular social systems stem from a psychology uniquely adapted to create complex culture. Richerson and Boyd illustrate here that culture is neither superorganic nor the handmaiden of the genes. Rather, it is essential to human adaptation, as much a part of human biology as bipedal locomotion. ... In abandoning the nature-versus-nurture debate as fundamentally misconceived, *Not by Genes Alone* is a truly original and groundbreaking theory of the role of culture in evolution and a book to be reckoned with for generations to come."

Alas, Poor Darwin: Arguments Against Evolutionary Psychology
edited by Hilary Rose and Steven Rose
The authors whose essays appear in *Alas, Poor Darwin* argue that "the claims of evolutionary psychology rest on shaky empirical evidence, flawed premises, and unexamined political presuppositions." Included are essays by Dorothy Nelkin, Charles Hencks, Gabriel Dover, Mary Midgley, Stephen Jay Gould, Hilary Rose, Barbara Herrnstein Smith, Annette Karmiloff-Smith, Patrick Bateson, Anne Fausto-Sterling, Tom Shakespeare and Mark Erickson, Ted Benton, Tim Ingold, and Steven Rose. Richard Lewontin praised *Alas, Poor Darwin* as "a superb collection of essays debunking this latest attempt to hijack Darwin," adding, "Anyone who has been seduced by the claims of 'evolutionary psychology' should read this book."

About

Sense and Nonsense: Evolutionary Perspectives on Human Behaviour
by Kevin N Laland and Gillian R Brown
In *Sense and Nonsense*, Laland and Brown seek to introduce the ideas, methods, and results of the five main approaches of applying evolutionary theory to human behavior: sociobiology, human behavioral ecology, evolutionary psychology, memetics, and gene–culture evolution. Henry Plotkin (the author of *Evolution in Mind: An Introduction to Evolutionary Psychology*) writes, "Laland and Brown have written an up to date, blessedly balanced and refreshingly critical review of the application of evolutionary theory to the human sciences based upon the single, and surely correct, view that human behaviour is multiply determined." Laland and Brown are both researchers in the Department of Zoology at Cambridge University.

Defenders of the Truth: The Sociobiology Debate
by Ullica Segerstråle
Twenty-five years in the making, *Defenders of the Truth* offers a lively and comprehensive history-cum-analysis of the debate over sociobiology by a sociologist who followed it closely as it developed, interviewing such luminaries as Stephen Jay Gould, EO Wilson, Richard Lewontin, Richard Dawkins, and John Maynard Smith — who, Segerstråle writes, "are all defenders of the truth — it is just that they have different conceptions of where the truth lies." The reviewer for *Science* commented, "she provides details with an apposite quote each time one hero's cutting review strikes another's bloody helm, and the details accumulate into an epic whole." Segerstråle is Professor of Sociology at Illinois Institute of Technology.



NCSE on the Road

A Calendar of Special Events, Presentations, and Lectures

Date April 4, 2006
City San Francisco CA
Presenter Eugenie C Scott
Title The Pillars of Creationism
Time TBA
Event A talk for a symposium on teaching evolution at the Experimental Biology meeting of the Federation of American Societies for Experimental Biology.
Location Moscone Convention Center
Contact Peter Farnham, pfarnham@asbmb.org

Date May 8, 2006
City Seattle WA
Presenter Eugenie C Scott
Title What's the Fuss about Intelligent Design?
Time 7:00 PM
Event Public lecture
Location University of Washington
Contact Richard Olmstead, olmstead@u.washington.edu

Date May 21, 2006
City Orlando FL
Presenter Eugenie C Scott
Title The New Anti-Evolutionism and Science
Time 5:30 PM
Event A talk for a symposium on evolution education at the annual meeting of the American Society for Microbiology
Location Orange County Convention Center
Contact Ferric Fang, fcfang@washington.edu

NCSE Speakers Available

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Title NCSE Executive Director
Contact scott@ncseweb.org

Name Andrew J Petto
Title NCSE Board Member
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Evolution and the Biology of Morality

Douglas Allchin, University of Minnesota

Critics of evolution contend that there can be no basis for morality if only "selfish" natural selection acts. For them — and for many evolutionists, as well — Darwinism implies Social Darwinism. If humans evolved, many imagine, moral relativism follows. Of course, one cannot derive values — even absence of values — from facts alone. Still, if one accepts the evolution of humans based on other evidence, a historical question remains. How did (or might) the behavior we call moral originate in humans?

Speculations on the biology of morality are as old as the ideas of human evolution itself. Darwin himself reflected deeply on human nature. He documented his ideas in several notebooks, even before the publication of the *Origin of Species*. He devoted an entire chapter of his renowned *Descent of Man* to the origins of morality. Skeptics today may feel that science can say nothing informative about morality. Science deals with facts, not values. However, evolutionary study might explain how humans came to develop moral values. That knowledge might fruitfully inform moral discourse and thinking. A recent renaissance in biological and philosophical studies contributes to our growing understanding. They help address deep-rooted objections to evolution.

The Case of Vampire Bats

Consider, for example, vampire bats. They must eat every few nights to survive. What if one fails in foraging? Perhaps a neighboring bat has returned to the roost more successful those particular nights? Might it share? Watch carefully. The bat grooms the second bat, licking its fur and eventually its lips. Note the response. The second bat regurgitates a small amount of blood, nourishing the first bat. How could this be? Natural selection supposedly acts selfishly. Only traits that benefit the individual will be inherited. Surely vampire bats do not have some abstract notion of "the

continued from page 26

because those who should challenge it will not. Let EP earn its praise if it is merited, but it is not yet merited because it is undeniable that EP is not based on the contemporary genic selection principles it *claims* to be founded upon. Selfish-gene theory, as currently formulated, does not — cannot — support the claims of the evolutionary psychologists. Morality is not a biological adaptation. And free will is, as Darwin said, a delusion.

Evolutionary theory is not necessarily supposed to be easy to understand or to accept. It is, like any science, supposed to be about debate, honesty and the search for truth. When we make it otherwise it becomes no better than creationism.

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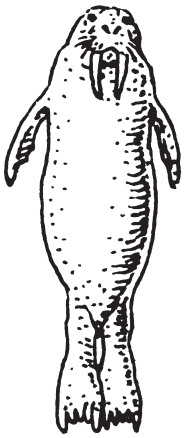
good of the species"? Is the vampire bat *moral*? How do biologists explain this paradoxical behavior?

First, expand your observations. Watch the bat colony on successive nights. Sooner or later, the second bat will face the same dilemma. Now the circumstance is reversed. Does the first bat reciprocate? Generally, *yes*. The trade seems complete. Both bats have survived by cooperating. Food sources are patchy. Not every bat succeeds every night. By sharing, each *individual* benefits, in accord with natural selection. Sharing, here, seems to be an *adaptation*.



But wait! Suppose one bat cheats. She begs for meals, but never "repays the favor." That individual would reap the benefit, while bearing no cost. The trait of cheating could proliferate in the population. Any system of sharing would collapse ... unless, of course, the bats are "wise" to cheaters. If they can recognize individuals and remember past events, they can learn if any specific bat does not reciprocate. Then the bat who cheats will *not* benefit. Tit for tat. A potential violator of the system is kept in check. The behavior persists.

This case opens many questions on the often overlooked biology of morality:

- What constitutes morality biologically?
- Do the bats share "knowingly"? Is intention important?
- Is denying cheaters a primitive system of justice?
- How did this sharing behavior evolve?
- Does this example offer clues for interpreting human morality?

For those who wonder about a naturalistic perspective on morality, addressing such questions is essential.

Three Concepts of Morality — and Three Biological Interpretations

What is morality, biologically? Simply put, it is a form of behavior. In this sense, one can begin to study it objectively, by observation. (One need not rely on uncertain introspection or speculation about mental states.) It thus fits in a standard biological curriculum along with studies of instinct, learning, social organization, animal communication and social dynamics.

The next challenge is: what concept of morality does one use? For centuries, philosophers have recognized at least three basic ways of conceptualizing morality:

- moral *acts,* evaluated primarily by their consequences or outcomes;
- moral *intentions*, evaluated by principled reasons or motives;
- moral *systems*, involving rewards and sanctions at the social level.

Each poses a different challenge. Yet each can be explained or addressed biologically.

Moral acts

For some, morality is about maximizing the ultimate good. "The greatest good for the greatest number," many say. Philosophers label such approaches utilitarian, or consequentialist. Biologically, one would assess specific behaviors. Here, what might matter is that as a result of sharing, more vampire bats survive.

In this view, altruism, or a nonselfish *act*, poses an evolutionary

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puzzle. In the competitive framework of natural selection, only traits that benefit an individual's fitness should persist. But many organisms seem to help others at their own expense:

- A Belding ground squirrel acting as sentry may alert others to an approaching predator, drawing attention (and greater risk) to itself while allowing others to escape.
- Florida scrub jays remain with their parents to help raise siblings, rather than raise offspring of their own.
- Honeybees work in a hive helping the "queen," not reproducing themselves.

Some altruistic acts, like the vampire bats' sharing, may be reciprocated. The ultimate benefit is mutual. The behavior is *both* selfish and cooperative. Does that negate its morality? If one measures morality by the act alone, only the overall benefit matters.

Other apparently altruistic acts may benefit the individual in a different context. The scrub jays ultimately benefit themselves. By staying at home, males secure better territories. Females can choose better mates. When sentries raise alarms, they may generate such confusing commotion that they, too, are safer from any predator. A biological perspective thus invites one to ask whether "unselfish" acts have hidden ("selfish") payoffs.

For honeybees, many social insects, and mole-rats, the "payoff" is hidden in the genetics. Honeybees, due to their chromosomal make-up, are more related to (share more genes with) their sisters in the hive than to their own offspring! In such cases, a honeybee that sacrifices its life "for the hive" benefits the long-term survival of its own genes indirectly. In the same way, a parent might sacrifice its life for a child under appropriate conditions. The ground squirrels, too, seem to be alerting their kin. Such "kin selection" can explain many apparently puzzling altruistic behaviors.

Although natural selection explains how certain behaviors originated, it does not determine any values. Traits that enhance survival and reproduction are "selected," but they are not thereby *valued*. Facts alone do not dictate values. "Is" does not imply "ought". The notion of "good" is a concept developed and discussed by humans. Values come from minds. Thus, for some, discussion of *acts* alone does not answer the fundamental questions about morality. One must address *intentions*.

Moral intentions

For others, then, morality is about good motives more than good outcomes. What matters is "conscience," or what Darwin called the "moral sense." Here, respect for others and honoring certain principles are fundamental. Philosophers call this general view deontology.

Do vampire bats choose consciously or deliberately? If so, the behavior appears ultimately "selfish." The exchange might be prudent, not motivated *morally*. (Of course, the same analysis might apply to humans who support some charity for tax reasons or are motivated to behave well merely by fear of punishment.)

Intention, too, seems to pose a fundamental evolutionary puzzle. Natural selection cannot project into the future. The process is *nonteleological*. Adaptations do not develop for some anticipated benefit. How, then, can an individual organism have purpose or imagine a desired outcome? Many organisms do, of course. Nervous systems and brains do this admirably. Memory allows expectation and even imagination based on past patterns, enhancing survival. *Valuing* is also a mental process. In this sense, the bats do seem to know crudely what their sharing means — inherent, for example, when they deny non-sharing roostmates. The response differs depending on the nature of the complex stimulus. There seems to be authentic *choice*.

Darwin's own interests focused on "the moral sense." He wondered about sympathy, for example, and what stimulus triggered it. Darwin studied how facial features could reflect internal mental states, such as pain or joy. His book *The Expression of the Emotions in Man and Animals* examined the ways in which organisms communicate feelings, even if unconsciously. Darwin believed that feelings aroused by an infant's distress, for example, would lead to parental behavior enhancing the lineage's survival. If such motivation was partly hereditary, as it is for hunger, thirst, or desire for pleasure, Darwin reasoned, emotions such as sympathy could evolve. Even dogs seem able to display shame or guilt, he noted: a simple moral feeling.

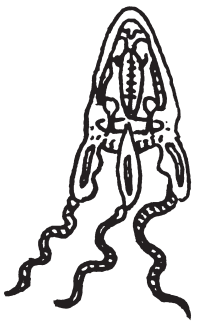
Moral systems

Finally, morality may be defined or conceptualized as a social system. This reflects the philosophical tradition of ethics as an implicit social contract. Here, an individual alone cannot establish an act or feeling as moral. Other organisms in the society acknowledge it as such. For example, the Golden Rule may express an expectation about mutual social relations. Morality would be evident in a system of rewards and punishments, for example.

In terms of evolution, moral systems may arise naturally in societies where:

- individuals can value or rate each others' behavior,
- they can learn and remember favorable and unfavorable acts, and
- they can reward or sanction others.

When individuals collectively reward "good" behavior and punish "bad" behavior, a set of social expectations — a definition of fairness, for example, or norm of truthtelling — is established. Individual behavior adapts to that social environment. The case of vampire bats is thus important because it seems to illustrate a simple system of justice among non-humans. Similar practices have also been observed in primates. In a colony of rhesus



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monkeys, where individuals call to the group when they find food, cheaters are again punished. They are more likely to be bitten, hit, chased, or rolled. As a result, cheaters eat less food. There are costs to deception. Social sanctions shape behavior.

If morality is fundamentally social, one would not expect to find a simple "morality" gene. Instead, moral values would all be learned. Likewise, ethical concepts and appropriate responses to feelings would all be reinforced through social incentives and disincentives. Biologically, organisms seem to exhibit a wide range of potential behavior. Depending on learning and motivational context, a society can potentially generate a serial killer as well as a philanthropist. Most important, perhaps, moral systems do not guarantee moral behavior. They merely generate the conditions that shape behavior.

Socially established values may potentially be quite complex in shaping behavior. With certain conditioning, even "self-sacrifice" or disregard for one's own survival could be taught and learned (whether one calls it terrorism or martyrdom). The nature of the system that evolved would depend on the organism's social organization and its history. For humans, this might involve the faculties of reason and foresight, as well as sophisticated communication of both ideas and emotions.

Ethics from Evolution?

Evolution seems able to explain how morality originated. It even seems able to explain how some behavior can be moral, while other is immoral. But can it say anything about moral principles? It is quite tempting to think so — and many have sought to make the connection. But no study of the way nature *is* can tell us how we *ought* to feel or what we *ought* to do. Still, the various evolutionary accounts may help us understand our moral resources and *how* we justify moral principles. Ultimately, it is humans who establish their own values, based on their own experience and interactions with one another. An evolutionary perspective thus leaves us with the very questions that have challenged moral philosophers for centuries: to articulate what we idealize as good and what we expect from one another.

Many assume that Darwinism implies Social Darwinism. They assume that if one accepts evolution as fact, one must forego beliefs in foundations of human morality. But this is a unjustified transition from facts to values. Charles Darwin himself was, by all biographical accounts, a gentle, moral man. Far from the Social Darwinist many take his theory to imply! On the contrary, Darwin was interested in understanding and explaining moral behavior. The doctrine of the "survival of the fittest" was not Darwin's. The phrase was coined by Herbert Spencer, who used it first in a social context. He voiced an ideology of Victorian England which ostensibly gave the upper classes a rationale to maintain their privilege. It was political ideology then as it is now. One can accept Darwinism in nature without adopting Spencer's doctrine for human society. As exemplified by the vampire bats, perhaps, morality is up to the society to define and to the individuals in it to secure it.

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Further Reading

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Hauser MD. 1992. Costs of deception: Cheaters are punished in rhesus monkeys. *Proceedings of the National Academy of Science USA* 89: 12137–9.

Huxley TH. 1893. Evolution and ethics. Available on-line from the Gutenberg Project, <http://www.gutenberg.org/etext/2940>.

Wilkinson GS. 1990. Food sharing in vampire bats. *Scientific American* 262: 76–82.

Recommended Reading and Viewing

De Waal F. *Good Natured*. 1996. Cambridge (MA): Harvard University Press.

Enjoy vivid anecdotes of primate behavior as a noted primatologist reflects on sympathy, rank and order, *quid pro quo* (tit for tat), and getting along.

Farber F. 1994. *The Temptations of Evolutionary Ethics*. Berkeley (CA): University of California Press.

A historian surveys the repeated efforts — and repeated failures — to justify particular human values from the facts of evolution. One chapter highlights Herbert Spencer, who introduced the phrase "survival of the fittest" and launched what is now known (misleadingly) as Social Darwinism. Here are the lessons for learning from our past mistakes.

Ridley M. 1996. *The Origins of Virtue*. New York: Penguin.

"Our minds have been built by selfish genes, but they have been built to be social, trustworthy and cooperative. This is the paradox this book has tried to explain," notes this lucid and personable science writer.

Stent GS, editor. 1980. *Morality as a Biological Phenomenon*. Berkeley (CA}: University of California Press.

This early volume maps how to reorient from morality as ideological rules to morality as behavior to be studied objectively. Topics include: phylogeny, analogs of cooperative sanction, fidelity, and so on, among nonhuman primates, psychology of prosocial behavior in early childhood, cognitive tools in moral decision-making, Asian perspectives on morality, and analysis of goal-oriented actions.

Sober E, Wilson DS. 1998. *Unto Others*. Cambridge (MA): Harvard University Press.

The two authors untangle, with philosophical sophistication, the evolutionary puzzle of altruism, notably teasing apart explanations at the level of genes and kin selection from motivations and psychological mechanisms.

The New Chimpanzees [video]. 1995. Washington DC: National Geographic Society.

Seeing is believing: compelling images of tool use and tool-teaching, organized hunting, grief, love of play, and infanticide all display — without anthropomorphizing — affinities of human behavior with that of our primate cousins.

and (of course?) Darwin's chapter on "the moral sense" in *The Descent of Man*.

Bush science is dangerous slope

The level of distortion of science is becoming quite high. The game of pushing a Christian agenda through public institutions is both terribly disingenuous and yet front and center. President Bush is seemingly sincere that his religious conversion and perspective is the right one. His born-again experience is public knowledge, as is his policy of breaking the barriers to religious influence in governmental programs. In Bush, the evangelical political movement got just the partner it wanted in the Oval Office.

Recently, speaking to his Texas constituency from the heart of the White House, Bush stepped over the line by announcing his support of ''intelligent design" in the teaching of natural history (*see p 13*). Said the President: ''Both sides ought to be properly taught ... so people can understand what the debate is about." He added,''You're asking me whether or not people ought to be exposed to different ideas, and the answer is yes."

The ''intelligent design" Bush is talking about begins with the biblical story of Genesis; it follows the particular story of the Christian biblical creation, with its inherent and particular logic. The hop from the parent concept of "creationism" to the concept-child named "intelligent design" is short indeed. The president's public testimony as a born-again Christian, following a long struggle with alcohol, is his foundational and inspirational driver for deepening the fundamentalist message from the bully pulpit.

The battle is an old one: religious conservatives, certain of their beliefs, argue that the opposite of their certainty is simply secular "relativism," which they portray as believing that all philosophies are equally valid. The hard-edged pundits on the right blast this charge constantly at the ''wishy-washy" liberals. Since the established science of evolution challenges directly the suppositions and timeframes of the biblical story, it becomes the object of attack — no matter how irrational, anti-scientific and utterly foolish the argument.

Fundamentalism of any sort leads to absolutist thinking, a derailing of public discourse in a democratic country. Now the argument — completely devoid of science and pretentious to the core — comes from the president of the most powerful country on earth. This is a source of worry for anyone in this country who can still appreciate empirical knowledge.

The President cannot be implying that we must explore "intelligent design" as a search for the creative genesis in nature and biology. Nor, as Shoshone Bannock columnist Mark Trahant pointed out recently, is he likely talking about the many complex, philosophical and wonderfully compelling Native creation stories, as recorded and retained in the tribal memories of the Americas.

Philosophical debate on the nature of human existence is one thing; again, there are many such stories from this hemisphere, many quite engaging and actually more suitable to peoples and places here than one imported from the far-away Middle East. It is quite another thing, as the

Bird Flu, Bush, Evolution – and Us

Steven Salzberg, University of Maryland

The emergence of the new, highly virulent bird flu is just the latest example of how the microscopic world is constantly evolving into new forms that threaten to devastate the human population. The seriousness of the threat was underscored yesterday by President Bush's announcement of a new $7.1 billion national preparedness plan.

To fight off this threat, we need to understand everything we can about the influenza virus. But even if we succeed completely in defeating the flu today, the problem is not going away. Not only will flu pandemics continue, but also we never know when a new disease such as SARS or West Nile virus will appear.

To keep ahead of these diseases, we need to continue our scientific research, and we need to educate our citizens about what they can do both to protect themselves and to help control the spread of disease. The current assault on the teaching of evolution greatly undermines our efforts to do this, now and in the future. If we stop educating our children about science, our society runs the risk of losing many of the wonderful advances that make our lives better.

Why has the debate about evolution re-emerged? Perhaps because few people see the obvious effects of evolution that geneticists and evolutionary biologists see every day.

Consider the influenza virus. Like many viruses, it mutates very fast, creating many slightly different strains that compete to see which ones can infect their host most efficiently. Each year, we create a new flu vaccine, which although not perfect, is very effective.

Why do we need a new vaccine every year? In a word, evolution. Each year, the flu accumulates many mutations, and some of those mutations allow it to avoid the existing vaccine. These resistant strains quickly take over — that's what Darwin meant by phrase "natural selection" — and become next year's flu strain. The same thing happens with bacteria, and this is why our over-use of antibiotics — in animal feed, hand soaps, and a growing number of other products — is hastening the evolution of frightening new antibiotic-resistant bacteria.

What about the feared bird flu, the H5N1 strain that has jumped from birds to humans and killed more than half the people it has infected? Most people do not understand that H5N1

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president has done, to propose that a quasi-religious evangelical theory be taught in schools as a science on the same plane as evolution, which is a vast, tried-and-true method completely interlaced within the biological and physical sciences.

No one can doubt that evolutionary science is complicated and at times difficult to absorb, given its calculus of biological changes and developments played out over vast stretches of time, but even this is part of the method through which, with critical assessment, a field of study can achieve answers to complex questions. It misinterprets the development of science over more than a century to propose that "creationism" or so-called "intelligent design," particularly if conceived from only one overwhelming religion, is an alternative to evolutionary theory.

Again, Bush's roots in the religious, evangelical mind-set appear to overarch the public reality of a democratic America. In 2004, across the political spectrum, some 60 scientists, led by several Nobel laureates and medical experts, requested that the present administration desist from distorting scientific fact to arrive at "partisan political ends." This is evident in a variety of issues relating to energy, the environment and natural resources, where the administration is unrelenting in what Robert F Kennedy Jr called a "campaign to suppress science that is arguably unmatched in the Western world since the Inquisition."

Once, important Western Christian thinkers saw their biblical exegesis in much broader terms. Not the literal but the broader, metaphorical implications of the Bible were the proper approach to its study. Evolution could fit then; it can make sense within the broader interpretations of Judeo-Christian-Islamic religions and even as a millennial guide to biological, geological or even historical fact-patterns.

In the context of creation stories, again, there are many from this hemisphere that are quite compelling. Just the wonderful narrative that names North America the great Turtle Island, from the eastern woodlands, proposes that the first human being was actually a pregnant female who fell from the Skyworld. The teachings of that story in the context of humans and the natural world are worth considering in these ecologically treacherous times.

Indian Country Today columnist John Mohawk this year published a succinctly edited book, *Iroquois Creation Story: Myth of the Earthgrasper,* which inspires with its clarity from ancient America. In fact, the Iroquois (Haudenosaunee) creation story is the living basis of the ceremonial cycles in the longhouses of several reservations, source of origin and the truth of existence for traditional Haudenosaunee. Yet, no one here is suggesting that it be taught as ''science" in the public schools.

Every Native culture across the hemisphere (and cultures from all over the world) would be in its right to line up, then, each with its origin story and each justifiably, as much as the Judeo-Christian Genesis, with its right to believe that its story is the true way that human beings came into existence.

Given the choice, we prefer the non-religious and secular space, such as public schools guided by universally shared scientific values and methods. Let each people have its religious approach and way of prayer. The other approach is a slippery slope to dangerous manipulation and intolerance. What little the various human cultures and societies have in common resides in the life of science and its search for open-minded truth.

[*Originally published as "Editors' report" in* Indian Country Today *2005; 25 (11) and reprinted with permission.*]

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is evolving not in people, but in birds. We do not yet know what genetic changes will turn this flu strain into a pandemic, but we do know that it will continue to evolve. Each time it jumps to humans, there's a chance that this one will be the new pandemic strain.

Scientists in my lab and others can tell you that developing a vaccine for the flu absolutely requires that we understand its evolution. We can also tell you that the flu does not "care" if we believe in evolution. It will keep evolving anyway, and it will kill us if we ignore it.

A major misconception about evolution is that it is a theory of the origin of life. It isn't. It *is* about the origin of species. It does not explain how life came to be in the first place, but rather it explains how, once life appeared, it separated into distinct forms that led to the wonderful diversity of life on our planet. (Darwin himself believed that the first life was put here by a divine being.)

The evidence for evolution is overwhelming and increases every year. Among the many astonishing things we have learned through the sequencing of the human genome is that we share hundreds of genes with the lowly *E coli* bacterium. These genes are so essential to life that their DNA has been preserved for two billion years, and today we can read the evidence in our genomes.

Several polls have reported that a majority of Americans believe that religion-based alternatives to evolution should be taught in science classes in our schools. These polls are called evidence that perhaps we should teach these alternative views. Reporters and pollsters deserve much of the blame here: Science is not like politics, where outcomes are determined by polls. Another recent poll revealed that less than half of the US population knows that the earth revolves around the sun. Does this mean we should teach that the sun revolves around the earth? What these polls do highlight, sadly, is the failure of science education. Of course it would be a huge mistake, and a disservice to our children, if we used polls to decide what to teach in school.

Let's drop the artificial debate about evolution and "intelligent design" and teach our children what science really is. Let's teach them that science requires a skeptical mind and that scientific theories must be supported by objective facts. If we want to teach children about scientific debates, let's pick a real debate — there are plenty of them — rather than an artificial one. And let's equip the next generation of scientists to bring us new cures and new technology, rather than burying our heads in the sand.

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Evolution is a winner – for breakthroughs and prizes

James McCarter

In 1965, the young American scientist Leland Hartwell had to make a decision crucial to his research on understanding how cells divide, a key step toward curing cancer.

Hartwell had to decide whether to place his bet on simple single-celled organisms like baker's yeast, which were easy to study but might be too distantly related to humans for the information to matter. Or he had to cast his lot on cells from humans and mice, which were clearly relevant but difficult to study. Hartwell gambled that over the course of evolution, certain genes would be so important that natural selection would conserve their key features, making them recognizable even between yeast and humans. Over the next few decades, this speculation was confirmed, and in 2001 Hartwell was awarded the Nobel Prize.

The importance of evolution to Hartwell's work exemplifies a key perspective that has been overshadowed by recent attacks on science and evolution from creationist ideologues advocating "intelligent design". While it is essential to explain the flaws in the pseudoscience of "intelligent design" and to review the overwhelming evidence supporting the facts of evolution, such discussions of fossils and extinct species can seem irrelevant to everyday concerns. So let's focus on some of the many practical applications of evolution in an area that matters to all of us: breakthroughs in medicine.

Evolution, in addition to being solid science, provides us with a practical and powerful tool-kit. Applied techniques based on evolution play central roles in the biotechnology industry, and in recent advances in genomics and drug discovery. Bioinformatics, the application of computers to biology and one of the hottest career opportunities in science, is full of evolution-based computer code. Tens of thousands of researchers in the multibillion-dollar field of biomedical research and development use evolution-based discoveries and concepts as a routine part of their important work.

For instance, our interpretation of the human genome is largely based on comparisons to genomes of other species. Coincidentally, the statement by President George W Bush in support of teaching "intelligent design" (*see p 13*) occurred just weeks before the publication of the chimpanzee genome, work led by Washington University's Genome Sequencing Center.

In a peer-reviewed article, many of the same world-renowned scientists responsible for sequencing the human genome presented in detail the differences between the DNA of humans and chimps. Consistent with chimpanzees' being our closest living relatives, the researchers reported that across billions of bases in the genomes, about 97.4% of the human and chimp DNA is identical. And the differences in the remaining 2.6% are fascinating, showing the signatures not of creation or design but of evolution. The DNA sequence differences show change driven over the last 6 million years by the forces of mutation and natural selection, from the selection for genes that aid in our defense against infection to the movement of transposable elements (parasitic DNA).

To see the integral role of evolution in biomedical research, consider Nobel Prizes, a good indicator of the most important breakthroughs in biology. Reviewing the last 50

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NATIONAL SCIENCE TEACHERS ASSOCIATION RESPONSE TO PRESIDENT BUSH

The National Science Teachers Association (NSTA), the world's largest organization of science educators, is stunned and disappointed that President Bush is endorsing the teaching of intelligent design — effectively opening the door for nonscientific ideas to be taught in the nation's K–12 science classrooms.

"We stand with the nation's leading scientific organizations and scientists, including Dr John Marburger, the president's top science advisor, in stating that intelligent design is not science. Intelligent design has no place in the science classroom," said Gerry Wheeler, NSTA Executive Director.

On Monday, Knight Ridder news service reported that the President favors the teaching of intelligent design "so people can understand what the debate is about."

"It is simply not fair to present pseudoscience to students in the science classroom," said NSTA President Mike Padilla. "Nonscientific viewpoints have little value in increasing students' knowledge of the natural world."

NSTA strongly supports the premise that evolution is a major unifying concept in science and should be included in the K–12 education frameworks and curricula. This position is consistent with that of the National Academies, the American Association for the Advancement of Science, and many other scientific and educational organizations.

[*From a NSTA press release issued August 3, 2005. Available on-line at <http://www.nsta.org/main/news/stories/nsta_story.php?news_story_ID=50792>.*]

years of Nobel Prizes in medicine or physiology, I asked, "Is training in evolutionary biology necessary for a thorough understanding of the award-winning discoveries and work resulting from each breakthrough?" By my criteria, understanding of evolution is necessary in 47 of 50 cases. From vaccines, viral cancer genes, and nerve cell communication to drug trials, and genes controlling cholesterol and heart disease, evolutionary insights are crucial.

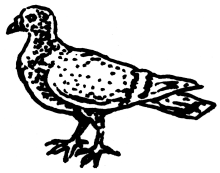
In Hartwell's case, a bet on the simple yeast cell revolutionized our understanding of how cells of all organisms replicate. Versions of most of the genes found in yeast cells by Hartwell and his co-recipients Tim Hunt and Paul Nurse were later found in humans. Despite over a billion years of evolution since they diverged from their common ancestor, humans and yeast still maintain similar gene-encoded machinery for cell replication. Drugs aimed at this replication machinery are currently in clinical trials for the treatment of breast, lung, kidney and other cancers.

In Kansas, backers of "intelligent design" have scoffed at the idea that watering down the evolutionary biology curriculum would have a negative effect on that state's fledgling biotech industry.

What does evolution have to do with biotechnology? As the president of a biotech firm in St Louis, I can tell you that evolutionary biology is an integral part of what we and other companies do. I hire scientists who are well-trained in molecular evolutionary biology; who know how to recognize the business end of enzymes simply by looking at DNA sequences; who know which changes in a protein are important; who can design research tools based on the way a species manipulates the genetic code. Today, these skills are as important to discoveries in the laboratory as knowing how to use a microscope, and it takes an understanding of evolution to master them.

Creationists ask, "Do you really think an ape was your ancestor?" Biologists are actually saying something much more profound. From anatomists, biochemists and immunologists to molecular biologists, neurobiologists and cell biologists, we are stating that all aspects of biology support the conclusion that humanity shares ancestry not only with primates, but with mammals, reptiles, fish, insects, worms, plants, and yes, even yeast and bacteria. We have evolved as part of one inseparable living world — one ancient tree of life that inhabits this planet. And for many scientists of diverse religious traditions, this realization does not pose the conflict with their faith that fundamentalist ideologues assert.

Americans, in addition to being a passionate people of many faiths, are also practical people. We are innovators who expect to lead the world in medical breakthroughs and products. Open-minded Americans must know that the assault on evolution in the science curriculum not only puts at risk our understanding of natural history, ecology and environmental change, but also jeopardizes the science literacy of our students and our international competitiveness in making biomedical breakthroughs of Nobel-Prize caliber. Americans have been awarded the Nobel Prize in Medicine in 39 of the last 50 years. At a time when we face international competition that is more intense than ever, a good start toward success is to put the attacks on evolution, biology, and science behind us.



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Chimpanzee Genome Sequenced

The common chimpanzee was highlighted in the September 1, 2005, issue of *Nature*, which featured the eagerly anticipated draft genome sequence of *Pan troglodytes*. Chris Gunter and Ritu Dhand (*Nature* 2005 Sep 1; 437: 50–1) commented:

> Until now, genome sequence information has shown us how many seemingly very different organisms are amazingly like humans. At a conservative estimate we share about 88% of our genes with rodents and 60% with chickens. ... So it's no surprise that we are still asking, "What makes us human?" To apply genomics to this quest, we need to shift the focus to look at our closest living relative, the chimpanzee. Given that we share more than 98% of our DNA and almost all of our genes, chimps are the best starting point to study not the similarities, but the minute differences that set us apart.

In addition to the draft genome sequence and three further research papers on the chimpanzee genome, the same issue of Nature contains a report on the first unequivocal fossil evidence of the genus *Pan* as well as a suite of articles reviewing recent work on chimpanzee culture, behavior, psychology, neuroanatomy, and neurogenetics — a wealth of material, in short, for the chimpanzee enthusiast.

[Nature*'s ensemble of literature on the chimpanzee, including the contents of the September 1, 2005, issue as well as work previously published in Nature, is available on-line at <http://www.nature.com/nature/focus/chimpgenome/index.html>. A portion of the material is available only to subscribers to the journal.*]

BOOKREVIEWS

Speciation

by Jerry A Coyne and H Allen Orr
Sunderland (MA): Sinauer Associates, 2004. 525 pages

Reviewed by Norman A Johnson, University of Massachusetts, Amherst

Although Darwin's *Origin of Species* provided compelling evidence for evolution and showed that it could occur via natural selection and other natural processes, ironically it said little about how species originate. Speciation as a subject of active research started during the 1930s and 1940s during the fusion of Mendelian genetics and Darwinian evolution that is known as the Modern Synthesis. The founders of this Modern Synthesis (notably Theodosius Dobzhansky and Ernst Mayr) viewed species as populations that could interbreed with each other but which were reproductively isolated from other populations. Under this definition, which Mayr called the Biological Species Concept (BSC), speciation is the acquisition of reproductive isolating barriers. These barriers can be premating, such as when behavioral differences cause females of one nascent species to reject males of the other, or postmating, such as hybrid sterility.

Studies of speciation, particularly the genetics of speciation, languished for several decades after the pioneering works of Dobzhansky, HJ Muller, and their associates. This lack of attention was due in part because speciation studies were overshadowed by such topics as measuring the extent of genetic variation within and among populations and the developing methodologies to determine evolutionary relationships. Starting in the 1980s, evolutionary biologists, using classical and molecular techniques, began paying increasing attention to speciation and its underlying genetics. Today speciation is once again at the forefront of evolutionary research.

Although there have been a couple of excellent edited volumes on speciation and monographs on various aspects of speciation published in the last 20 years, there had been no comprehensive account of studies in speciation since before the speciation "renaissance" until now. Jerry Coyne and Allen Orr, who have alone and together made several seminal discoveries in speciation, have written a magisterial, comprehensive volume, simply called *Speciation*. Their book contains at least 1600 references, many of which are from the 21st century. Had Coyne and Orr just published their annotated bibliography, that would be a great service for professional evolutionary biologists and their students. But they do so much more!

Coyne and Orr begin by addressing whether species are real or just arbitrary constructs of the human mind. It's not surprising that Coyne and Orr think that species are real and not just constructs — after all, if they didn't think species were real, why would they write a 500-page book on the formation of new species? What is more of interest is the nature of the evidence used to support the reality of species. One line of evidence is based on folk taxonomy — indigenous peoples categorize nature into species almost exactly in the same way that professional biologists do. Intriguingly, folk taxonomy breaks down with the higher taxa: indigenous peoples and biologists don't recognize the same genera and higher levels. The other line of evidence is based on statistical identifications of clusters using either morphological or molecular data. Although we sorely need more of these studies, the current studies allow us to draw the tentative conclusion that species are real.

Although a variety of other species concepts have proliferated since the modern synthesis, Coyne and Orr support a modified version of the BSC: "distinct species are characterized *by substantial but not necessarily complete reproductive isolation*" (p 30, emphasis theirs). They state their reasons for supporting the BSC in chapter 1 and in a very detailed appendix on species concepts. Aside from these two sections, Coyne and Orr use the evolution of reproductive isolation as a proxy for speciation.

The standard view of speciation is that populations that are separated by geographical barriers genetically diverge from one another via mutation, natural selection, and other evolutionary forces. Without the geographical barriers, gene flow among populations can counteract this divergence. In addition, reproductive isolation usually is not in itself adaptive but is instead a byproduct of that genetic divergence, which may or may not be adaptive. Evolutionary biologists generally accept that speciation often occurs as per this standard view but hold that speciation can occur via other means. As Coyne and Orr illustrate, debates about speciation are usually about the importance of various alternative modes of speciation.

To what extent can speciation occur in the absence of geographic barriers? In recent years, there has been what Coyne and Orr describe as a "wave of enthusiasm" for "sympatric speciation", reproductive isolation evolving despite the diverging populations' being in the same place. Proponents of sympatric speciation have said that it may be a rather common mode of speciation, especially for plant-eat-

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ing insects and cichlid fish in crater lakes. Coyne and Orr conclude that this current enthusiasm is hard to justify based upon the data at hand. In their critique of possible cases of sympatric speciation, the authors demand a much higher standard of evidence for the claim that the speciation took place in sympatry than they do that it took place in allopatry. Their rationale for this higher standard of evidence is that "… it seems reasonable to accept a controversial standard only when it appears more likely than a well established one" (p 142), and sympatric speciation is controversial. A substantial part of the debate between those who are enthusiastic about sympatric speciation and those like Coyne and Orr who are more skeptical revolves around standards of evidence.

Can reproductive isolation be adaptive and not just a byproduct of divergence? In the 1940s, Dobzhansky championed a mode of speciation in which premating isolation can evolve when two formerly allopatric population that have developed some postmating isolation meet again. In what has become called "reinforcement", selection works to reduce the number of "mistakes" females make in mating with males of the other nascent species. During the 1970s and early 1980s, theoretical models and a lack of solid case examples led most evolutionary biologists to reject reinforcement as a plausible mode of speciation. Starting in the late 1980s and spurred by some of Coyne and Orr's own research, there has also been a wave of enthusiasm for reinforcement. Reinforcement does better than sympatric speciation from Coyne and Orr's critical review of the evidence, but the authors do caution that not all (or even most) premating isolation has evolved via reinforcement.

In their final chapter, Coyne and Orr tackle the relationship between speciation and evolution at levels above the species (macroevolution). Are there evolutionary trends that cannot be predicted by examining selection within species? If so, the species would be a level of selection above the individual. The existence of species selection has been a major debate with paleontologists (such as the late Stephen Jay Gould) generally championing species selection and population geneticists generally being more skeptical. Coyne and Orr argue that the presence of biological traits that facilitate or impede speciation would be evidence of species selection and demonstrate that there are such traits. In the concluding two sentences of the book (excluding the appendix), they state: "Those who continue to debate the possibility of species selection fail to realize that comparative studies have already settled the issue. What remains is to determine how often this type of selection has shaped evolutionary trends" (p 445).

In addition to these intellectual questions, Coyne and Orr explore detailed studies of particular isolating mechanisms, in particular hybrid sterility and hybrid inviability. In fact, these are among the most interesting sections of *Speciation.* Coyne and Orr demonstrate that real progress has been made along several fronts in the last two decades, including studies of the numbers of genes involved in reproductive isolation, the localization of these genes to ever-smaller chromosomal regions, and the identification of what a handful of these genes actually do. These genes that contribute to hybrid sterility and inviability appear to have a variety of functions, but most probably have some role in the regulation of other genes. In addition, molecular evolution studies find that these genes all show the hallmarks that show that natural selection operated on them. Hybrid sterility and inviability thus are often the byproduct of adaptive rather than neutral divergence.

Although most of the work on the genetics of speciation has been with fruit flies of the genus *Drosophila* and Coyne and Orr are committed Drosophilists, their book is taxonomically diverse, at least within animals and plants. While an excellent book for professionals and graduate students in the area, *Speciation* would be hard going for the non-specialist. While there are few typos and the figures are well done, more illustrative and instructive diagrams would have been useful for non-professional readers. Hopefully, these changes would be made in an update. And updated regularly this book should be! One of the most attractive features of *Speciation* is that is directs us to where new studies should be headed. It will be interesting to see how the field develops and how subsequent versions of *Speciation* cover it.

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Law, Darwinism, and Public Education: The Establishment Clause and the Challenge of Intelligent Design

by Francis J Beckwith
Lanham (MD): Rowman & Littlefield, 2003. 177 pages

Reviewed by Todd Mollan, Bradley J Cosentino, and Jason J Williams

In *Law, Darwinism, and Public Education* (*LDPE*), Francis Beckwith analyzes the legality of teaching "intelligent design" (ID) in United States public schools. He uses the landmark decision of *Edwards v Aguillard* and several related cases to make inferences about Supreme Court jurisprudence related to ID. He also extensively discusses ID as it relates to creationism and evolution. The book is meticulously well researched, and the ideas are pre-

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sented in a clear and straightforward manner. However, the subtext of the book is plainly that ID is legitimate science, and that teaching it in public schools should be found constitutionally acceptable. In advocating this view, the book fundamentally mischaracterizes certain aspects of evolutionary theory. Though Beckwith maps out some of the relevant legal issues for teaching ID in public schools, his analysis is noticeably biased in several key sections.

The book is divided into an introduction and four chapters. In the introduction, Beckwith briefly informs the reader of some of the main tenets of ID, but spends most of his time listing notable intellectuals, institutes, scholarly works, and political leaders supportive of ID. The list gives a misleading view of ID's scientific validity, as an overwhelming majority of the works cited are popular pieces rather than empirical and peer-reviewed. Further, while ID has clearly gained more attention within mass media and academic circles, that attention has not always been positive. Beckwith concludes his introduction by setting forth the question he attempts to answer in his book: "Given the Supreme Court's holding in *Edwards*, would a statute or government policy requiring or permitting the teaching of ID in public schools violate the Establishment Clause of the First Amendment?" (p xxii).

In chapter one, Beckwith purports to clarify and define important terms and review prior court cases. Unfortunately, he adopts a remarkably broad definition of evolution. He defines it as "… the view that the entire universe and all the entities in it can be accounted for by strictly material processes …" and as a "grand materialist explanation" in which "… there is neither need, nor room, to fit any nonphysical substances or properties…" (p 5–6; citation omitted). Throughout the book, the breadth of this definition causes serious problems for *LDPE*.

First, courts have not previously recognized evolution as synonymous with materialism. Beckwith observes that the holdings of *McLean v Arkansas* (p 21) and *Peloza v Capistrano School District* (p 62), as well as Justice Powell's comments in *Edwards v Aguillard* (p 55–6), did not use this definition of evolution. Moreover, the Louisiana Balanced Treatment for Creation-Science and Evolution-Science in Public School Education Act was struck down because its definition of evolution stipulated "… scientific evidences for [creation or evolution] and inferences from those scientific evidences" (p 50; citation omitted).

Second, although Beckwith believes his definition is accurate (and therefore that the definition used in the cases above is wrong), he clearly mischaracterizes evolutionary biology. Neither evolution nor any other individual scientific discipline provides an overarching, cosmological explanation of universal origins and processes. Beckwith says that evolution is a "view [concerning] … the entire universe and all the entities in it" (p 5). However, evolutionary biologists do not investigate the stock market, supernovas, or quarks, for instance, though these are certainly included in "the entire universe and all entities in it" (p 5).

Third, Beckwith assumes that the science of evolution entails specific philosophical worldviews (that is, materialism and atheism). Yet even Pope John Paul II, who clearly did not subscribe to the exclusive materialism entailed in Beckwith's definition, affirmed scientific evolution and recognized that materialism is not the only possible underpinning:

> Rather than the theory of evolution, we should speak of several theories of evolution. On the one hand, this plurality has to do with the different explanations advanced for the mechanism of evolution, and on the other, with the various philosophies on which it is based. Hence the existence of materialist, reductionist and spiritualist interpretations. (John Paul II 1996)

Furthermore, Beckwith's interpretation fails to distinguish between evolution as a science and as a secular religion (Ruse 2003: 1524). This is an especially important distinction in the context of this book, for it is science, not materialism (or any other secular worldview that could be inferred from evolution), which is actually taught in science classrooms, despite Beckwith's claims. Beckwith's chosen definition becomes a recurring problem and in chapter 3 leads him to pursue some bizarre philosophical arguments for ID (such as "Souls, minds, and essences" [p 103], "Moral claims and properties" [p 105], and so on), in addition to summarizing standard ID fare (such as "specified complexity" [p 107], "irreducible complexity" [p 110], and so forth).

Beckwith's biases are far less pronounced in chapter 2, which is devoted mainly to providing a judicial history of *Edwards* as well as an analysis of the Court's majority, concurring, and dissenting opinions in this case (p 49). Chapter 2 also discusses several lower court cases. Beckwith cites apposite cases and critiques the opinions supporting the holdings. One of the major problems he struggles with, however, is distinguishing between an intelligent designer and a divine creator. Since binding legal authority strongly and uniformly militates against teaching about a divine creator in public schools, Beckwith has a lot of work to do to show that teaching about an intelligent designer in public schools is permissible. Indeed, the holdings for each of the main cases he cites in chapter 2 are discouraging for ID advocates.

In *Edwards*, for instance, the Supreme Court invalidated an act that prohibited the teaching of evolution unless accompanied by creation science. In *Webster*, *Peloza*, and *LeVake*, the courts severely limited high-school teachers' freedom to teach alternatives to evolution or non-evolutionary theories of creation. In the last main case cited in this chapter, *Freiler*, the Court invalidated a disclaimer stating that the teaching of evolution is not intended to dissuade high school students of the biblical version of creation or any other concept.

In keeping with the chapter's stated purpose of merely providing a judicial overview, Beckwith

does not spend much time expounding on how these cases may be distinguished or overruled. However, he makes it apparent that the Establishment Clause is very hostile toward laws that promote or permit teaching about a creator or an intelligent designer. This is undeniably a serious problem for ID proponents — one that is perhaps tacitly acknowledged in Beckwith's highly qualified conclusion to chapter 2, where he states that nothing in these cases, "*when [their narrow holdings] are rightly understood*, would prohibit, *in principle*, the teaching of ID in public schools" (p 78; emphasis added).

Finally, after describing ID and pursuing a few unusual philosophical arguments in chapter 3, chapter 4 provides us with the central conclusions of the book. In this chapter, Beckwith argues that a carefully drafted statute for teaching ID would probably not run afoul of the Establishment Clause. His stated approach is to look at the constitutional definition of religion and then to ask whether ID is a religion. Beckwith concludes that the relevant cases do not provide a clear constitutional definition of religion, but that Christianity, Judaism, and Buddhism are paradigms of religion. This part of the chapter seems evenhanded and informative, though it is curious to note that even if ID is not a religion, it still may be unconstitutional to teach it in public schools (for example, old-earth creationism is not a paradigm of religion, yet it is still unconstitutional to teach it in public schools). Thus, it is not entirely clear why this framework is helpful to *LDPE*'s stated goal.

Regardless, in the second section of chapter 4, Beckwith initially spends some time trying to convince the reader that evolution and ID provide different answers to the same question (that is, what is the origin of apparent design in biological organisms and/or other aspects of the natural universe?). Then he explicitly sets forth the reasons that the statute in *Edwards* was struck down, and argues that these reasons do not apply to ID. Beckwith's *a priori* commitment to his own views reaches perhaps the highest volume in these pages. He looks at the doctrines used in *Edwards* and other Establishment Clause cases, and roundly concludes that teaching ID in public schools is constitutionally acceptable under almost every test. Moreover, Beckwith by implication characterizes academics and mass-media articles that cast ID in a negative light as narrow-minded near the end of the section. He says that they are guilty of professional marginalization, and likens the editor of *Scientific American* to Tony Soprano.

In the end, several common approaches seem to stand out in Beckwith's analysis: (1) overstate evolution so that it looks theoretically extremist and absurd; (2) make ID look more moderate and like a mere secular criticism of evolution; (3) attack the rationales of cases unfavorable to creationism; (4) analogize ID to evolution in order to show that it is no more religious than evolution; (5) argue that ID is not a religion and that it is a purely secular theory; and (6) argue against those who do not embrace ID without presenting their views adequately. These approaches undercut the credibility and persuasiveness of *LDPE* because they run counter to the book's stated goals. That is, *LDPE* purports to provide legal analysis aimed at answering important questions, but its argument are based on an overly-broad, overwhelmingly unaccepted definition of evolution, and therefore the book's conclusions are contingent on accepting Beckwith's unorthodox views. Overall, *LDPE* is more an argument against materialism and naturalism (and therefore *all* of science) rather than an analysis of ID's legality in public schools.

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Why is a Fly not a Horse?

by Giuseppe Sermonti
Seattle: Discovery Institute Press,
2005. 176 pages

**Reviewed by Andrea Bottaro,
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Medical Center**

At the ripe age of 80, Giuseppe Sermonti can hardly be considered the new kid on the block of creationism, even more so because he has been pushing his personal brand of anti-evolution, an idiosyncratic brew of supernaturalism, structuralism, and postmodernist anti-rationalism, already for a couple of decades. Judging by the treatment this retired Italian genetics professor recently received in the United States by the local creationist "intelligent design" honchos, however, one would be almost forgiven for thinking that Sermonti might be the movement's next star. Much of the newfound enthusiasm is, I suspect, due to his editorship of *Rivista di Biologia/Biology Forum*, a third-tier but historical and, importantly, ISI-indexed biology journal which he has turned into a haven for all sorts of creationist and anti-Darwinian material. Sermonti's *Rivista* provides "intelligent design" advocates a much-needed back door to the "mainstream scientific literature" without the inconvenience of proper peer-review — a unique opportunity that they have already started to exploit. Hard on the heels of Sermonti's trans-Atlantic travel to appear at Discovery Institute-sponsored lectures and as an "expert witness" at the Kansas anti-evolution hearings, now comes a translation of his book *Dimenticare Darwin* ("To forget Darwin"), published by none else but the Discovery Institute itself, under the title *Why is a Fly not a Horse?*

Despite the back-cover claim that the book is "loaded with sci-

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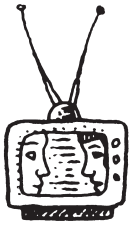
entific facts," it can hardly be called a scientific treatise. In fact, the book lacks any coherent thread, any substantial argument that is logically developed. In its place, two main ideas reverberate and echo throughout the book: first, that modern evolutionary theory and the current mechanistic models of development — indeed, the scientific method itself — are utterly inadequate to explain biological form in all its fascinating and rich complexity, and second, that abstract form exists apart from, and precedes — indeed *must* precede — its physical ontogenetic and phylogenetic realization. Sermonti bounces these two ideas around, roaming across themes as diverse as fractals and paleoentomology, prions, and anthropology. This could have even been an instructive approach, if it were not for the fact that the treatment is mostly superficial, and often outright misleading, practically overwhelming the reader with an avalanche of factoids, pseudo-claims, and anecdotes which, due to the general lack of proper citations and attributions, a general reader will not even be equipped to confirm and evaluate properly.



The lack of citations is actually strategic, because for the most part Sermonti runs through the usual gamut of well-known creationist rhetorical arguments and scientific misrepresentations (key transitional forms are missing, no models exist for the origin of genetic information, evolution contradicts the Second Law of Thermodynamics, natural selection is a purely conservative force, and so on), sometimes with highly personal twists, such as his creative claim that the evidence indicates that *Homo sapiens* appeared first (and abruptly) among hominids, and that all other fossil hominids and extant great apes are its degenerate forms. When support for an argument is missing, Sermonti does not turn away from inventing some, for instance when he argues that modern evolutionary theory, via its adherence to the "Central Dogma" of molecular biology, posits that DNA must act as a thermodynamically closed system (and therefore is subject to the Second Law).

In most cases, Sermonti's arguments are based on mere misrepresentations or cherry-picking of the existing evidence; I can't say whether intentionally or due to ignorance. Thus, the finding that homologous "master" genes (hox genes, pax6) can drive similar developmental programs in morphologically different organisms is cited as a strong argument that morphological differences cannot be genetic in origin, but must be due to "some vague 'field' that unfolds to the point of being the very form of a fly or a cat" — a view, Sermonti assures the reader, that is "gaining ever wider support" (which may be news to developmental biologists). Later, he claims that leaf insects, or phasmids, predated the appearance of the leafy plants they mimic (angiosperms) in the Cretaceous. This is simply false.

First, there is no fossil evidence at all of Phasmida before the radiation of angiosperms. Second, the Permian fossil insects of the order Protophasmida, which Sermonti cites as problematic evidence, do not particularly mimic sticks or leaves, and certainly not angiosperm leaves. (As Sermonti notes with characteristic suspicion for scientists' motives, they are unfortunately named: they are not even related to modern Phasmida at all.) Third, leafy plants, such as ferns and gymnosperms, existed in the Paleozoic anyway, and with visual predators such as amphibians and early reptiles around, it would hardly be a surprise if some insects did find an advantage in forms of camouflage. Sermonti says, "The entomologists I have consulted prefer to gloss over the phasmids." Quite possibly, he simply did not like their answers.

Also on an insect topic, Sermonti cites as another case of impossible evolutionary "premonition" the fact that most of the extant insect mouth apparatuses existed before angiosperms (Labandeira and Sepkoski 1993). He asks, "How did it happen that these complex and delicate apparatuses existed millions and millions of years before they had a job to do?" The straightforward answer is, because they had a job to do on non-angiosperm plants, as highlighted by the damage detected on plant fossils.

A review paper by Labandeira (1998) describes insect feeding modes for which Paleozoic evidence already exists: "spore feeding and piercing-and-sucking" (extending to the early Devonian), "[e]xternal feeding on pinnule margins and the intimate and intricate association of galling" (in the Carboniferous), "hole feeding and skeletonization" (in the early Permian), "surface fluid feeding" and possible but inconclusive evidence of "mutualistic relationships between insect pollinivores and seed plants" by the end of the Paleozoic. In other words, insects pierced, sucked, gnawed, crushed, lapped, imbibed, scraped and otherwise fed on non-angiosperm plants then, much as they do on angiosperms today (the only exception being the current highly specialized flower-feeding apparatuses, whose appearance in the fossil record not surprisingly overlaps that of flowering plants).

Quite amusingly, these supposed entomological "evolutionary mysteries" so struck "intelligent design" advocate and biochemist Michael Behe's fancy that he made them the centerpiece of his endorsement of Sermonti's book: "With charming prose Sermonti describes biology which contradicts Darwinian expectations: leaf insects before leaves, insects before plants [*sic*] …" It would have taken Behe some basic knowledge of biology and paleontology and a few hours of checking the appropriate literature to figure out the facts. Perhaps Behe blindly trusted Sermonti's scholarship, but he should have asked the book's editor (Jonathan Wells of *Icons of Evolution* fame) and translator first, who (to their credit) went to the trouble of correcting several banally gross errors from the Italian version of the book (such as the claims that all animal phyla, including Protozoa, Porifera, and Cnidaria, appeared in the Cambrian, and that there are no known fossil transitional forms in cetacean evolution).

The alternative view of the biological world Sermonti proposes has less to do with science, even anti-Darwinian structuralism, and

more with some sort of passive, contemplative mysticism. Ultimately, Sermonti seems to suggest, we should just marvel at nature's intricacies, and give up on trying to understand it with our faulty tools: "The budding flower of the world is a cathedral of cathedrals, and it remains to us to bend our knee and say '*Domine, non sum dignus*'".

I am all for being transported by contemplation of nature at times, but Sermonti is not St Francis, and his anti-scientific approach ultimately sounds alternatively resentful (of the veil-piercing successes of science) and defeatist (of its future prospects). The goal of Sermonti's approach, however, is not knowledge but, as he states in a 1996 open letter to Rupert Sheldrake in *Rivista di Biologia* (Sermonti 1996), to endow the modern world with an "enchanted and magic aura" (interestingly, Sermonti is also the author of several books and articles of literary criticism of fables and fairy tales).

If one has to look for a positive aspect in the book, it may reside in the exposure of creationist and "intelligent design" readers to some of the more respectable structuralist ideas, which although limited may be something not often encountered in their pamphlets. As one of the founders of the Osaka Group, Sermonti should at least have a reasonable understanding of structuralism. Alas, he barely runs through the topic in a couple of chapters (most effectively in the one entitled "Prescribed forms of life"). He talks about D'Arcy Thompson and even describes Brian Goodwin's more pragmatic approach to structuralist embryology, only later to essentially apologize for its empirical nature, and fall back on empty fluff such as Rupert Sheldrake's "morphic resonance" and the "inherent collective memory" of natural systems.

So, all in all, between the poor arguments, the many errors, and the misrepresentations, what is left of this book to leave a mark on the reader is the "charming prose" Behe alludes to. Certainly Sermonti loves to turn out flourishing phrases and rich descriptions — possibly even too much for many English readers, more used to terse and utilitarian prose. Another Discovery Institute Fellow, Jonathan Witt, crows, "Anyone who believed in reincarnation would say Sermonti was a poet in a former life." Judging solely from this book, any knowledgeable reader would have a hard time believing that Sermonti has been a scientist in this life.

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[*Some material and ideas in this essay first appeared on the Panda's Thumb website <www.pandasthumb.org> in Bottaro's review of the Italian version of Sermonti's book and later commentaries.*]

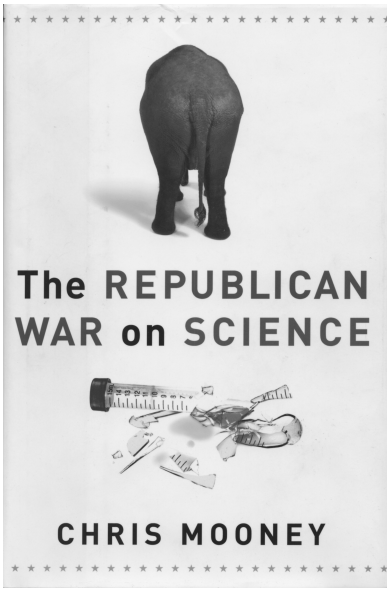
The Republican War on Science

by Chris Mooney
New York: Basic Books, 2005. 342 pages

Reviewed by Robert L Park, University of Maryland

Faith-Based Government

On August 1, 2005, in an interview with Texas reporters, the President of the United States of America publicly declared war on science. Siding with biblical literalists, George W Bush called for "intelligent design" to be taught in public schools alongside the theory of evolution (*see p 13*). An undeclared war that had smoldered behind the headlines suddenly broke out on the front



pages. The war on science was now national news.

It was certainly not the first time that George W Bush had embraced ideologically driven pseudoscience. Large blocks of the scientific community had already been alienated by the President's stand on such issues as climate change, missile defense, abortion, stem cell research, the environment, the test ban treaty, energy, and so on. But now, as if by design, he had found the one issue that seemed to offend every scientist. Darwin's theory of evolution by natural selection occupies a special place in the world of science. When it was published in 1859, the reaction of the great biologist Thomas Huxley was "why didn't I think of that?" Every scientist since, whatever his or her field, has felt that same sense of awe. How could an idea of such clarity and simplicity, an idea that explains so much of what is known, have eluded scientists for so long? Darwin's theory of evolution demonstrates what the human mind is capable of when it's freed from the shackles of tradition. It is treasured by scientists in every field — even as it is despised by the religious right.

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By fortunate coincidence, even as the President was calling for a religious fable to be taught beside science in our schools, the story of how the most advanced nation on earth came to reject science, Chris Mooney's *The Republican War on Science,* was already at the printer's.

The Republican dismissal of mainstream science actually began two decades ago with Ronald Reagan's Strategic Defense Initiative, a missile defense program commonly referred to as "Star Wars". Technological optimism was substituted for scientific reality. The reckless Reagan "dream" of "rendering nuclear weapons impotent and obsolete" never had any realistic prospect of working and risked initiating a peremptory strike from the Soviets. "Star Wars" — overwhelmingly opposed, even ridiculed, by the scientific community — simply did not work. Now, under George W Bush, a vastly scaled-down version of Star Wars is also opposed by scientists, and it also does not work.

George W Bush, like Ronald Reagan, has no interest in science. Bush, like Reagan, saw no urgency in appointing a science advisor and listens to whoever tells him what he wants to hear. It was almost a year before Jack Marburger, a physicist and director of Brookhaven National Laboratory, was confirmed as director of a scaled-down White House Office of Science and Technology Policy. Moreover, the job had been stripped of the rank of Special Advisor to the President, greatly reducing the influence of science in this administration. None of this seemed to perturb Marburger, a registered Democrat, who was President of the State University of New York at Stony Brook prior to becoming director at Brookhaven.

Following the President's comment on teaching "intelligent design", however, Marburger, whom the President had not bothered to consult, told *The New York Times* that the President had been misunderstood. "Evolution," he said, is the "cornerstone of modern biology," whereas "'intelligent design' is not a scientific concept." All of this is perfectly true, but he needed to be telling this to the President, not *The New York Times.* The President did not bother to take notice of Marburger's comments.

Scientists have traditionally been reluctant to take public stands as a group on partisan political issues, believing that science should be a high priority for both parties. But as Mooney points out, that changed on February 18, 2004, when 60 leading scientists, including 20 Nobel laureates, signed a statement denouncing the Bush administration for distorting scientific information and manipulating the process by which science advice is factored into government decisions. To the charge of manipulating the science advisory process, the eloquent White House response was to eject two advocates of stem cell research from the Council on Bioethics, replacing them with three appointees whose opposition to stem cell research is solidly faith-based.

The number of Nobel laureates signing the statement eventually rose to an astonishing 48, along with 62 recipients of the National Medal of Science. The administration response was to trivialize the issue. John Marburger was assigned the task of belittling the statement. Marburger, after all, had nothing else to do. He told *The New York Times* that it was just a matter of a few scientists "getting their feathers ruffled."

It is one thing to point out how pervasive the Republican war on science has become, another to devise a strategy for deterring future abuse. In a final chapter, or "Epilogue," Mooney makes it clear there is no one solution. Legislative reforms are needed to safeguard science advice and rescind measures that have served to further politicize science. Moderate Republicans might convince their more extreme colleagues of the dangers of science abuse, but so far he points out, "we can detect no evidence" that they are having any effect. Indeed, in the short time since Mooney wrote those words, the lure of the White House has pushed Republican moderates such as McCain and Frist, who witnessed the power of the Christian right in the last election, to endorse the teaching of "intelligent design" alongside evolution.

Strong belief in "fair play" is one of the most appealing characteristics of Americans, but it is often exploited by fringe groups who have little rational justification for their positions. Reporters also justify giving "balanced" treatment to such issue on which one side has little or no sensible support.

But in the end, Mooney says, "We must mobilize the natural defenders of Enlightenment values: scientists themselves, who all too often fail to engage anti-evolutionists and other know-nothings in defense of what they hold dear."

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Paradigms on Pilgrimage: Creationism, Paleontology, and Biblical Interpretation

by Stephen J Godfrey and Christopher R Smith
Toronto: Clements Publishing, 2005. 207 pages

Reviewed by Daryl P Domning, Howard University

There are plenty of books today that counter the arguments of "creation scientists" with catalogs of hard evidence from legitimate science. These are useful sources for teachers and debaters who have to confront creationists, and for the occasional reader who is genuinely seeking answers to the scientific questions being raised. They are much less useful, I suspect, to the many who are wrestling with the deeper, existential issues, such as the meaning of life, the explanation of evil, and the existence of God.

These sincere questioners, nonscientists for the most part, are not

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passionately concerned about DNA or radiometric dating. What they are passionate about is the tension they feel between science and their own religious faith. By failing to address these deeper issues (which are the real driving force of the perennial controversy over evolution) and playing the creationists' game (arcane scientific disputes in which doubts about evolution can easily be planted in laypeople's minds), many earnest evolutionists just help perpetuate the present stalemate.

Paradigms on Pilgrimage is a rarity: a book that can be recommended to people who are trying to think their way through the conflicting claims of fundamentalism and modern biblical scholarship as well as natural science. It should appeal to such readers, and maybe persuade them, because it is the highly personal story of two former fundamentalists who made that same intellectual and spiritual journey themselves.

Stephen Godfrey is a paleontologist and curator at the Calvert Marine Museum in Solomons, Maryland. A Canadian with a PhD from McGill University, he has worked on a variety of fossil vertebrates, most recently whales. Raised an evangelical Christian and young-earth creationist, he encountered more and more contrary evidence as he pursued his studies in biology and paleontology from elementary through graduate school. In the first half of this book, he recounts his inner struggles with the implications of superposed fossil forests, footprints, and faunas in layered rocks; resemblances between *Archaeopteryx* and dinosaurs; and other evidence that finally convinced him to abandon creationism.

Godfrey's story is neatly complemented by that of his brother-in-law, Christopher Smith, a Baptist minister and Bible scholar. In the second half of this joint intellectual autobiography, Smith describes the very different but convergent path that led him to their eventual co-authorship. In his teens he converted from mainline Christianity to fundamentalism and creationism. Pursuing his aptitude for languages and literature through studies at Harvard, seminary training, and a Boston College PhD, he too had his fundamentalist beliefs increasingly challenged. In his case, however, the challenges were to his literal reading of the Bible and came from the biblical text itself and his growing grasp of literary criticism.

By this time he was married to Godfrey's sister, and witnessed Godfrey's disillusionment with creationism at close range. Already perplexed by evidence for evolution (though not understanding it well) and impressed by his paleontologist in-law's sincerity of moral purpose, Smith increasingly came to see a middle ground between "moral though unscientific" creationism and "scientific but amoral" evolutionism. Together they moved toward a new understanding of God as having created by means of evolution, and agreed to share their stories through this book.

The result fascinatingly documents the thinking of real people as they move into and out of the creationist worldview. Along the way, they also provide some gems of original, ingenious arguments against creationism and biblical literalism — which are of all the more interest because they were ones that actually helped change these individuals' minds.

Why, asks Godfrey (p 76), would God have made the first tetrapods look so much like contemporaneous fish, when they could have been created so different in time or morphology as to raise no suspicion that they evolved? Moreover, the Bible says that God sent rain on the land of Palestine; but even creationists do not see the meteorological explanation of rain as a denial of God. So couldn't biological diversity, which the Bible also attributes to God's action, likewise have come about through natural means (p 83)?

Most enlightening to the average scientist will be Smith's comments on the literary, rather than literal, sense of Genesis 1–3. For example, the clear contradictions between the creation accounts in Genesis 1 and 2 can only mean that the editor(s) of Genesis who juxtaposed them did not understand them to be works of history (p 122). Furthermore, Genesis does not teach that physical death was the result of Adam's Fall: before the Fall, God told humans and animals what to eat (Genesis 1:29–30), but why would they need to eat if they could not die (p 163–4)?

The final section of the book offers an original reading of Genesis 1 with commentary, to show how this creation account presents (and makes good sense as) a naïve observational cosmology radically different from our objective scientific one. For example, the creation of light on the first day seems to us inconsistent with the sun's creation only on day 4 — but not if the original light is identified as *twilight*, which always appears in the sky even when the sun does not (as on overcast days). We now know this light comes from the sun, but the ancients would have been justified in thinking it to be an independent entity. The authors' argument — that the biblical authors were not and did not claim to be omniscient about the natural world — restores to the biblical text the integrity it loses in the hands of literalists.

This book is an enjoyable and stimulating read that will give evolutionists insight into the minds of their opponents, and give creationists persuasive reasons to change their minds. To my mind, it's a valuable contribution.

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The Trial of John T Scopes: A Primary Source Account

by Steven P Olson
New York: The Rosen Publishing Group, 2004. 64 pages

Reviewed by Glenn Branch, NCSE

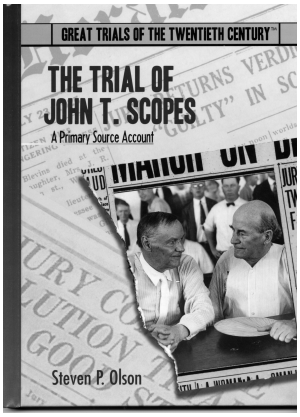
Eighty years on, the Scopes trial continues to fascinate. Steven P Olson's *The Trial of John T Scopes*, in a series called Great Trials of the 20th Century, is aimed at readers

between 9 and 12 years old. (The author is a freelance writer in Oakland, California, not to be confused with the science writer Steven Olson, whose publications include *Mapping Human History* [New York: Houghton Mifflin, 2002].) The book is equipped with a variety of useful aids, including a glossary, a page listing a few sources for more information (and giving a link to a regularly updated web site with relevant links), a short list of further readings, and a brief but adequate index. It is also extraordinarily well illustrated, mainly by sepia-toned photographs from the time of the trial.

Populated by a colorful cast of characters, teeming in anecdotes hilarious and touching, and redolent with antecedents in and implications for science, religion, education, law, and popular culture, the Scopes trial might overwhelm any writer. To his credit, Olson proceeds in workmanlike fashion, establishing the scene with a compelling opening chapter ("The meeting at the drugstore"), sketching the scientific and religious background and the preparations for the trial, detailing the eight days of the trial at a brisk pace in four chapters, and pondering "The meaning of the Scopes trial" in a concluding chapter. He writes clearly and, for the most part, at a suitable level for his intended readership, and, given the limits of the space available to him, he succeeds in sketching the essential contours of the trial.

Such a brief book is almost bound to contain a variety of trivial errors, both of commission and omission, and much can be excused in the name of brevity and simplicity. Unfortunately, the value of Olson's book is vitiated by substantive errors — in law, the history of science, and religion — that cannot be so easily excused.

Olson's grasp on the legal issues involved in the case is shaky. At two points (p 37, 53) he writes as though he thinks that the First Amendment is only about the freedom of speech, and he misreads two passages in such a way as to



corroborate that impression. On page 30, he quotes John R Neal as saying, "The legislature spoke for the majority of the people of Tennessee, but we represent the minority, the minority that is protected by this great provision [freedom of speech] in our constitution." But the interpolation is wrong; Neal was arguing that the Butler Act violated the constitutional guarantee of freedom of *religion* (Anonymous 1990: 55). Similarly, on page 53, Olson wrongly claims that *Epperson v Arkansas* was decided on freedom of speech grounds. Nowhere in his book is the First Amendment actually stated.

Olson also struggles with the task of explaining the defense's legal strategy. True, it is frequently difficult to tell exactly what the strategy was, since the factions in the defense team differed among themselves about how to argue the case, and in the trial they adopted a scattershot approach: as Olson notes, the defense's motion to quash the indictment involved 14 separate points of Tennessee and federal constitutional law. Nevertheless, the major theme of the defense strategy was to argue that the statute under which Scopes was prosecuted — which forbade teachers in the public schools "to teach any theory that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals" — presupposed and thus privileged a particular religious view, that evolution is incompatible with divine creation. By concentrating on issues about freedom of speech and academic freedom, Olson's account distorts the trial.

The scientific content of the book is understandably limited, but still inadequate. Olson incorrectly describes Darwin's conception of natural selection as occurring at the level of species (p 13–4). Moreover, he fails to distinguish Darwin's argument for evolution (in the sense of common ancestry) from his proposal of natural selection as its driving force.The result is manifest in his discussion of *The Fundamentals*, which, he says, "argued that the stories of the Bible were truly the word of God and there was no room for interpretation. The Book of Genesis was right, and Charles Darwin was wrong" (p 16). To be sure, *The Fundamentals* contained such essays as "The decadence of Darwinism" and "The passing of evolution". But the primary target of the essays was not evolution as such but selectionism (or "Darwinism"), and the fundamentalist assault on Darwinism was bolstered by the fact that natural selection, then just beginning to emerge from its eclipse (Bowler 1983), still looked scientifically dubious.

Finally, although Olson is clearly striving to be appropriately respectful of religious sensibilities, he seems at times to be persuaded by Darrow's portrayal of the trial as a clash between religion and science. Besides his caricature of *The Fundamentals*, he stresses Darrow's objection to the court's opening with prayer (p 55), without noticing that modernist clergy were later allowed to alternate with their fundamentalist colleagues (Larson 1997: 167). In his account of the grueling interrogation of Bryan, he writes, "Darrow finally got Bryan to agree to the moment when God created Earth: October 23, 4004 BC, at 9:00 AM" (p 46) — which, to be pedantic, is wrong; only the year was mentioned, and Bryan was hesitant about it (Anonymous 1990: 287–90) — and then describes Bryan's disavowal of a "six days of twenty-four hours" creation as a disavowal of "the plain text of the Bible" (p. 48), as if only a young-earth creationist reading of the Bible were conceivably legitimate.

The Trial of John T Scopes is not a bad book about the Scopes trial for its intended readership.

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But with greater attention to the legal issues and greater sensitivity to the scientific and religious milieu of those eight hot days in Dayton, it could have been a much better one.

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Evolution, Creationism, and Other Modern Myths

by Vine Deloria Jr
Golden (CO): Fulcrum Publishing, 2002. 274 pages

Reviewed by H David Brumble, University of Pittsburgh

I was channel surfing last night, when a nest of dinosaur eggs caught my eye. It turned out that they were plaster casts of dinosaur eggs, but that was okay. A professorial type — tweedy jacket, scruffy beard, haircut a couple of weeks overdue — was pointing out that each of the eggs in this nest was found with the narrow end down. This was *not* the way they were laid. No, this orientation is clear evidence that all the eggs in this nest had *floated* — and so, these eggs turn out to be evidence of the biblical flood. Genesis is history.

Now, this was wonderful: Noah's flood picked up these very eggs, floated them about upon the bounding main, and then, when the waters abated 150 days later (Genesis 8:3), gently floated those eggs down to rest still in perfect formation. But we were supposed to believe this delicious absurdity because it was delivered by a man costumed as a *professor*. His hair was carefully mussed, his tie was a bit askew, and he had the plaster eggs set up on one of those laboratory-bench tables with the faucet and sink, the kind of thing that we find down front in chemistry and physics lecture halls. Behind the table was a blackboard — again, just the kind of thing we all remember seeing in science lecture halls. Occasionally this TV professor would dash back there to draw something on the board. He did this quickly and carelessly, just as an excited physics professor might do.

This is American Indian provocateur/lawyer Vine Deloria's method exactly. In his first anti-science diatribe, *Red Earth, White Lies* (1995), Deloria donned a professor costume — footnotes, scholarly citations, and impressive bibliography — to tell us that the Genesis account of Noah's flood is real history, that humans and dinosaurs were probably on earth at the same time, and that college basketball players are taller now than they were a generation ago because of higher levels of carbon dioxide in the air. In *Evolution, Creationism, and Other Modern Myths,* Deloria pulls the costume out of the closet again, this time to scrawl upon the studio blackboard that:

> the earth's mountain chains were probably formed as wave-action response to planetary fly-bys (p 107);
>
> ancient Chaldean star charts going back 370 000 years might well have been based on actual observations (p 166);
>
> ancient Sumerian civilization was probably installed, all in one piece, by extra-terrestrials (p 169);
>
> American Indians might well have seen the flying machines of such ancient extra-terrestrials (p 174);
>
> all of Judeo-Christian theology might well have been developed in response to oppressive rule by space aliens (p 175).

Deloria is careful not to make definite assertions in some of these matters. He wants us to understand that he is open-minded, that he is not bound by dogma, as is that credulous and pitiful tribe, the Scientists. He does not claim to *know*, for example, that the ancient astronaut theory is correct, but he *does* "believe that it has much to tell us and should be a topic for serious historical investigation" (p 179).

But Deloria's professor costume consists of more than an open mind. The book is graced by 372 footnotes. But anyone who takes the trouble to check the footnotes will find pseudo-scholarship. At one point, for example, Deloria assures us that science is now rapidly coming to accept Velikovsky's idea that tribal oral traditions preserve accurate memories of civilization-ending "celestial events" (p 211). Deloria's authority for this extraordinary claim? A one-page article in the *Denver Post*. Deloria provides neither source nor explanation for the strange assertion that the Dead Sea Scrolls "revealed evidence" that Jesus was a "deluded revolutionary hero" (p 115). For his summary statement of the nature of Western religious thought, Deloria relies on *Newsweek* (p 126).

Deloria suggests that perhaps the ancients *burned* their sacrificial animals because their gods were in fact space aliens — and those aliens had "experienced an illness from badly cooked food early in their occupation of the valley in which the Garden of Eden was located" (p 176). Deloria's source is CA O'Brien, an "English prehistorian" (p 175). But Deloria does not cite a particular work by O'Brien, and so, alas, we will never know just what evidence there might be for this interesting idea.

Some of Deloria's sources are "creation scientists", such as Donald Patten, and the book brims with old creationist canards: that scientific attitudes toward evolution is basically religious, that the earth is far younger than the geologists would have us believe, that humans are not related to apes, that Noah's flood was real, and that

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all creationists want, really, is openness to ideas.

In fact, Deloria's insistence that this book offers "no comfort to religious fundamentalists" (p ix) is merely a part of his scholar's costume. Deloria's second-hand evolution bashing — his summaries of anti-evolutionist books by Richard Milton, Jonathan Wells, Phillip Johnson, Patten, and others — is comfort indeed for fundamentalists. (On the other hand, fundamentalists will probably be as amused as I am by Deloria's space aliens obsession.)

And goodness, we are supposed to be impressed by the breadth of Deloria's learning. He moves confidently from biblical and classical scholarship, to theology, European and American history, astronomy, geology, paleontology, anthropology, archaeology, ancient and American Indian mythology, physics, the law, philosophy, and the history of science. But his scholarship is a quarter-inch deep, merely another part of his costume.

One of the points that Deloria most wants to make, for example, is that, unlike tribal peoples, both science and Christianity are sadly limited by their sense that time is linear. It was, he assures us, St Augustine who "firmly implanted the idea of the absolute progression of time in the Western mind so that it became a constant" (p 131). This casual reference to Augustine does seem impressive. But those who have read some Augustine will remember that he distinguished between time, which was *created*, and God's eternity, which exists outside of time (see, for example, *City of God* 12.6). Strange, then, to say that Augustine could think of time only as a single "absolute". It is also strange to think that no one in the Western tradition had thought of time as linear, *until* Augustine in the 4th century. What about all those Old Testament genealogies? Think of all the ancient Egyptian chronicles. Deloria provides no citation here and no explanation, so we are left with no idea as to what he has in mind. (Toulmin and Goodfield's account of *The Discovery of Time* [1965], by the way, mentions Augustine only twice, briefly.) We are left with the impression that Deloria's reference to Augustine is decoration merely, a shiny button on his costume.

The scary thing about the book is that a wide range of those who know better put on "political correctness" spectacles when evaluating Deloria's pronouncements on science, religion, and oral traditions. Historians Dee Brown and Alvin M Josephy Jr provided dust-jacket praise for Deloria's *Red Earth, White Lies*. Can you imagine these men praising a creationist's book that argued that humans and dinosaurs were on earth at the same time? Studs Terkel claims to regard the present book as "revelatory". Does Terkel really believe that the people of the Old Testament were worshiping space aliens? And Deloria was one of 70 authors and illustrators invited to speak at the National Book Festival, hosted by Laura Bush in October 2002. Deloria's anti-evolutionist, ethnic-creationist speech was televised by C-SPAN. Imagine a Southern Baptist being provided such a forum to expound Biblical creationism!

Those who are inclined to give to Deloria's ideas a free pass from scholarly criticism for any reason should realize that loopy ideas can have serious consequences. In *Red Earth*, *White Lies*, for example, Deloria castigated geologists and paleontologists (the most deluded sub-tribes of the Scientists) for their obstinate neglect of American Indian oral traditions. His argument went like this: The earth is not nearly so old as the geologists would have us believe; and tribal memories going back thousands of years are accurately preserved in oral traditions; therefore, geologists should learn about the formation of the earth from tribal oral traditions. Similarly, paleontologists should look to tribal oral traditions for accurate information about dinosaurs.

This theme is continued in the present book. Here the idea is that geologists need to study tribal oral traditions that describe various "ages" or "worlds". Geologists should notice that these "ages" were bounded by catastrophes — and so, if only they would pay attention to ancient "non-Western" oral traditions, geologists would be able to work up a *vastly* abbreviated, *much* more accurate geological time-line.

Now, geologists and paleontologists are unlikely to follow this advice — but the uncritical, acceptance of these ideas by so many public figures is shaping the public sense of the reliability and extent into antiquity of oral traditions. This has real-world consequences in land-rights cases, such as in the famous case of Kennewick Man.

In this case, skeletal remains found near the Columbia River were determined to be nearly 10 000 years old, a good deal older than the earliest evidence of American Indian habitation in this region. Some Umatilla Indians argued that the bones ought to be handed over to them for "reburial" on the grounds that, since their oral traditions tell of the creation of the Umatillas in this region some 10 000 years ago, Kennewick man *must* be Umatilla (see Chatters 2002: 87). A Portland court recently decided this case in favor of the scientists (*Bonnichsen et al v US Army Corps of Engineers et al*, 2002) — but it was a near thing. The loss to science would have been considerable, since these bones seem to be important evidence that there was more than a single pre-Columbian immigration to the Americas. And this is but one example of the sort of damage that uncritical acceptance of the ideas in this book could cause.

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Vine Deloria Jr Dies

Vine Deloria Jr, a Standing Rock Sioux who championed the rights of Native Americans through his writing and activism, died on November 13, 2005, at the age of 72. Born in 1933 in Martin, South Dakota, near the Pine Ridge Oglala Sioux Indian Reservation, Deloria served in the United States Marine Corps in the 1950s before receiving a degree in general science from Iowa State University and a master's degree in theology in 1963 from the Lutheran School of Theology in Illinois. In 1970 he received a law degree from the University of Colorado, where he taught history from 1990 to 2000. The most famous of his twenty-plus books is *Custer Died For Your Sins* (New York: Macmillan, 1969), in which Deloria incisively criticized the stereotyping of Native Americans.

Deloria's commendable respect for Native American tradition seemed to go too far, however, with *Red Earth, White Lies* (New York: Scribner, 1991), which distorted science in the service of upholding traditional accounts of creation. Writing in *American Literary History* (1998; 10 [2]: 335–346; reprinted in *RNCSE* 1998 Nov/Dec; 19 [6]: 10–14), H David Brumble of the University of Pittsburgh described the book as "ethnic pseudoscience," noting its affinities and debts to young-earth creationism. Similarly, Deloria's later book *Evolution, Creationism, and Other Modern Myths* (Golden [CO]: Fulcrum, 2002) brimmed, as Brumble noted in his review for *RNCSE* (p 49), with "old creationist canards" and "second-hand evolution bashing."

See also the obituary in *The New York Times* (2005 Nov 15).

Glimpses of the Wonderful: The Life of Philip Henry Gosse 1810-1888

by Ann Thwaite
London: Faber and Faber, 2002.
387 pages

Reviewed by Robert Ackerman

Philip Gosse's life was one of unremittingly energetic achievement. It began unpromisingly: his family was poor (his father was an itinerant portrait painter), he lacked influential connections who might have opened doors for him, and his formal education ended at the age of 15. Nonetheless, through extraordinary industry, remarkable powers of observation, an accessible literary style, and artistic talent in illustrating his work, by middle age he had become the most popular writer on natural history in Britain, a fellow of the Royal Society, and a wealthy man. In addition he was blessed with an optimistic temperament and a happy marriage. All in all, truly an admirable person and (I intend the phrase unironically) an eminent Victorian.

Inevitably there were clouds as well. The first was the devastating loss of his wife to cancer after only eight years of marriage. (The upbringing of his son, Edmund, about whom more below, was a continuing worry later.) Further, Gosse was a member of the fundamentalist denomination known as the Brethren (often mistakenly called Plymouth Brethren) and as such committed to a literal understanding of the Bible as the inspired word of God. In his own scientific work, primarily on microscopic marine creatures (especially the rotifers), he was keenly aware of the exquisite adaptation of species to their environments, and had he lived a century earlier this awareness would probably not have caused him any special anxiety. As an almost exact contemporary of Darwin, however, he could not avoid the evolutionary ideas that seemed to be "in the air" everywhere, and he felt keenly the implied threat to the basis of his religious life. The evidence for continuing geological change presented by Lyell in the 1830s, along with his intimate familiarity with the work of the leading naturalists of his day (he was a friend of Darwin, Huxley, and Wallace among others), precipitated an intellectual and emotional crisis. After much thought and prayer, in 1856 he came to believe that the Lord had shown him an ingenious way to reconcile the biblical timetable of creation and immutability of species with the implications of evolutionary natural and physical science.

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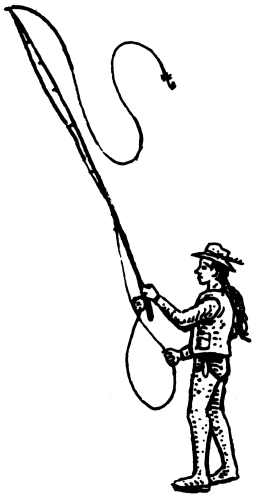

His answer was "prochronism", which he presented in *Omphalos* (1857). If, as he assumed, Genesis is literally true and therefore species do not and cannot change, it then must also be true that God created the whole of the natural and physical world *as we know it*. That is, the trees in Eden came complete with growth rings, God included fossils in the rocks, and Adam and Eve were fashioned with navels ("omphalos" is Greek for navel) even though they were not born of woman. The appearance of "pastness," then, was an inherent and therefore benign attribute of the divine plan for the world. Gosse thus concluded that the conflict between the biblical account of creation and the evidence for evolution and the new chronology implicit in geology and biology implied by it was illusory.

Thinking that he had thus resolved the conflict between science and Christianity, he was shocked when neither the godly nor the worldly appreciated *Omphalos*. His friend the novelist Charles Kingsley rejected prochronism because if he accepted it he would also have to accept a God who was a deceiver, whereas those who approached the natural world without supernatural assumptions saw prochronism as the makeshift that it transparently was. (Of course, the flaw lay in its complete untestability — explaining everything, it explained nothing.)

Omphalos, however, was one of Gosse's few failures, and its

adverse reception, though personally hurtful, did not dent his reputation as an exponent of science, which continued to grow through the 1860s and 1870s. (Gosse's greatest innovation was his development of the aquarium, which permitted those whom he had inspired to enjoy at home the creatures they found at the seaside and which also did a great deal to nourish the infant tourism industry; its development concomitantly created the trade of dealers in marine specimens.)

Philip Gosse, though known today only to historians of science, also figures as the dour, even tyrannical parent in the classic autobiography by his son, the Edwardian man of letters Edmund Gosse, *Father and Son* (1907). As Ann Thwaite narrates Philip Gosse's life, she takes pains to show how frequently and significantly Edmund darkened the colors in the portrait of his father. In *Father and Son*, which I warmly recommend, Philip Gosse appears to be overbearingly protective, driven by his anxiety lest Edmund, his only child and the living reminder of his beloved dead wife, drift away from the true path of faith — which of course he did. Thwaite is able to offer this useful corrective to Edmund's revenge (if that is what it was) because she is blessed by access to an abundance of written sources, both by and about Philip Gosse.

The book, which contains many photos and illustrations from Gosse's books, is a pleasure to read. The narrative flows easily, and the author has done an immense amount of research, especially in setting Gosse within the larger intellectual and social context of the nineteenth century. Thwaite is neither a scientist nor a historian of science and must rely on the judgments of others in assessing Gosse's contributions to scholarship, but in the event this is no serious shortcoming because historians of science are unanimous in their appreciation of his work. She also offers a sympathetic description of Gosse's spiritual life, and especially of his passionate hope that he might be one of the elect who are on earth when the Second Coming occurred. The absence of polemic on Thwaite's part gives her book an extra resonance for readers today because of the disinterested insight it offers into a critical early moment in the modern history of the relations between science and religion.

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The Piltdown Forgery

by Joseph S Weiner
Oxford: Oxford University Press, 2004. 248 pages

Reviewed by Jim Foley

"Piltdown Man" was discovered in Sussex, England, by Charles Dawson, an amateur fossil hunter, and unveiled in 1912. Consisting of a human braincase and an ape-like jaw, it quickly became England's very own celebrity ape-man. Further finds by Dawson strengthened its status as an early ape-human intermediate. But by the 1940s, Piltdown was increasingly being forced into the periphery because nothing else in the fossil record remotely resembled it. Scientists were divided over whether the Piltdown fossils belonged to one species or were a mixture of ape and human fossils, but both explanations faced great difficulties. While pondering the problems with all the natural explanations of Piltdown, it occurred to Weiner that there might be an unnatural explanation. Once he and some colleagues examined the Piltdown fossils with that possibility in mind, the hoax collapsed quickly. Many tests, most of them unavailable when Piltdown was first found, showed beyond a shadow of a doubt not only that the Piltdown Man was a fraud, but so were most and probably all of the other fossils and artifacts found with it.

Stephen Jay Gould, for one, has argued that the Piltdown hoax was not all that well executed, and it is probably true that it was lucky to remain uncovered as long as it did. Nevertheless, it is evident from Weiner's book that the hoaxer or hoaxers went to a lot of effort and showed considerable ingenuity and persistence in the fabrication of the hoax. It is also clear from Weiner's descriptions of the tests that could be brought to bear on fossils, even in the 1950s, that it would be virtually impossible to create another fraud to rival Piltdown nowadays.

The most interesting question about Piltdown is, of course, whodunnit? The difficulty is not in finding plausible culprits, but in ruling them out. Like some detective novels in which all the characters are suspects, virtually everyone associated with Piltdown Man has been fingered as the hoaxer at some point.

Once the fraud was discovered, Weiner immediately started investigating it. At that point the fraud was already over 40 years old, and some of the principals were already dead. However, Weiner was still able to interview some of the participants and many other people with knowledge of the affair. It was not until about 1980 that the cottage industry of solving the Piltdown fraud really kicked into high gear. (One suspects that until then, the scientific community was so horribly embarrassed by Piltdown that scientists could not bring themselves to look at it.) By then, of course, everyone with first-hand knowledge of the events at Piltdown was dead. So, although later researchers have uncovered further information not available to Weiner, this book (originally published in 1955) remains an invaluable primary resource about the Piltdown fraud.

In his conclusion, Weiner found it extremely difficult to see how Dawson could not be implicated, but felt that his guilt could not be established beyond reasonable doubt.

Chris Stringer's new afterword briefly brings the reader up to date on developments in the 50 years since Weiner's book was originally written. Ronald Millar, in his book *The Piltdown Men* (London: Victor

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Jim Foley has written extensively on the hominid fossil record for the TalkOrigins Archives, <http://www.talkorigins.org/faqs/homs/index.html>.

Gollancz, 1972), felt that precisely *because* Dawson was such an obvious culprit, he would not have committed the hoax. Millar thought that the anatomist and anthropologist Grafton Elliot Smith was involved, with Dawson's help, since Smith would not have been able to commit the fraud on his own. Gould felt that Teilhard de Chardin was involved, as did a number of other prominent scientists, including Louis Leakey. Frank Spencer, building on the research of Ian Langham, argued after a comprehensive study that the anatomist and anthropologist Sir Arthur Keith was guilty along with Dawson. In the 1970s a suitcase belonging to Martin Hinton, a paleontologist at the British Museum, was discovered which contained fossils apparently stained in a similar manner to Piltdown. It looks very suspicious, but were these Hinton's early attempts at working out how to forge Piltdown, or later experiments to determine how it was done?

And these are only a few of the most prominent accusations; at least 25 men have been implicated in the forgery by various accusers. John Evangelist Walsh in his book *Unraveling Piltdown* (New York: Random House, 1996) shows that Dawson was involved in many shady dealings involving fossils and archeological items. (Stringer considers this the best modern book on Piltdown, and I agree.) The fact that Dawson, the person most closely involved with Piltdown, had a record of similar forgeries makes for a strong case against him. In the end, Stringer agrees with Weiner's initial verdict that Dawson was probably the culprit (though he also has his suspicions about Hinton) — but that, short of some startling new evidence, we will probably never know for sure.

For more information about Piltdown, visit the Piltdown Man Home Page at <http://home.tiac.net/~cri_a/piltdown/piltdown.html>.

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Controversy, Catastrophism, and Evolution: The Ongoing Debate

by Trevor Palmer
New York: Kluwer Academic/Plenum Press, 1999. 450 pages

Reviewed by Hiram Caton

Trevor Palmer, an enzyme biologist at the University of Nottingham, provides in this volume a chronicle of the emergence of catastrophe evidence and thought. He explores planetary science, paleontology, geology, and evolution, with emphasis on human evolution, from about 1970 to 1999, but with substantial expeditions into the history of astronomy and evolutionary theory, plus some early 20th-century material. The author puts flesh and bone on his chronicle by including contextual detail about authors, about specific books and articles, conference proceedings, special issues of journals, and other factors bearing on the conduct of science. These supplements are requisite for dealing with the principal theme — controversy — but they do not constitute a philosophy or a sociology of science of controversy. He also abstains from interpreting the significance of contemporary catastrophism for understanding "man's place in nature". One indication of this restraint is the temper of the book's conclusion. Titled "Postscript — The hammer and the pendulum", it is a brief statement promoting reconciliation by calling on TH Huxley's 1869 pronouncement that catastrophism and uniformitarianism are compatible. Palmer does not mention that no one paid this admonition the least mind, including Huxley himself, who, a decade later, declared that geologists had completely refuted catastrophism. There is the additional infelicity that, either way, Huxley's advice pertains to a state of science that, on the author's own showing, bears little comparison with its present state.

If Palmer's book proposes no philosophy of controversy, it is nonetheless a major contribution to understanding the growth of the present position. Contemporary catastrophism begins with Luis Alvarez's 1980 article proposing that a 10-km–diameter asteroid strike caused the Cretaceous–Tertiary (K–T) boundary mass extinction. It is the beginning in the sense that the old idea of catastrophic impact now, for the first time, escaped the stigma of fringe science to compel the attention of geologists and paleontologists. It was the beginning also in the sense that the experimental methods and instruments needed to canvas the question fruitfully were available and continued to be refined.

The explosion of information about the solar system initiated by space exploration was, of course, a major contributor to establishing the revisionary premise that our planet is subject to numerous cosmic perils, of which impacts are one. Geology and paleontology were primed for uptake of fresh debate by immediately antecedent developments. Geology had passed through the anguish of the plate tectonics controversy, which raised the spectre of a catastrophe interpretation of earth history. Paleontology was eight years into its adventure with the alternative to gradualism, punctuated equilibrium. Impacts dealt the insurgents a strong card by delivering a mechanism of mass extinctions while rattling the confidence of gradualists at the very time when the advent of sociobiology strongly stimulated reassertion of the gradualist position. Exciting times.

Palmer thoroughly documents the K–T extinction dispute. At that time the geochemistry of meteorites and of impact traces was reasonably well known, but there was no candidate crater of the size and time of the hypothetical impact. Much of the debate concerned the interpretation of impact traces (iridium, shocked quartz, microtektites), whether the extinction was

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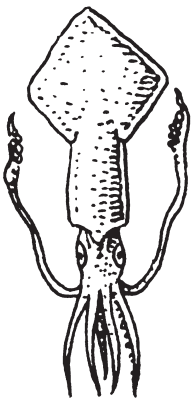
more or less instantaneous or phased over as much as a million years, whether flood basalt volcanic activity was involved as an independent cause or as an activity generated by an impact, and whether climatic and ocean changes associated with tectonic activity figured in the scenario. In 1991 a candidate crater, dubbed Chicxulub, 180 km in diameter, was found off the coast of the Yucatan Peninsula. Some protagonists interpreted this finding as marking the end of the debate as to whether impacts figured significantly in extinction events. It was not an isolated finding, but yet another in a roster of about 140 impact craters dating over a period of 1.4 billion years, which in turn is nested in an increasingly sophisticated planetary science of comet and asteroid behavior that transformed the impact concept from the improbable to the expected.



Gradualists nevertheless continued to dispute the K–T boundary mass extinction by contending that the species turnover rate was inconsistent with a single event or a cluster of temporally closely associated events, but consistent with long-term climatic change associated with tectonic movement. Is it then a stand-off? Not at all. The controversy contributed significantly to understanding the complexity of extinction and radiation events and stimulated the improvement of evidence gathering and evaluation methods. On this criterion the debate was good science. In addition, the debate compelled gradualists to change their tune. In 1980, they dismissed, often derisively, impacts as causal factors in earth or evolutionary history. By 1995, even the most hard-nosed accepted impacts in principle. This admission entailed relinquishing a key gradualist premise, that extinctions result exclusively from ordinary evolutionary competition.

The import of this concession may be minimalized by invoking the adage "One swallow doth not a summer make." Even if mass extinctions are acknowledged, and even if all five of the supposed mass extinctions were due in part or in whole to impacts, the gradualist position still holds for the grand tableau of evolutionary history. Palmer, as I interpret him, ever so gently prods his readers to reject this position. The reason is — and again I am interpreting delicately phrased passages — that "revised gradualism" preserves the continuity of evolutionary thought from Darwin forward, whereas today's evidence, properly evaluated, requires recognition of a fundamental departure from that history — a departure still in the making.

The evidence falls under four headings. First, there is a new conception of the solar system. Second, the old vision of a straight march from anthropoid apes to hominids to the human genus to *Homo sapiens* has been replaced by an erratic pattern in which times and places of origins and migrations are still undecided. In particular, Chinese paleontologists excavating two fossil-rich sites are a new source of surprising evidence of the early origin of *Homo erectus* far from Africa. Third, the punctuated equilibrium pattern, even if it characterizes only a portion of evolutionary history, is a major departure from traditional gradualism that requires specific explanations for stasis and sudden bursts of change. Finally, non-linear dynamics, which made its debut in thermodynamics, may have a future in the long-sought explanation of the origin of life (to mention but one field). I shall confine my remarks to the first of these headings, partly because it bears most directly on catastrophism, and partly because few areas of science have undergone such stupendous growth in the past quarter century.

Charles Lyell's *Principles of Geology* is the sacred text for uniformitarianism; Archibald Geikie's *Founders of Geology* (1905) set the text in stone thanks to his authority as Britain's leading geologist. Palmer shows, by referencing many authors over a two-century period, that uniformitarians stigmatized catastrophism as miraculous causality parading as objective science. This is a *pars pro toto* fallacy. The great exponent of catastrophism, Georges Cuvier, was a dust-bowl empiricist hostile to speculation. His example was followed by his influential geologist disciple, Elie de Beaumont. Palmer dwells on the now well-known criticism (first stated by Whewell) of Lyell's formulation of uniformitarianism, which confounds a sound methodological principle (actualism) with an empirical thesis that geological processes are uniform because they flow from universal laws. The effect of this blunder was to present earth history as cyclic. Lord Kelvin's deeply resented intervention brought geologists around to admitting time's arrow, but this was done as a largely unacknowledged concession that avoided an explicit reanalysis of principles.

I conclude this review by advising that it falls woefully short of conveying the complexity and quality of the author's achievement. As one who converted some time ago from the standard position to catastrophism, I leave it at noting that the conversion process, at least in my case, was not effected by mere acknowledgement that catastrophic impacts have happened and will happen. One must ponder the evidence in detail and over time, because the transition involves a profound discontinuity of thought that alters also one's own sense of self. Palmer's thorough, polemic-free volume is a worthy point of departure for those wishing to try this adventure.

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Evolution Resources On-Line

I am developing two websites which, taken together, include more than ten full-length books on the evidence for evolution and the arguments against creationism and "intelligent design". See <http://bio.sunyorange.edu> and <http://ocl.watchers. net>.

There are hundreds of photos and drawings and it is my hope that these websites will serve as a valuable resource for those involved in this battle. Although the key resources are in place, I am still in the process of editing these texts and producing summary versions

Letters to the Editor

13 Answers

[*In* RNCSE *2005 Jan–Apr; 25: (1–2): 54, Steve Bratteng provided a list of 13 questions that can be answered by evolution but not by "intelligent design". Now that readers have had a chance to ponder these questions, here are his suggested answers.*]

As a follow-up to "13 questions for ID" in the previous issue of *RNCSE*, here are some answers that provide the basic outline of the way in which evolutionary theory addresses them. In most cases, there is considerable elaboration available, beginning with Nesse and Williams's "Evolution and the origins of disease" (*Scientific American* 1998 Nov; 279 [5]: 86–93).

1 During infections, the body locks up iron in the liver. Although this lowers levels of iron in the blood, it also deprives bacteria of iron and prevents their running wild. However, if we give iron supplements to undernourished people (who have a reduced ability to make antibodies to fight off infection), the bacteria flourish thanks to the higher blood levels of iron and the reduced immune response.

2 The first vertebrates adapted to life out of the water had inherited a structure that could exchange gases with the blood stream — the swim bladder. It was located close to the spinal column above the digestive system and, as today's lungfishes show, adaptations to life on land included opening a passageway on the top of the snout. Later, what became the lungs filled the chest cavity, and the digestive system moved back toward the tail end. So, the lungs became a ventral (belly-side) organ derived from a dorsal (back-side) organ. The air passageway, of course, followed the migration, and crossed paths with the food passageway. While there is a mechanism to avoid choking, it fails from time to time, making the Heimlich maneuver a lifesaver.

3 Vertebrate eyes evolved from an extension of the brain, with the light-sensitive cells of the retina and the blood supply coming in from the outside. On the other hand, squids' eyes are produced by in-pocketing of the outer layer of the body. The photosensitive cells are on the outside and the blood and nerve supplies are behind. The difference shows two evolutionary pathways to a structurally similar result and illustrates the way that developmental and anatomical pathways taken by ancestral organisms can affect a wide array of evolutionary descendants. The tendency of the vertebrate retina to detach is a direct result of our evolutionary heritage.

4 Depression, as well as other issues in behavioral health, can be traced to variations in behavioral adaptations to a variety of environmental challenges and filtered through changes in human lifestyles as we adjust to the conditions of "civilization". Since these conditions are relatively recent in evolutionary terms, humans may lack specific responses that are effective in coping with these conditions. The same could be said for changes in diet and physical activity due to agricultural, industrial, and economic transformations; human populations have not had time to adapt evolutionarily.

5 The Europeans who emigrated to the New World had endured a long evolutionary relationship with endemic disease organisms, resulting in a small pool of susceptible individuals. This was the result of evolution in both the pathogen and the host populations. However, among indigenous people who had not been exposed, the diseases spread rapidly because of the greater likelihood that any person in contact with an infected individual was also susceptible to infection.

6 Morning sickness is most often associated with the stages of embryonic development that are most sensitive to toxins and compounds that would cause serious birth defects. The sensitivity to certain smells and tastes is a mechanism shown to prevent ingestion of substances that might contain these substances. Once a certain stage has been reached the embryo (now a fetus) is no longer as vulnerable, and morning sickness tends to go away.

7 Immunoglobin E (IgE) seems to be involved in this story. In non-industrialized countries, where sanitation is less developed, populations tend to have a fairly high load of intestinal parasites, IgE helps combat these parasites and other pathogens. People in industrialized countries have few, if any, intestinal parasites, and live in "clean" environments, so IgE appears to respond instead to the body's own tissues.

8 Malaria is transmitted by mosquitoes, and the sicker someone is, the easier it is for mosquitoes to acquire malaria. Therefore, increased virulence enhances the survival of the parasite and the spread of the disease. Increased virulence also results in more deaths among infected individuals.

9 In our upright posture, the tissues associated with keeping the abdominal organs in the proper place fail to do this as we age. In addition, pregnancy puts particular stress on the muscles that control urinary, reproductive and digestive organs passing through the pelvic outlet. In combination, these result in a reduced ability to control bladder function.

10 Diarrhea is the body's way of getting rid of nasty organisms; suppressing it allows the organisms to hang around longer.

11 It is thought that this allele was advantageous in helping avoid tuberculosis, which apparently enters cells in the same manner as the HIV particle. This is another example in which selection for resistance to one pathogen can provide the basis for a new adaptation to another.

12 The urethra is surrounded by the prostate gland, which enlarges with age. This often leads to problems as the enlarged organ restricts the passage of urine. This is another case in which selection that puts off design failure to advanced age (see #9 above) is overtaken by other adaptations that increase the average length of life.

13 Hay fever and allergies in general seem to be the body's overresponding to essentially harmless antigens. This could be likened to having a smoke detector that goes off when you burn your toast, but then saves your life when there is a real fire.

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of these materials that might be more useful to general audiences and for resources for students in younger grades.

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