

# REPORTS

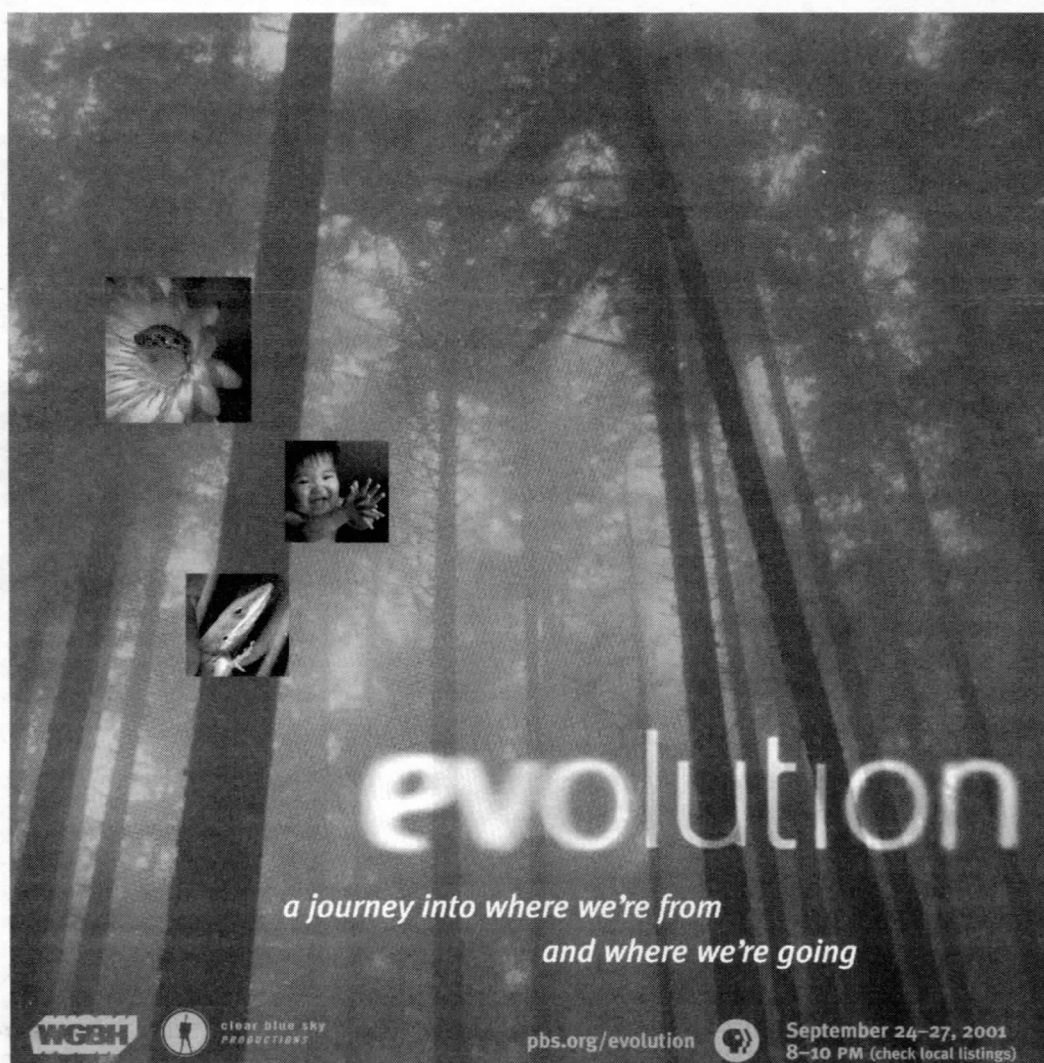
OF THE  
NATIONAL CENTER FOR SCIENCE EDUCATION  
DEFENDING THE TEACHING OF EVOLUTION IN THE PUBLIC SCHOOLS



Volume 21, Numbers 5-6

SEP-DEC, 2001

CONTINUES NCSE REPORTS &  
CREATION/EVOLUTION



Recapitulations:  
More on Birds  
and Dinosaurs

Intermediates  
in Seacow  
Evolution

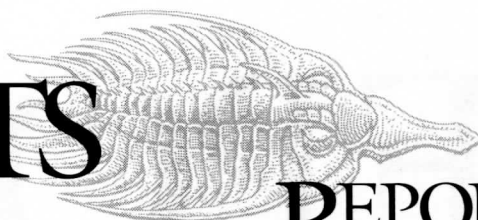
Creationism in  
the Comics

Top 10:  
Evidence for  
Human  
Evolution

PBS Airs *Evolution*:  
Creationists Attack

NCSE Produces Congregational  
Study Guide for *Evolution*

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NATIONAL CENTER FOR SCIENCE EDUCATION  
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CONTINUES NCSE REPORTS & CREATION/EVOLUTION

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### EDITOR

Andrew J. Petto  
Division of Liberal Arts  
University of the Arts  
320 S Broad St  
Philadelphia PA 19102-4994  
(215) 717-6276 fax: (215) 717-6620

e-mail: editor@ncseweb.org

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Eugenie C. Scott, *Publisher*  
National Center for Science Education  
PO Box 9477  
Berkeley CA 94709-0477  
(510) 601-7203  
fax: (510) 601-7204  
e-mail: ncse@ncseweb.org  
<http://www.ncseweb.org>

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Cover: Artwork from the PBS series *Evolution*.

Artwork © Ray Troll, 1997  
For more information on Ray's work explore his website at <[www.trollart.com](http://www.trollart.com)>.

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Readers who remember Ray Sutra's article on whale evolution (*RNCSE* 20 [5]: 33-41) may recall his opening question: "How do you convince a creationist that a fossil is a transitional fossil?" Ray's answer matches the experience of many supporters of evolution: "It is a trick question. You cannot do it." In part, this is because many people do not understand what a transitional fossil is or how intermediate forms are used to understand the evolutionary history of a group of related organisms. The other reason may be that throwing around outdated terms like "missing link" keeps the focus off the evidence itself — evolution defenders end up spending energy trying to explain why "missing link" is not a concept in use by scientists and what constitutes a transitional fossil. In truth, even evolution supporters among the media and general public sometimes refer to transitional specimens as "missing links".

In this issue, we revisit two recent articles on transitional forms and add a third. Gregory Paul, an NCSE member and a new contributor, writes that the transition from hoofed, land mammals to sea-living organisms is not only possible, but has most certainly already occurred — at least in whales and sea cows.

In response to several inquiries, Kevin Padian revisits the discussion on the evolutionary relationships between birds and dinosaurs. Kevin address concerns about developmental and molecular evidence, as well as about the cladistic method used to understand pathways of evolutionary change and the relationships among branches. Since a number of correspondents asked the same questions, we compiled them into a list of questions for Kevin to answer.

The third article is a summary of the recent discoveries about sea cows by NCSE member Daryl



Domning. Daryl's recent article in *Nature* reports the land-mammal-to-marine-mammal transitions for the sirenians that Ray Sutra described for the cetaceans. The take-home message is that transitional fossils are everywhere and so-called missing links are nowhere — not because evolutionary transitions are absent, but because missing links are the unicorns of evolutionary history — figments of our non-scientific imaginations.

#### EVOLUTION FROM PBS

Much of our News section is taken up with items about the PBS series *Evolution* that aired in September 2001 and about the responses from a variety of anti-evolutionary organizations. As Glenn Branch points out in a series of articles arranged chronologically, the "reaction" started long before the series was aired and peaked a few weeks after. In addition to Glenn's excellent, detailed account, we have included a number of other articles related to the flood of anti-evolutionist criticism. In most cases, the arguments against evolution will be familiar to our readers, but these pages contain a few interesting twists and variations on the anti-evolution themes.

#### IN THE NEWS

The big news, of course, is that the US Supreme Court refused to hear

Rodney LeVake's appeal of lower court decisions denying his claim that his school district violated his constitutional rights by preventing his teaching "evidence against" evolution.

Elsewhere in the news, a major flare-up in Ohio was reported to NCSE in December 2001. At the time of publication, an anti-evolution group calling itself Science Excellence for All Ohioans (SEAO) managed to convince the Ohio Board of Education to hold a special program on "Intelligent Design Theory" in developing new science education standards. State legislators in Washington have again introduced a "disclaimer" bill. Finally, Pennsylvania's science education standards — with strong support for evolution — were implemented at the beginning of January 2002. More in future issues.

#### NCSE NEWS

Lots of news from NCSE, including the activities of some of our members and a welcome to Phina Borgeson, who heads up NCSE's Faith Network Project. Her *Congregational Study Guide* to accompany the PBS *Evolution* series drew fire immediately from Answers in Genesis. Welcome aboard, Phina!

#### ABOUT YOUR RNCSE

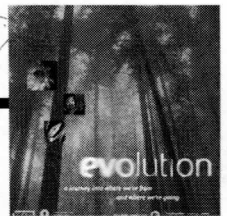
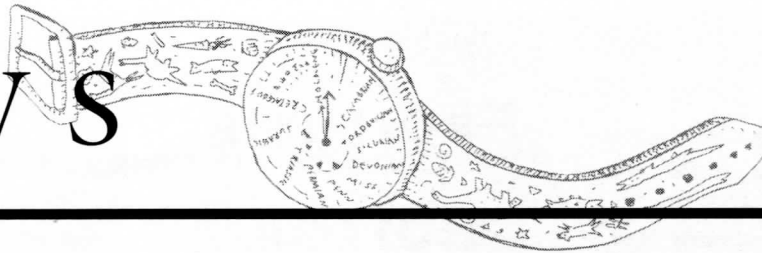
This is the third double issue in volume 21 of *RNCSE*. This adjustment has allowed us to match our publication dates with the real date that our readers receive the issues. In volume 22, we will return to our regular schedule of 1 issue every 2 months. All subscriptions will be extended by two issues. Check your mailing label for the status of your subscription, or contact Glenn Branch at NCSE.

*RNCSE* 21 (5-6) was printed in March 2002.

VOL 21, NR 5-6 2001

REPORTS

# NEWS



## PBS Broadcasts *Evolution* Series *Eugenie C Scott, NCSE Executive Director*

Across the country, from September 24 to September 27, 2001, *Evolution* happened: a 7-episode, 8-hour series on evolution, produced by Boston PBS station WGBH in partnership with Seattle's Clear Blue Skies Productions. Most PBS stations showed the series for two hours each night on those days, though some showed it on other days. Like many important PBS series, *Evolution* is accompanied by a book (*Evolution: The Triumph of an Idea*, by science journalist Carl Zimmer), and it also features a web site with strong support for teachers.

The goal of the series was to "inform, inspire, and entertain through multimedia resources" in order to "enhance science literacy and heighten viewers' understanding and appreciation of the natural world."

Tapes of the program are available for purchase on-line (including from the NCSE store: <[www.ncseweb.org/bookstore.asp](http://www.ncseweb.org/bookstore.asp)>), as are additional materials for teachers. If you missed the initial broadcast, you might inquire whether your local PBS station will be showing it again; many have done so. Brief descriptions of each program follow:

### **1 Darwin's Dangerous Idea (2 hrs)**

Why does Charles Darwin's "dangerous idea" matter more today than ever, and how does it explain the past and predict the future of life on earth? The first show interweaves the drama of Darwin's life with current documentary sequences, introducing key concepts of evolution. In Victorian England, the notion of evolution threatened Darwin's family, his place in society, his standing in the

scientific community, and the prevailing world view.

### **2 Great Transformations (1 hr)**

What underlies the incredible diversity of life on earth? How have complex life forms evolved? The journey from water to land, the return of land mammals to the sea, and the emergence of humans all suggest that creatures past and present are members of a single tree of life.

### **3 Extinction! (1 hr)**

Five mass extinctions have occurred since life began on earth. Are humans causing the next mass extinction? And what does evolutionary theory predict about the world we will leave to our descendants?

### **4 The Evolutionary Arms Race (1 hr)**

Survival of the fittest: Raw competition? Intense cooperation? Both are essential. Interactions between and within species are among the most powerful evolutionary forces on earth, and understanding them may be a key to our own survival.

### **5 Why Sex? (1 hr)**

In evolutionary terms, sex is more important than life itself. Sex fuels evolutionary change by adding variation to the gene pool. The powerful urge to pass our genes on to the next generation has changed the face of human culture in ways that we are only beginning to understand.

### **6 The Mind's Big Bang (1 hr)**

Fifty thousand years ago, something happened — the modern human mind emerged, triggering a creative, technological, and social explosion. What forces contributed to that breakthrough? Where might our power of mind ultimately lead us?

### **7 What About God? (1 hr)**

Of all species, we alone attempt to explain who we are and how we came to be. This final show explores the struggle between science and religion. Through the personal stories of students and teachers, it offers the view that they are compatible.

I and several other NCSE members served as program advisors for both the video and web-based portions. Speaking for myself, it was a very intellectually stimulating experience to work with talented people who were skilled in taking the essence of a scientific idea and turning it into a visual statement — while maintaining the integrity of the science. *Evolution* is unique: nowhere else is there such an extensive video presentation of evolution. WGBH personnel had wanted to produce a video series on evolution for years, but funding was not available from corporations and foundations; evolution, as we know, is "controversial". The no-strings-attached funding provided by Microsoft billionaire Paul Allen resulted in eight hours of unapologetic, unqualified evolutionary science. The series, web materials, and companion book will be valuable resources for teachers for years to come. All of us concerned about the public understanding of evolution should be pleased to have such an entertaining and informative resource to help to educate people about evolution.

For more about *Evolution*, see the PBS web site <[www.pbs.org/evolution](http://www.pbs.org/evolution)>, Timothy Goldschmidt's review in *RNCSE* 2001 (Jan-Apr); 21 (1-2): 51-3, and other articles in this issue.



## Evolution: The Creationist Backlash

Glenn Branch, NCSE Office Manager

The seven episodes of *Evolution* received glowing reviews not only from scientists (see Timothy H. Goldschmidt's review in *Science* 2001 Sep 23; 293: 2209-10, reprinted in *RNCSE* 2001 Jan-Apr; 21 [1-2]: 51-3, and Frans de Waal's review in *Natural History* 2001 Nov; 76-7) but also from the mainstream media. Writing in *The New York Times* (2001 Sep 24; E5), Julie Salamon said that "[a] powerful sense of drama, discovery and intellectual enthusiasm runs through this rich eight-hour series ... The series covers an enormous amount of ground but doesn't leave you feeling swamped." The Boston *Globe's* reviewer described it as

"brilliant television: an enthralling modern adventure story, entertaining and accessible, challenging and even disturbing" (2001 Sep 23; B7). And even *TV Guide* said that *Evolution* was "[a]s grand and multifarious as the system it celebrates" (2001 Sep 22-8; 51).

Creationists, however, were not so enthusiastic — to nobody's surprise. Well before the September 2001 broadcast of *Evolution*, the producers of the series were bracing for the expected creationist backlash. According to an article in the June 11, 2001, issue of *Current*, a newspaper that covers public broadcasting, "Even months before the series airdate, *Evolution* is

already on the radar screens" of anti-evolutionists, said director of national strategic marketing for WGBH Anne Zeiser (see <<http://www.current.org/prog/prog0111evol.html>>).

In the series of articles and commentaries that follow, we invite *RNCSE* readers to inspect the reactions of prominent creationists and other ideological opponents of evolution. Acronyms used are DI for the Discovery Institute, CRSC for the DI's Center for the Renewal of Science and Culture, ARN for the Access Research Network, ICR for the Institute for Creation Research, and AIG for Answers in Genesis; all dates are in 2001.



## Preparing for the Deluge

Glenn Branch, NCSE Office Manager

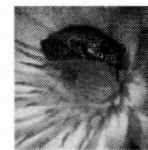
Anti-evolutionists did not wait for *Evolution* to air. They knew what was wrong with it and what they needed to say about it before its premiere. On July 26, as part of its presentation of its fall line-up at the National Press Tour, PBS held a press conference for *Evolution* in Pasadena, California. Among the attendees were Josh Gilder (a Reagan speechwriter, former editor of *The American Spectator*, and a cousin of George Gilder, who is a Senior Fellow of the DI) and John Mark Reynolds (Director of the Torrey Honors Institute at Biola University and a Fellow of the DI's CRSC). Both were vocal during the press conference, Reynolds asking why the series is (in Gilder's words) "so patently and gratuitously offensive to the religious sensibilities of the majority of the American people" and Gilder intimating that Paul Allen, the funder of the series, exercised undue influence over its content. Gilder

also asked James Moore, biographer of Darwin and historical consultant for *Evolution*, about the effect of his study of Darwin on his personal religious views; Moore, finding the question impertinent, explained that he would "as soon talk about my sex life as about my particular religious views in public." Reynolds's report on the press conference, "Come to Darwin", appeared on FreeRepublic.com ("a conservative news forum") at <<http://www.freerepublic.com/forum/a3b621a671921.htm>>. Gilder posted his report at the ARN web site at <<http://www.arn.org/docs/pbsevolution/pbsgilder072601.htm>>.

In a press release issued on August 31, headlined "PBS — pushing bad science", AIG describes *Evolution* as a "blatant propaganda series for evolution" intended "to show, once and for all, that molecules-to-man evolution is true." The press release predicts that AIG will

be misrepresented by the series, despite the producers' assurances of a balanced treatment. It also complains that "[a]s is usual for such evolutionary productions, various 'religious leaders' will be used to try to persuade the masses that it is okay to believe in evolution, since they have no problem with it. Of course, the real issue, the authority of the Bible as a trustworthy revelation from God, and hence the integrity of its Gospel message, will be glossed over."

The September 3 issue of *Christianity Today* contained Tom Bethell's review, "Hagiography for moderns" (103-4); Bethell is a senior editor at *The American Spectator* and a long-time anti-evolutionist (his "Darwin's mistake" [*Harper's* 1976 Feb; 252: 70-75] prompted Stephen Jay Gould's "Darwin's untimely burial", reprinted in *Ever Since Darwin*, New York: WW Norton, 1977, p 39-45). Bethell describes the series as "propaganda for Charles Darwin and his cause ... ideology masquerading as science" and castigates it for not revealing "the truth that virtually no scientific





ic evidence for evolution exists." Instead, he says, deniers of evolution "are isolated in the disreputable camp of fundamentalism. Ken Ham's followers *sing* their arguments — with guitars. Those who criticize evolution from a scientific perspective are not included." (AIG took exception at Bethell's characterization of its ministry as unscientific [see <<http://www.answersingenesis.org/docs2001/0830news.asp>>]). Connoisseurs of the anti-evolutionists' habit of quotation out of context will relish the reference to Colin Patterson in the final paragraph of Bethell's review.

On September 8, in Cincinnati, Ohio, AIG's president Ken Ham spoke at a banquet for AIG's "Creation Museum and Family Discovery Center", warning of the "onslaught" of *Evolution*, "the most well-funded evolutionary propaganda piece ever produced." He touted AIG's resources for combating the series, including its web site, Jonathan Sarfati's *Refuting Evolution*, a forthcoming CD-ROM (see below) to be sold at cost, its pamphlets, videotapes, and magazines, and its antiracism initiative (see <<http://www.onehumanrace.com>>).

On September 10, the DI issued the first in a series of press releases criticizing *Evolution*, headlined "PBS charged with 'false claim' on 'universal genetic code'". The press release accuses *Evolution* of asserting that all living creatures share the same genetic code and adducing the universality of the genetic code as evidence for their common ancestry. Michael Behe and Jonathan Wells, both Senior Fellows of the DI's CRSC, note the existence of exceptions to the universality of the genetic code, Wells adding that the exceptions undercut the evidence for common ancestry. The press release concludes with the announcement by the director of the DI's CRSC, Stephen Meyer, of a special web site devoted to criticizing the "scientific shortcomings" of *Evolution*.

Shortly thereafter, the web site

appeared as <<http://www.pbsevolution.org>>, easily confused with <<http://www.pbs.org/evolution>>, the official PBS web site for *Evolution*. The DI eventually renamed its web site <<http://www.reviewevolution.org>>, removed the tag line "the magnum opus of a dying theory", and redesigned it to make it clear that it was not associated with *Evolution* or with PBS. The press release may be found at <[http://www.reviewevolution.org/press/pressRelease\\_FalseClaim.php](http://www.reviewevolution.org/press/pressRelease_FalseClaim.php)>. In response to the DI's press release about the universal genetic code, NCSE issued a press release on September 17, in which Harvard's James Hankin and the University of Colorado's Norman Pace debunked Behe's and Wells's claims, and another press release on September 25, in which Brown University's Kenneth R. Miller explained in extensive detail the DI's errors (all of NCSE's press releases are listed, in reverse chronological order, at <<http://www.ncseweb.org/article.asp?category=12>>).

During the week before the series aired, ARN began to devote a section of its web site to its "Response to the PBS *Evolution* project" (<[http://www.arn.org/pbs\\_evolution0901.htm](http://www.arn.org/pbs_evolution0901.htm)>). For the most part, the contents of ARN's response are links to the DI's critique and to articles by Fellows of the DI's CRSC, perhaps unsurprisingly in light of the "research partnership" between ARN and CRSC. One interesting claim, which suggests that ARN envisions its audience as including teachers, appears in the introduction to ARN's Response: "As with the Carl Sagan's [*sic*] *Cosmos* series two decades ago, the PBS *Evolution* Project comes across more as evangelism for the Darwinian worldview, then [*sic*] as rigorous, undebatable science. We think this program offers a great opportunity to teach your students critical thinking skills." In announcing the response, Dennis Wagner, ARN's executive director, described the series (with a nod to

the Beatles) as "The PBS *Evolution* Propaganda Band" (<<http://www.arn.org/announce/announce0901no17.htm>>). Curiously, although Phillip Johnson contributes a weekly column ("The Weekly Wedge Update") to ARN's web page (see <<http://www.arn.org/johnson/wedge.htm>>), he failed to comment there on the series.

On September 20, AIG posted "Ken Ham exposes PBS's *Evolution* deception" on its web site as its daily news piece (<<http://www.answersingenesis.org/docs2001/0920news.asp>>), which summarizes Ham's September 8 speech and links to a video file of it.

On September 20, the DI issued a flurry of press releases. Perhaps the most important was headlined "*Evolution* spokesperson tries to tar scientific critics" (available at <[http://www.reviewevolution.org/press/pressRelease\\_ScientistsTar.php](http://www.reviewevolution.org/press/pressRelease_ScientistsTar.php)>), which took NCSE Executive Director Eugenie C. Scott to task for her comment in NCSE's September 17 press release that "virtually every reputable scientist in the world agrees that evolution is good science". Bruce Chapman, president of the DI, describes her comment as "tautological thinking"; Stephen Meyer accuses *Evolution* of hiding the existence of scientific dissent about evolution. NCSE itself is described as "an interest group that exists to promote the teaching of Darwinism and which routinely opposes criticism of Darwinian theory, including scientific criticism." The press release also announced the release of the DI's 154-page critique of the series, *Getting the Facts Straight: A Viewer's Guide for PBS's Evolution*, available at <<http://www.reviewevolution.org/getOurGuide.php>>, where it is explained that "*Evolution's* biased content ... makes it inappropriate for classroom use without supplementary materials. This Viewer's Guide has been prepared to help teachers, parents, students, and interested citizens ensure that discussions of evolution in the classroom fairly represent the evidence





and the full range of scientific viewpoints about Darwin's controversial theory." Many of the DI's press releases summarize criticisms that are to be found in the Viewer's Guide.

Also on September 20, the DI issued a press release criticizing *Evolution* for ignoring scientific disagreement over human origins ([http://www.reviewevolution.org/press/pressRelease\\_HumanOrig.php](http://www.reviewevolution.org/press/pressRelease_HumanOrig.php)). Jonathan Wells was quoted as remarking, "The truth is that committed evolutionists disagree sharply over how to interpret the meager evidence for human origins, and many of them admit that the entire field of paleoanthropology suffers from a tendency toward myth-making." In support of his claim, the press release quoted passages from paleoanthropologist Misia Landau, anthropologist Geoffrey Clark, and science writer Henry Gee. It ended with Stephen Meyer's complaint that "*Evolution's* one-sided approach fails to meet even the most basic standard of professionalism." On September 26, NCSE issued a press release in which Geoffrey Clark stated that "In an effort to discredit the PBS *Evolution* series, the quotes attributed to me and circulated on the creationist Discovery Institute's website were taken completely out of context. I do not believe, nor have I ever argued, that paleoanthropology is not a scientific endeavor." (The DI responded [[http://www.reviewevolution.org/press/pressRelease\\_NCSEFalseCharg.php](http://www.reviewevolution.org/press/pressRelease_NCSEFalseCharg.php)] by insisting that Clark was correctly quoted, apparently oblivious to the fact that NCSE and Clark accused the DI not of misquoting Clark but of quoting him out of context.) And in an NCSE press release issued on October 15, Henry Gee, responding to the DI's misrepresentation of his views in its Viewer's Guide, wrote, "I regard the opinions of the Discovery Institute as regressive, repressive, divisive, sectarian and probably unrepresentative of views held by people of faith generally. In addition, the use

by creationists of selective, unauthorized quotations, possibly with intent to mislead the public undermines their position as self-appointed guardians of public values and morals."

Also on September 20, the DI issued a press release complaining that *Evolution* misrepresented the Swedish zoologist Dan-Erik Nilsson's simulations of the evolution of the eye as the results of computer modeling ([http://www.reviewevolution.org/press/pressRelease\\_EyeEvolution.php](http://www.reviewevolution.org/press/pressRelease_EyeEvolution.php)). David Berlinski (author of several popular books on mathematics) and Jay Wesley Richards, both Senior Fellows of the DI's CRSC, are quoted. In an NCSE press release issued October 3, Brown University's Kenneth R Miller notes that in its discussion of Nilsson's work, "[n]ot once does the PBS program refer to or even imply the existence of a 'computer program'" (see "*The Discovery Institute strikes out*", p 16).

Also on September 20, the DI issued a press release taking *Evolution* to task for its "uncritical — and unrebutted — presentation of some of evolutionary psychology's wildest and most speculative claims" ([http://www.reviewevolution.org/press/pressRelease\\_Infomercial.php](http://www.reviewevolution.org/press/pressRelease_Infomercial.php)). John West, an assistant professor of Political Science at Seattle Pacific University, Senior Fellow of the DI, and associate director of its CRSC, described the discussion as "about as educational as an infomercial"; Jeffrey Schloss, chair of the Biology Department at Westmont College as well as a Senior Fellow of the DI's CRSC, is also quoted. The press release also parades Steven Pinker's comments about infanticide and Randy Thornhill and Craig Palmer's book on rape as examples of the worst excesses of evolutionary psychology, and quotes comments critical of evolutionary psychology from Jerry Coyne and Richard Lewontin. On October 1, NCSE issued a press release in which Coyne not only scathingly discusses

the DI's tactics but also describes *Evolution's* treatment of evolutionary psychology as appropriate.

On September 21, the DI issued a press release charging *Evolution* with distorting the historical record in order to portray all opposition to evolution as motivated by biblical literalism ([http://www.reviewevolution.org/press/pressRelease\\_RewriteHistory.php](http://www.reviewevolution.org/press/pressRelease_RewriteHistory.php)). John West comments, "Since *Evolution* purports to be about science, not religion, it is strange that it virtually ignores the scientific controversy sparked by Darwin and replaces it with a hackneyed story of fundamentalists battling science." Stephen Meyers agrees, and goes further to complain about aspects of the dramatization in Episode 1: "For example, the first episode shows Charles Darwin's brother Erasmus lampooning the classic hymn 'Rock of Ages' during a church service. But the scene is a complete fabrication, supported by no evidence whatsoever. The same is true of some of the scenes between Darwin and Captain Robert Fitzroy [*sic*] during the famous voyage of the *Beagle*. PBS should have to explain its resort to fictionalized history." In an NCSE press release issued October 3, Darwin biographer James Moore, reacting to the historical errors and distortions in the Executive Summary of the DI's Viewer's Guide, sets the record straight (see "*Discover history*", p 17).

AIG posted a revised version of its August 31 press release on its web site on September 22 (<http://www.answersingenesis.org/docs2001/0922news.asp>).

Jonathan Wells's "Evolution for the masses" appeared in the *Washington Times* on September 23, the day before *Evolution* began to air. Wells asserts that "the miniseries distorts scientific evidence to make it look like support for Darwin's theory", adding that *Evolution* "also presents uncritical some of the theory's more disreputable manifestations", citing as evidence the segment in which





Geoffrey Miller expounded his views on evolutionary psychology. He also complains about the presentation of religion in the series, claiming that *Evolution* presents all opponents to "Darwinian evolution" as "ignorant biblical fundamentalists" despite the existence of scientific critics (he cites Michael Behe) and of religious critics who are not fundamentalists (he cites Huston Smith). "Instead of being an educational documentary", Wells writes, *Evolution* is "a work of pro-Darwin propaganda that is out of place on public television." His article is reposted at <[http://www.](http://www.reviewevolution.org/press/fromPress_EvolutionFrMasses.php)

[reviewevolution.org/press/fromPress\\_EvolutionFrMasses.php](http://www.reviewevolution.org/press/fromPress_EvolutionFrMasses.php)>.

#### AND NOW, OUR FEATURE PRESENTATION...

All of this "reaction" occurred before the series had even aired. Most *RNCSE* readers will recognize these arguments as emphatic restatements of existing positions by anti-evolutionary organizations and individuals. However, once the series was broadcast, anti-evolutionists were able to point to specific examples from the program. These complaints are detailed below in the next article in this series.

Josh Gilder's review of *Evolution* appeared in the September 24 issue of *WorldNetDaily* at <<http://www.worldnetdaily.com/news/article.asp?24640>>. According to a note from the editor, the review was originally commissioned by *The Weekly Standard*, which, however, declined to print it. Gilder complains that the series was boring ("[e]xcept for a brief lesbian lovemaking scene"). The cause of its tediousness, he conjectures, was that it neglected "the growing body of evidence against Darwinism", which he documents by summarizing Jonathan Wells's *Icons of Evolution*. Citing the DI's Viewer's Guide (and in passing disclosing that he is "connected" with the DI), he accuses the series of being rife with error. He concludes by complaining of *Evolution*'s neglect of the "intelligent design" movement: "At a recent PBS press conference I asked the overall series producer, Richard Hutton, why Intelligent Design's scientific critique of evolution was completely ignored. He answered that he'd looked into it and decided there was nothing there. That's one way to decide important scientific disputes — let a TV producer decide." Excerpts from Gilder's review were reprinted in the *Washington Times* on September 26.

Also on September 24, Mark Hartwig's commentary on *Evolution* appeared on Family News in Focus, a web site associated with James Dobson's organization Focus on the Family (<<http://www.family.org/cforum/fnif/commentary/a0017777.html>>); Hartwig is not only science and worldview editor for Focus on the Family but also a former managing editor of *Origins Research*, the predecessor of the ARN's journal *Origin & Design*. In his commentary, Hartwig explains that "Darwinism" is unappealing both because it entails that life is without meaning and because its adherents "uncritically recycle the same ineffective arguments — some of which are demonstrably false ... then compound the problem by depicting doubters ... as religiously

## The Rising Tide

Glenn Branch, NCSE Office Manager

On September 24, the first day of the broadcast of *Evolution*, AIG announced the release of its CD-ROM *Creation: A Shattering Critique of the PBS/NOVA Evolution Series* (<<http://www.answersingenesis.org/docs2001/0924news.asp>>). "While lacking scientific weight, *Evolution* is the most well-funded and well-promoted evolutionary propaganda piece ever produced", AIG writes; the CD-ROM is intended to demonstrate that "real science supports the biblical account of origins as recorded in Genesis, the first book of the Bible." Its contents, according to the AIG web site, are:

- Articles by Dr Jonathan Sarfati [author of AIG's *Refuting Evolution*] responding to each of the seven programs ...;
- Other scientifically relevant articles;
- The complete video *From a Frog to a Prince* ...;
- Select clips from other videos;
- The complete book *Refuting Evolution* by Dr Jonathan Sarfati ...;
- Special audio interviews and messages by creationist scientists & speakers.

AIG is offering the CD-ROM for \$5.00 apiece; \$2.00 apiece for bulk orders of 10 or more. (See sidebar, p 12, for a summary of Sarfati's responses.)

Charles "Chuck" Colson's BreakPoint, a production of the Wilberforce Forum, itself a division of the Prison Fellowship Ministry, posted three articles on *Evolution* on September 24. These are apparently transcripts of radio commentaries broadcast in the previous week. The first two end with a reference to the DI's Viewer's Guide, on which Colson appears to have relied. "Why falsify history?" (<<http://www.christianity.com/CC/article/0,,PTID2228|CHID100546|CIID852910,00.html>>) claims that *Evolution* distorts the historical record; "Looking for the real evidence" (<<http://www.christianity.com/CC/article/0,,PTID2228|CHID100546|CIID859398,00.html>>) contends that "no one knows how macroevolution would occur — or, of course, if it ever does"; and "Upholding accuracy in science journalism" complains that *Evolution* ignored "intelligent design" (<<http://www.christianity.com/CC/article/0,,PTID2228|CHID100546|CIID868530,00.html>>).





motivated yahoos." He follows the DI in accusing *Evolution* of misrepresenting the universality of the genetic code and of omitting "the many scientific arguments raised against Darwinism" by Michael Behe, Jonathan Wells, and William Dembski, among others. He also echoes the DI's complaint about the historical accuracy of episode 1's portrayal of the conflict between Darwin and FitzRoy.

Also on September 24, the DI issued a press release with the headline "100 Scientists, National Poll Challenge Darwinism" (<[http://www.reviewevolution.org/press/pressRelease\\_100Scientists.php](http://www.reviewevolution.org/press/pressRelease_100Scientists.php)>). The press release described the DI-sponsored "A scientific dissent from Darwinism", which Skip Evans analyzes in "Doubting Darwinism through creative license" (see p 22), and a DI-sponsored poll conducted by Zogby America. The poll asked the following questions:

1. Which of the following two statements comes closest to your own opinion?

- Biology teachers should teach only Darwin's theory of evolution and the scientific evidence that supports it. 15%
- Biology teachers should teach Darwin's theory of evolution, but also the scientific evidence against it. 71%
- Neither/Not sure. 14%

2. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the following statement: "When Darwin's theory of evolution is taught in school, students should also be able to learn about scientific evidence that points to an intelligent design of life."

- Agree 78%
  - Strongly agree 53%
  - Somewhat agree 25%
- Disagree 13%
  - Somewhat disagree 5%
  - Strongly disagree 8%
- Not sure 9%

3. Which of the following two statements comes closest to your own opinion?

- When Public Broadcasting networks discuss Darwin's theory of evolution, they should present only the scientific evidence that supports it. 10%
- When Public Broadcasting networks discuss Darwin's theory of evolution, they should present the scientific evidence that supports it, but also the scientific evidence against it. 81%
- Neither/Not sure. 10%

4. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the following statement: "The universe and life are the product of purely natural processes that are in no way influenced by God or any intelligent design."

- Agree 24%
  - Strongly agree 12%
  - Somewhat agree 12%
- Disagree 69%
  - Somewhat disagree 13%
  - Strongly disagree 56%
- Not sure 7%

The results of the poll may reflect the popularity of the "fairness" approach. However, the wording of the poll's questions incorrectly assumes that the theory of evolution is exhausted by Darwin's contributions to it and that any scientific evidence against "Darwin's theory" invalidates the theory of evolution. Since these assumptions and implied connections are erroneous, it is doubtful that the poll's results are significant.

On September 26, the Pleasanton, California, *Tri-Valley Herald* published an article about the DI's "A scientific dissent from Darwinism" (the article is not available at the newspaper's web site; it is available at <[http://www.reviewevolution.org/press/fromPress\\_SciencalDarwin.php](http://www.reviewevolution.org/press/fromPress_SciencalDarwin.php)>). As far as NCSE is aware, the article, entitled "Lab scientists challenging Darwin", is the only notice taken of the DI's "A scientific dissent" in the mainstream media; the *Herald's* interest apparently stemmed from the fact that two of the signatories of the DI-sponsored statement work at the local Lawrence

Livermore National Laboratory. In the article, the DI's spokesperson Mark Edwards commented on the DI's exclusion from *Evolution*: "The final episode paints a picture that the only critics of Darwinian theory are these guitar-strumming hillbillies in Kentucky who are creationists, and that's just not true. We're glad we're not part of that stereotype." NCSE's executive director Eugenie C Scott was quoted as saying, "These guys don't have a scientific model ... All they have is a bunch of assertions that evolution didn't happen. Because they don't produce anything that's of scientific value, they're not taken seriously."

Also on September 26, the Culture and Family Institute — "an affiliate of Concerned Women for America, the nation's largest public policy women's organization ... [which] focuses on cutting-edge social issues with particular emphasis on the homosexual activist movement and other forces that threaten to undermine marriage, family and religious freedom" — posted a discussion of *Evolution* by Martha Kleder on its web site at <[http://cultureandfamily.org/report/2001-09-26/m\\_darwin.shtml](http://cultureandfamily.org/report/2001-09-26/m_darwin.shtml)>. Kleder's discussion relies heavily on the DI's press releases and its Viewer's Guide, but concludes with a link to a dialogue between America's Beverly LaHaye and AIG president Ken Ham.

On September 27, the DI issued a press release citing an internal PBS memorandum as evidence of "an improper political agenda behind WGBH/Clear Blue Sky's ongoing series *Evolution*" (<[http://www.reviewevolution.org/press/pressRelease\\_LeakedPBSMemo.php](http://www.reviewevolution.org/press/pressRelease_LeakedPBSMemo.php)>). "Public television is funded in part by American taxpayers, and it should be held to high standards of fairness. It is inappropriate for public broadcasting to engage in activities designed to directly influence the political process by promoting one viewpoint at the expense of others," said the DI's president, Bruce Chapman. The evidence for the supposed political agenda of the series appar-





ently consists of the memorandum's two allusions to "government officials" and "government leaders" as a niche audience and its hope that the series will inspire citizens to work with their local school boards on issues of scientific literacy. The press release also quoted John West's characterization of NCSE as "a single-issue group that takes only one side in the political debate over evolution in public education."

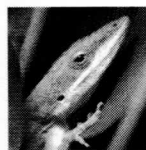
Across the country, several public broadcasting stations succumbed to anti-evolutionary pressure and broadcast creationist shows to "balance" the *Evolution* series. According to an article in the September 10 issue of *Current* (<http://www.current.org/prog/prog0116evol.html>), at least 14 public television stations were planning to broadcast "Voices for Creation", a 1992 documentary pro-

duced by WNMU in Marquette, Michigan. "Voices for Creation" features the ICR's Duane Gish and Richard Lumsden; it is described by its distributor as "a point-of-view documentary produced in response to increasing criticism of public television for its perceived pro-evolution stance." At least two public television outlets, Idaho Public Television and North Dakota's Prairie Public Broadcasting, aired documentaries produced by Earth Sciences Associates, run by Robert Gentry, the young-earth creationist known for his work on polonium halos and his *Creation's Tiny Mystery* (Knoxville [TN]: Earth Science Associates, 1992 [third edition]); information on the documentaries is available at <http://www.halos.com/videos.htm>. In Idaho, the pressure to present the creationist point of view was not

particularly subtle: state senator Stan Hawkins, who cochairs the legislature's joint budget committee, handed a videotape of Gentry's "The Young Age of the Earth" to Idaho Public Television officials at the committee's February meeting and urged them to air it, according to a report in the *Spokane Spokesman-Review* (2001 Sep 20).

#### CLOSING THE BARN DOOR ...

In summary, most of the arguments against the evidence presented in the series were little more than emphatic restatements of existing positions by anti-evolutionists — including some apparently desperate attempts to impugn evolutionary scientists. After the series had aired — to much acclaim — it was time for damage control. The post-broadcast comments changed gears again, as detailed below.



## The Abatement

Glenn Branch, NCSE Office Manager

Once the series aired, anti-evolutionists changed gears. With the broadcast, the power of evolutionary theory and its continuing success was now a matter of public record — reaching an audience much wider than those who usually consider the theory, its meaning, and its implications. Now it was necessary for critics of evolution to reach out for a broad audience in a variety of media outlets.

On September 28, World NetDaily posted "Darwin's public defenders" ([http://www.worldnetdaily.com/news/article.asp?ARTICLE\\_ID=24710](http://www.worldnetdaily.com/news/article.asp?ARTICLE_ID=24710)), by Stephen Meyer of the DI's CRSC. Meyer accused *Evolution* of making "a very selective presentation of the scientific evidence", saying that it presented "micro-evolutionary" changes as evidence of "macro-evolutionary" innovations, quoting Swarthmore College's Scott Gilbert's dictum that "natural selection explains the survival, but not the arrival, of the fittest." Meyer also

complained that *Evolution* ignored the "other scientists who could have provided informed dissenting opinion", citing the DI's "A scientific dissent from Darwinism". He concluded by criticizing what he takes to be *Evolution*'s message about religion: "good religion accommodates Darwinism, bad religion rejects it. But that implies, of course, that the real religion of this series is Darwinism." In an NCSE press release issued on October 12, Scott Gilbert commented on the DI's use of his dictum: "Of course, it is out of context, in that the paragraph mentions that natural selection alone cannot explain the origin of species. One needs natural selection plus developmental genetics."

Michael Behe's "Fatuous filmmaking" was also posted on WorldNetDaily on September 28 ([http://www.worldnetdaily.com/news/article.asp?ARTICLE\\_ID=24713](http://www.worldnetdaily.com/news/article.asp?ARTICLE_ID=24713)). Behe complained that *Evolution* "trumpets not just evolution (descent with modification) in

general, but Darwinism (random mutation and natural selection) in particular. Yet the show can't even bring itself to mention that some scientists and academics — plus the vast majority of the public — are profoundly skeptical of natural selection as the driver of evolution", citing Stuart Kauffman. In words strongly reminiscent of Meyer's article, he claims that *Evolution*'s message about religion is that "[g]ood religion cheerfully accommodates Darwinism. Bad religion doesn't." In an NCSE press release issued on October 14, Stuart Kauffman reiterated, "I wish to distance myself from use of my own work on self-organization plus selection in evolution by both 'creation scientists' and 'Design theory'. My own work on self-organization suggests that spontaneous order in complex systems may offer a second source of order in biology, in addition to natural selection. My argument does not entail that Darwinian descent with modifica-





tion into the branching "tree of life" is invalid" (see also his statement quoted in *RNCSE* 2000 Sep-Oct; 20 [6]: 12-3).

The DI's "A scientific dissent from Darwinism" appeared as a paid advertisement in the October 1 issue of *The Weekly Standard*, the October 8 issue of *The New Republic*, and the November 1 issue of *The New York Review of Books*. Its appearance in the last of these was perhaps in reaction to Frederick Crews's two-part essay "Saving us from Darwin" (*The New York Review of Books* 2001 Oct 4; 48 [15]: 24-7 and Oct 15; 48 [16]: 51-5), in which he savaged Phillip Johnson, Jonathan Wells, Michael Behe, and William Dembski, writing that "'intelligent design' — the theory that cells, organs, and organisms betray unmistakable signs of having been fashioned by a divine hand — bears only a parodic relationship to a research-based scientific movement." Judging from the rate cards of the magazines, the combined cost of the advertisements was in the neighborhood of \$50 000.

Jonathan Wells's "PBS's *Evolution*: The broadcast of an ideology" appeared in *Human Events* ("The National Conservative Weekly ... the conscience of the conservative movement and the antidote to liberal media bias") on October 1 (<<http://www.humanevents.org/articles/10-01-01/wells.html>>). Wells complained that "some of the 'evidence' presented in *Evolution* is known to be false, and the remaining evidence provides surprisingly little support for Darwin's theory. In place of scientific evidence, *Evolution* relies on a parade of experts to assure us that Darwin had it right, and that the only people who disagree are ignorant biblical literalists." On the contrary, he asserts, "[i]t turns out that belief in Darwinian evolution is not so much a matter of scientific evidence as a matter of personal philosophical commitment. The oft-repeated claim that Darwinism is supported by 'overwhelming evidence' is not a scientific statement, but an advertising slogan."

The following week, Timothy

Wallace, the proprietor of the True.Origin web site ("A rational alternative to — but not affiliated with — the 'Talk.Origins Archive'"), posted "The dogma of PBS", a three-paragraph-long introduction to links to Gilder's, Behe's, and Meyer's critiques of *Evolution* in WorldNetDaily and to the DI's Viewer's Guide. Unlike the other creationist criticisms of *Evolution* listed here, Wallace's specifically attacks PBS, insisting that *Evolution* is only the latest in a series of nefarious PBS projects: "American taxpayers have long subsidized the indoctrination efforts of the 'Public Broadcasting Service' (PBS) via various combinations of historical revisionism, moral relativism, anti-Christian humanism, and pseudo-scientific evolutionism. The fall of 2001 should be remembered as the season when taxpayers assisted PBS in their greatest propaganda effort to date: the broadcast of the series entitled 'Evolution'" (<<http://www.trueorigins.org/pbsevolution.asp>>).

The DI issued another press release about the universality of the genetic code on October 10 (<[http://www.reviewevolution.org/press/pressRelease\\_ReplyMiller.php](http://www.reviewevolution.org/press/pressRelease_ReplyMiller.php)>), responding to Kenneth R Miller's "A 'dying theory' fails again", an NCSE press release issued on September 25 in response to the DI's original press release of September 10. The press release accused Miller of misunderstanding a paper on the phylogeny of genetic codes that he cited, of relying upon a specious analogy between variant genetic codes and variant dialects of a language, and of misrepresenting the experimental literature on variant genetic codes. Miller, in an NCSE press release issued on October 18, rebutted its accusations; he went on to comment, "I read their press releases in vain looking for details. I had hoped to learn how a designer might have chosen to alter the code in some organisms and not in others, and especially why the patterns of variation come to resemble something that we scientists 'misinterpret' as evolution. Naturally, I was disap-

pointed. As usual, the Discovery Institute is silent on this issue. 'Intelligent Design', it seems, amounts to little more than saying 'Maybe a Designer did it' for each and every fascinating pattern that appears in living organisms. It is no wonder that the scientific community has rejected 'Design' again and again for the simplest of all reasons — a lack of evidentiary support."

On October 16, a parody of NCSE's previous press releases, written by a person who wished to remain anonymous, was communicated to NCSE's Network Project Director Skip Evans by David Buckna, a creationist active in British Columbia:

In a stunning, unprecedented move this week, the National Center for Science Education (NCSE), a pro-science organization based in Berkeley, contacted every living scientist on earth to warn them that the Discovery Institute had quoted them out of context, or would soon do so.

The Discovery Institute is a Seattle-based "intelligent design" think-tank that recently criticized programs such as the PBS *Evolution* series.

"It took us a while to phone or e-mail every living scientist", said NCSE Executive Director Eugenie Scott, "but we did it. We've needed this sort of comprehensive response for some time. Now absolutely every scientist, anywhere on the planet, knows that anything the Discovery Institute writes, in the past, present, or future, is out of context."

NCSE staffer Skip Evans added that the organization was still trying to contact deceased, still-unborn, and extraterrestrial scientists to obtain their condemnations as well. "We're making every effort to contact Charles Darwin, TH Huxley, and George Gaylord Simpson", Evans said. "Yes, these dead guys are kind of hard to



## ANTI-DARWINIAN BULLDOG



As *Evolution* was broadcast, AIG's Jonathan Sarfati, author of *Refuting Evolution*, watched; his responses to the episodes were posted on AIG's web site on the day following the broadcast of each episode (the entire collection of Sarfati's responses is posted at <[http://www.answersingenesis.org/pbs\\_nova/default.asp](http://www.answersingenesis.org/pbs_nova/default.asp)> and also appears on the *Creation* CD-ROM released by AIG). Sarfati's commentaries are very lengthy and contain abundant references. The main points are summarized here.

### EPISODE 1

#### "DARWIN'S DANGEROUS IDEA"

Sarfati complains that *Evolution* gives "the impression there is only 'religious' criticism of evolution" and ignores "the rabidly atheistic faith of many of evolution's proponents". He contends that evolution requires impossible "changes that *increase the genetic information content*" (emphasis in original) and denies that the episode's discussion of the Galapagos finches and the HIV virus provide support for evolution. He also argues in detail against the claim that the vertebrate eye is badly designed, suggesting that such defects "reflect the fact that we live in a fallen world". He concludes by repeating the DI's arguments against the universality of the genetic code.

### EPISODE 2

#### "GREAT TRANSFORMATIONS"

Sarfati claims that the episode "tries to prove the 'big picture' of evolution, ... i.e. particles to people", and complains that the series never addresses the question of the origin of life. He finds paleontologist Neil

reach, but it's important that we try. We have to protect science." The NCSE would not elaborate on their plans to contact fetal or extraterrestrial scientists.

NCSE posted the parody, with a grin and the permission of its author, on its web site on October 22.

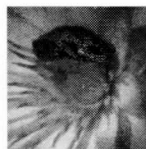
On October 22, the Discovery Institute issued what, for now, is the final salvo in the press release battle against NCSE: "National Center for Science Education's shrill campaign in defense of *Evolution*" (<[http://www.reviewevolution.org/press/pressRelease\\_NCSECampaign.php](http://www.reviewevolution.org/press/pressRelease_NCSECampaign.php)>). Both Bruce Chapman and Stephen Meyer criticized NCSE for engaging in "red herrings and *ad hominem*s" in the style of a political campaign. Alluding to the statements of Henry Gee, Jerry Coyne, and Geoffrey Clark in various NCSE press releases, Jonathan Wells remarked, "Darwinian biologists themselves frequently acknowledge that there are problems with the evidence for various aspects of evolutionary theory. Dogmatic Darwinists, however, believe in the theory so fervently that they don't like critics to quote their candid assessments of the evidence. So they claim that they have been misquoted, when in fact they have been quoted correctly." Of course, NCSE's charge is not that the DI *misquoted* Gee, Coyne, and Clark, but that it *misrepresented* them, a charge that the DI never adequately rebuts.

On November 10, Benjamin Wiker's "Do you bonobo? Meet our make-love-not-war primates" appeared on *National Review Online* ("America's premier conservative website") at <<http://www.nationalreview.com/weekend/television/television-wiker111001.shtml>>. Wiker is a Fellow of the DI's CRSC and a lecturer in the history and philosophy of science at the Franciscan University of Steubenville, Ohio; he is also the author of the forthcoming *Moral Darwinism: How We Became Hedonists* (Downers Grove [IL]: InterVarsity Press, 2002). He complained that in

Episode 5 of *Evolution*, "Why Sex?", "the conflict between Left and Right was played by bonobos and chimps respectively ... The use of science to forward a particular moral and political agenda could not have been bolder ... 'Why Sex?' was carefully crafted to serve the agenda of the leftward leaners." Wiker also said (incorrectly) that "the scientific consensus of the series seemed to be that ... we really did evolve from the chimp."

Cornelius Hunter, a PhD student in biophysics at the University of Illinois, a former technology executive, and the author of *Darwin's God: Evolution and the Problem of Evil* (Grand Rapids [MI]: Brazos Press, 2001), the cover of which features blurbs from Phillip Johnson, Michael Behe, William Dembski, and Stephen C. Meyer, posted a review of Carl Zimmer's *Evolution: The Triumph of an Idea* (New York: HarperCollins, 2001), the companion volume to the series, on the ARN web site at <<http://www.arn.org/docs/pbsevolution/zimmerreview112101.htm>>. Although Hunter praised Zimmer's book for being "wonderfully written and illustrated", he regarded it as superficial, over-optimistic, and tendentious. His lengthy review (about 5000 words) concluded, "Instead of unwrapping the evolution story and clarifying the myths that have grown up around it, Zimmer's work only reinforces those myths. *Evolution: The Triumph of an Idea* is [a] high-quality volume but it adds little in the way of a fresh understanding to this complex story. In promoting evolution, Zimmer has not captured the essence of this important subject."

On November 15, Casey Luskin of the IDEA (Intelligent Design and Evolution Awareness) Club — a student-run organization at the University of California, San Diego, that seeks to "promote, as a scientific theory, the idea that life was designed by an Intelligence" (<<http://www.acs.ucsd.edu/~idea/>>) — posted two documents on the ARN web site concerning *Evolution*. "An abridged PBS



*Evolution* viewer's guide & summary" (<<http://www.arn.org/docs/pbsevolution/pbssummary111501.htm>>) appears to be a summary of the DI's Viewer's Guide, which it recommends. "Ten questions to ask your students about the PBS *Evolution* series" (<<http://www.arn.org/docs/pbsevolution/tenquestions111501.htm>>), apparently intended for the use of teachers, poses questions that either suggest that there are difficulties with the theory of evolution or insinuate that there are credible alternatives to it. These documents, along with links to other materials about *Evolution*, also appear on IDEA's web site at <<http://www.acs.ucsd.edu/~idea/pbsevolution.shtml>>.

The December 2001 issue of the ICR's *Impact* (nr 342; on the ICR's web site in PDF format at <<http://www.icr.org/pubs/imp/pdf/imp-342.pdf>>), by Ken Cumming, the Dean of Graduate Studies at ICR, reviewed *Evolution*, beginning with a startling comparison: "Only 13 days after the act of terrorism on New York, Public Broadcasting Stations delivered a different, but another event of grave importance that was witnessed by millions of Americans — ... one of the boldest assaults yet upon both our public schools with the millions of innocent school children and the foundational worldview on which are nation was built. These two assaults have similar histories and goals. ... America is being attacked from within through its public schools by a militant religious movement of philosophical naturalists (i.e., atheists) under the guise of secular Darwinism." Cumming proceeded to characterize evolution as intrinsically atheistic and its adherents as evangelists for a system of religious belief antithetical to Christianity; NCSE member Keith Miller, the geology professor and evangelical Christian who appears in Episode 7, is summarily dismissed as "double-minded". Cumming's comparison was cited by *The New Republic* in its Idiocy Watch — its "attempt to keep up with all the dumb and outrageous things being said and writ-

ten about America and the terrorists" — at <<http://www.tnr.com/102901/notebook102901.html>>.

### THE MORALS OF THE STORY

This sampling of creationist reactions to the *Evolution* series is necessarily incomplete. This discussion represents only the reactions that were either covered in the mass media or produced by organizations with sufficient resources to publicize them themselves — in particular, AIG and the DI. It is possible, nevertheless, to reach a few conclusions.

Just as there are three basic themes in the creationist response to evolution — the three pillars of anti-evolutionism, as it were — so there are three corresponding basic themes in the creationist response to *Evolution*. Thus, because evolution is a "theory in crisis", *Evolution* is criticized for not revealing the "problems" of evolutionary theory; because evolution is antireligious, *Evolution* is castigated for suggesting that evolution is compatible with religion; because it is only fair to teach "both sides" or to teach "the controversy" about evolution, *Evolution* is condemned for unfairly presenting only one side and portraying the controversy as scientifically unimportant. These, in various permutations and combinations, are the themes that were repeatedly belabored throughout these reactions against *Evolution*, whether they originated from the young-earth creationists at AIG or the would-be pioneers of "intelligent design" at the DI.

The media strategies, however, differ conspicuously. Hugh Ross's old-earth creationist organization Reasons to Believe seems to have taken only minimal notice of the series, and the ICR, which used to be the principal voice of creationism, hardly commented on *Evolution* at all. Although AIG's response to the series was extensive, it was preaching to the choir, so to speak, issuing its response through its own outlets (primarily its web site).

Shubin's explanation of deep time disrespectful of Christianity, for it contradicts Scripture. He criticizes the episode's discussion of whale evolution, tetrapod evolution, and the Cambrian explosion, faulting paleontologists for revising their theories in response to new evidence.

### EPISODE 3

#### "EXTINCTION!"

Sarfati expresses puzzlement because this episode "hardly made any attempt to prove evolution *per se*" and uses some dubious arithmetic to deny that most species are extinct. He claims that the fossil evidence for mass extinctions is the result of Noah's Flood. He proclaims ecological issues irrelevant to evolution and concludes that evolution necessarily undercuts any moral imperative for conservation.

### EPISODE 4

#### "THE EVOLUTIONARY ARMS RACE"

Sarfati speculates that the "arms race" between the poisonous rough-skinned newt and the garter snake might be a case of decreased genetic "information", reiterating the claim that random mutation and natural selection are incapable of increasing "genetic information". He concludes, however, that the newt's poison glands were divinely prearranged and "switched on" at the Fall. Sarfati similarly uses the aftermath of the Fall to explain antibiotic resistance, decreasing virulence of disease-causing organisms, and symbiosis.

### EPISODE 5

#### "WHY SEX?"

To Sarfati this episode is "one of the most revealing about the conflicts between evolution and Christianity" because "evo-







lutionary psychology directly affects questions of sexual morality." Referring to the segment about the sexual activity of bonobos, he infers that it offers a "justification of an 'anything goes' approach to sexual morality." He also took issue with the portrayal of humans "as just an advanced species of ape."

#### EPISODE 6

##### "THE MIND'S BIG BANG"

Sarfati complains that the episode's discussion of the human mind and language does not even try to prove evolution, but just "assumes it" (emphasis in original). Following a meandering discussion of the creationist view of paleoanthropology and linguistic development, he adds that if "Eugenie Scott were truly concerned about non-science being taught in the science classroom, she would oppose evolutionary psychology and memetic evolution as well, and certainly not support using this PBS series in science classrooms. No, what she's opposed to is challenges to her materialistic faith."



#### EPISODE 7

##### "WHAT ABOUT GOD?"

Sarfati's central objection is that the episode obscures the obvious — "that evolution and Biblical Christianity are diametrically opposed". He complains that AIG and Ken Ham were erroneously portrayed, especially because AIG's "extensive scientific criticisms of evolution" were omitted. He describes Wheaton College, a focus of the episode, as "compromising" and as planting "the seeds of apostasy". (See [http://www.answersingenesis.org/Home/Area/feedback/negative\\_15October2001.asp](http://www.answersingenesis.org/Home/Area/feedback/negative_15October2001.asp) for a response from a Wheaton student, with a reply from AIG's Carl Wieland.)



## MISREPRESENTED SCIENTISTS SPEAK OUT

*As described in "Evolution: The Creationist Backlash" (p 5), NCSE asked several of the scientists whose statements were quoted out of context by the Discovery Institute in its critique of Evolution to respond. Here are their statements, which are also posted on NCSE's web site at <http://www.ncseweb.org/article.asp?category=12>.*

#### GEOFFREY CLARK

In an effort to discredit the PBS *Evolution* series, the quotes attributed to me and circulated on the creationist Discovery Institute's web site were taken completely out of context. I do not believe, nor have I ever argued, that paleoanthropology is not a scientific endeavor. The out-of-context quotes derive from a paper in which I argue a technical point to other scientists in the fields of archaeology and paleoanthropology: I encourage them to pay more attention to collecting data with an explicit conceptual framework firmly in mind, rather than just assembling factual information. As in all good science, anthropologists must regularly re-examine their approaches, and I never intended to imply that paleoanthropology is unscientific.

While there are many views of humans, and of the place of humans in the natural world, there is only one scientific view — that of neo-Darwinian evolutionary theory.

#### JERRY COYNE

The Discovery Institute is up to its old tricks. Given the complete absence of evidence for their own theory of "intelligent design" — a theory that has produced not a single scientific paper in a peer-reviewed journal — they instead seek "confirmation" of their views in controversies about evolutionary biology. Their strategy (transparent to all thinking people) is to sow doubt about the fact of evolution simply because scientists do not know every detail about how evolution occurred.

One of these controversies is about evolutionary psychology: the view that much of modern human behavior was molded by natural selection in our distant ancestors. I have been a strong critic of this enterprise, not because I think it is misguided, but because I feel that its practitioners often hold low standards of evidence and because [its hypotheses are] difficult to test. There are others who disagree with

The DI, however, evidently regarded *Evolution* as a prime opportunity to make a splash of its own, pouring time and money into its effort to discredit it. Yet the DI's response to the series, although uncritically used by publications and organizations on the political and religious right, went largely ignored by the mainstream media — perhaps because the media were understandably preoccupied with the tragic events of September 11 and their aftermath. But it is entirely possible that the next spate of creationist propaganda will receive more attention. As always, NCSE will be ready to respond.

[NCSE wishes to acknowledge the generosity of Geoffrey Clark, Jerry Coyne, Irene Anne Eckstrand, Wesley Elsberry, Barbara Forrest, Henry Gee, Scott Gilbert, James Hankin, Richard Hutton, Stuart Kauffman, Joseph Levine, Kenneth R. Miller, James Moore, Norman Pace, Kevin Padian, Ellen Paul, Robert T. Pennock, David Wake, Judith Weis, and Anne Zeiser in helping NCSE to answer the flood of creationist misinformation about evolution and Evolution.]

#### AUTHOR'S ADDRESS

Glenn Branch  
National Center for Science Education  
PO Box 9477  
Berkeley CA 94709-0477  
[ncseoffice@ncseweb.org](mailto:ncseoffice@ncseweb.org)

[Readers with any additional information about or examples of anti-evolutionists' reactions to PBS's *Evolution* series should contact Glenn Branch at NCSE.]

me. This is simply one of many scientific disputes that are hard to resolve because the evidence is scanty.

But does this controversy show that humans did not evolve? Hardly! The fossil evidence for human evolution is overwhelming, and new details of how it occurred are constantly appearing with new fossil finds and contributions from molecular biology. Only those willfully blinded by adherence to religious dogma would deny that we evolved from apelike ancestors. Evidence for how our behavior evolved is more tenuous for only one reason: unlike bones, behavior does not fossilize.

The Discovery Institute is curiously silent about the fact of human evolution, preferring to concentrate instead on the controversy about the evolution of human behavior. They claim that the PBS series is guilty of "effective censorship" in failing to show the controversial nature of evolutionary psychology and that criticisms like mine have been deliberately expunged from the show.

I have watched the *Evolution* series and have examined its companion book, and the Discovery Institute's accusation of censorship is flatly wrong. Evolutionary psychology is clearly characterized as "controversial" in the television show, and the companion book goes into great detail about potential problems with evolutionary psychology, quoting at length from a critique written by Andrew Berry and myself. I am in complete agreement with the statements in the companion book (Carl Zimmer, *Evolution: The Triumph of an Idea*, New York: HarperCollins 2001, p 284): "The debate over evolutionary psychology won't be resolved any time soon .... As hard as it may sometimes get, it's important to stay focused on the science, or the lack thereof, in evolutionary psychology. The weight of the scientific evidence will ultimately determine whether it stands or falls." This is hardly a one-side, "censored" presentation of evolutionary psychology!

## HENRY GEE

The Discovery Institute has used unauthorized, selective quotations from my book *In Search of Deep Time* to support their outdated, mistaken views.

Darwinian evolution by natural selection is taken as a given in *In Search of Deep Time*, and this is made clear several times; for example on p 5 (paperback edition), I write that "if it is fair to assume that all life on earth shares a common evolutionary origin..." and then go on to make clear that this is the assumption I am making throughout the book. For the Discovery Institute to quote from my book without reference to this is mischievous.

That it is impossible to trace direct lineages of ancestry and descent from the fossil record should be self-evident. Ancestors must exist, of course — but we can never attribute ancestry to any particular fossil we might find. Just try this thought experiment — let's say you find a fossil of a hominid, an ancient member of the human family. You can recognize various attributes that suggest kinship to humanity, but you would never know whether this particular fossil represented your lineal ancestor — even if that were actually the case. The reason is that fossils are never buried with their birth certificates. Again, this is a logical constraint that must apply even if evolution were true — which is not in doubt, because if we did not have ancestors, then we would not be here. Neither does this mean that fossils exhibiting transitional structures do not exist, nor that it is impossible to reconstruct what happened in evolution. Unfortunately, many paleontologists believe that ancestor/descendent lineages can be traced from the fossil record, and my book is intended to debunk this view. However, this disagreement is hardly evidence of some great scientific cover-up; [anti-evolutionists] such as the DI — who live by dictatorial fiat — fail to understand that scientific disagreement is a mark of health rather than decay. However, the point of *In Search of Deep*

*Time*, ironically, is that old-style, traditional evolutionary biology — the type that feels it must tell a story, and is therefore more appealing to news reporters and makers of documentaries — is unscientific.

I am a religious person and I believe in God. I find the militant atheism of some evolutionary biologists ill-reasoned and childish, and most importantly unscientific — crucially, faith should not be subject to scientific justification. But the converse also holds true — science should not need to be validated by the narrow dogma of faith. As such, I regard the opinions of the Discovery Institute as regressive, repressive, divisive, sectarian, and probably unrepresentative of views held by people of faith generally. In addition, the use by creationists of selective, unauthorized quotations, possibly with intent to mislead the public, undermines their position as self-appointed guardians of public values and morals.

The above views are my own and do not necessarily represent those of my colleagues at *Nature* or any opinion or policy of the *Nature Publishing Group*.

## SCOTT GILBERT

Of course, it is out of context, in that the paragraph mentions that natural selection alone cannot explain the origin of species. One needs natural selection plus developmental genetics. Most natural selection "black-boxes" the genes that are involved in forming morphological structures during development. However, we now know something about these developmental regulatory genes. Evolutionary developmental biology focuses on these genes (that the creationists say do not exist and the "intelligent design" people conveniently ignore) to show that changes in gene expression can give one the raw material upon which natural selection can work.

## STUART KAUFFMAN

While all scholars are free to make what they will of the work of





other scholars, I wish to distance myself from use of my own work on self organization plus selection in evolution by both "creation scientists" and "[intelligent] design theory". My own work on self organization suggests that spontaneous order in complex systems may offer a second source of order in biology, in addition to natural selection. My argument does not entail that Darwinian descent with modification into the branching "tree of life" is invalid. Nor does it entail that natural selection is not a critical process in evolution. It does argue that some forms of order in complex systems, such as ordered behavior of genetic reg-

ulatory networks and the emergence of self-reproducing, collectively autocatalytic networks, are much more probable than we have realized. Because these arguments suggest a higher probability of such complex systems than we might have supposed, the arguments tend to run against [intelligent] design theory, which is based on the argument that such complex systems are so improbable that one must infer design. If I am right, that is just what one cannot infer. More, there is nothing in my work that I personally take to support "creation science", if by some stretch of the definition it be science at all.

the Darwinian concept of a universal common ancestor. This was a point made by Princeton University researchers Robin D Knight, Stephen J Freeland and Laura F Landweber in an article earlier this year ("Rewiring the keyboard: Evolvability of the genetic code," *Nature Reviews - Genetics* 2001; 2: 49-58). Incredibly, the Discovery Institute, which cited this very paper in its Viewer's Guide to the PBS series, actually wrote: "It is now clear that the genetic code is not the same in all living things, and that it does not provide 'powerful evidence' that all living things 'evolved on a single tree of life.'"

When Laura Landweber, the senior author on this paper, read the Discovery Institute's analysis of differences in the genetic code, she minced no words. Landweber wrote: "That is indeed a horrible misinterpretation, because it is clear, particularly in the tree in our paper and in others, that each non-standard code is a subtle derivative of the standard genetic code and that all codes are derived from it."

In plain language, when these "subtle" differences in the code are examined, they actually provide powerful evidence in favor of evolution. Not only was PBS right, but, if anything, it understated the extent to which the genetic code supports Darwin's theory. The status of this scientific "evidence" against evolution? According to Landweber, it is nothing more than a "horrible misinterpretation".

## STRIKE TWO

Brown University biologist Kenneth Miller asserts that the "imperfect" wiring of the vertebrate retina proves that natural selection, not an intelligent designer, produced the eye. God, in Miller's opinion, wouldn't have done it that way. To arrange the retina as Miller thinks best, however, would render it inoperative.

In the first episode of the PBS series, I pointed out that the light-sensitive portions of the photoreceptor cells of the vertebrate retina

## The Discovery Institute Strikes Out

*Kenneth R Miller, Brown University*

*In the following press release, issued by NCSE on October 3, 2001, Kenneth R Miller briefly refutes three scientific errors in Stephen C Meyer's "Darwin's public defenders" <[http://www.worldnetdaily.com/news/article.asp?ARTICLE\\_ID=24710](http://www.worldnetdaily.com/news/article.asp?ARTICLE_ID=24710)>. Meyer is director of the Discovery Institute's Center for the Renewal of Science and Culture.*

The Discovery Institute's latest attack on the PBS *Evolution* series provides a remarkable glimpse of the actual caliber of the scientific "evidence" they claim to have developed against Darwin. In a single paragraph, Meyer accused the series of having made three important "factual errors" in support of Darwin's theories. A close look at his criticisms, however, shows that it is the scholars of the Discovery Institute, not PBS, who have just gone 0 for 3.

### STRIKE ONE

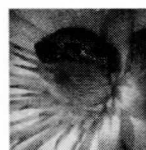
"Evolution" . . . makes numerous factual errors that exaggerate the evidential support for Darwinism. The series asserts that the universality of the genetic code establishes

that all organisms had a common ancestor. But biologists have known for well over a decade that the genetic code is not universal.

Wrong. The genetic code is indeed universal. If it were not, genetic engineers would not be able to swap genes between organisms as different as humans, insects, bacteria, and yeast and still have them work. For better or for worse, gene swapping does work and it works brilliantly. So how did the Discovery Institute decide that the code is "not universal"? It turns out that in some organisms, a few of the 64 possible "words" of the genetic code are different. Do a few different words mean that the code is not universal? Only if you are willing to say that the US and Britain do not share a common language because elevators in the UK are called "lifts" and Britons spell the word "color" with a "u".

It gets better. These slight differences in the code actually support

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





are not positioned optimally to face the incoming light. Instead, they are placed beneath the neural wiring of the retina. This arrangement cannot be explained in terms of intelligent design, but is perfectly understandable in light of evolution. The vertebrate retina evolved as an outgrowth of the brain, and as a result its neural wiring retains its original arrangement, scattering the incoming light before it can be sensed by the photoreceptor cells.

One can argue whether or not "God would have done it that way", but on one point there can be no dispute. The Discovery Institute is dead wrong when it says that the retina would be "inoperative" if it were arranged with the neural wiring beneath a layer of light-sensing cells. How can we be so sure? Because that is exactly how the eyes of many mollusks are arranged. It will, no doubt, come as a great surprise to squid everywhere that, according to the Discovery Institute, their eyes do not work!

### STRIKE THREE

Beauty may indeed be in the eye of the beholder, but is there any excuse for criticizing a statement that was never made? The third charge made by Meyer was that PBS had implied that researcher Dan-Eric Nilsson had written a "computer program" that simulated the evolution of the eye:

The series leaves the distinct impression that a computer program has successfully simulated the evolution of the eye. But such a program nowhere exists — a fact recently verified by Dan Nilsson (of Lund University in Sweden), the very expert that PBS interviewed about eye evolution.

It is not at all surprising that Nilsson "verified" the non-existence of such a program, since the PBS series never claimed that such a program existed in the first place. Here are the exact words from the broadcast:

**NARRATOR:** At the University of Lund in Sweden, zoologist

Dan-Eric Nilsson has developed models to show how a primitive eye-spot could evolve through intermediate stages to become a complex human-like eye in less than half a million years.

**NILSSON:** I've been interested in eye evolution for a long time, and in particular I've been interested in the question of how long a time it would take for an eye to evolve.

**NARRATOR:** Nilsson envisioned a sequence of stages by which a flat patch of light-sensitive cells on an animal's skin could evolve into a camera-type eye. As a first step, nature would favor any changes that made the flat patch more cup-like.

Not once does the PBS program refer to or even imply the existence of a "computer program". Where did the "distinct impression" come from? It is impossible to say, and I would hope that at some point our friends in the Discovery Institute

would explain the thought process that led them to write a press release complaining about a statement that was never made.

### THE DISCOVERY INSTITUTE'S BOX SCORE: 0 FOR 3

The Discovery Institute has complained repeatedly that PBS, as well as mainstream science, has ignored powerful evidence against Darwin's theory. Unfortunately, when given a chance to say just what that evidence might be, they have consistently struck out. Those three "factual errors" in the PBS series? They actually come from the Discovery Institute's own "horrible misinterpretation" of genetic code data, their lack of knowledge of the mollusk eye, and their comically overactive imagination.

Just like Darwin, and unlike the Discovery Institute, PBS got it right the very first time.

#### AUTHOR'S ADDRESS

Kenneth R Miller  
Professor of Biology  
Brown University  
Providence RI 02912



## Discover History: The DI's Historical Distortions

James Moore

*Despite the Discovery Institute's concerns about historical accuracy in PBS's Evolution series, the very first two sentences of its guide to Episode 1 contain two glaring historical errors. Darwin did not attend a "divinity school"; he graduated from Cambridge University. And his position aboard the Beagle was not "ship's naturalist"; he sailed as a private citizen. In the following press release, issued by NCSE on October 3, 2001, James Moore reflected further on the DI's criticisms of Evolution.*

Over the last forty years, the study of Charles Darwin and his works has become a specialty not unlike biblical scholarship. The *Origin of Species* now has its own concordance; Darwin's private

notebooks are in a definitive edition; his marginalia have been recorded with scribal exactness; and so far has textual criticism progressed on his published works that antiquarian booksellers search out unnoticed errors in late printings as a hedge against inflation.

In such a well-trodden field, there are many pitfalls into which the-blind-leading-the-blind may stumble. (The phenomenon is familiar in the field of biblical studies.) Thus in preparing the drama for Episode 1, the production team of *Evolution* sought expert guidance at every stage and on each draft-script before the shoot. Verisimilitude was not the aim, but rather a story-line with character development that, like other historical drama, would be consonant with authoritative scholarship.





Nevertheless, some people have found the episode historically deficient. They believe that they have good grounds for charging it with bias and falsification. (Similar charges arise in biblical studies from those overly reliant on the private interpretation of scripture.) It seems worthwhile, therefore, to comment on aspects of the episode that critics have brought to the public's attention.

### SCIENCE VERSUS RELIGION

The critics of Episode 1 have yet to exhibit much historical discernment. While this may be consistent with the manner in which some of them read the Bible, it fails to inspire confidence in their ability to score points against evolution. Consider, for example, how members of the Discovery Institute, who bid to be taken seriously in such matters, dismiss the episode's opening scene as a "stereotype" setting the stage for the whole *Evolution* series: "Darwin, the enlightened scientist, against Captain Robert FitzRoy, the supposed religious fundamentalist." The statement itself is a silly caricature, created by projecting modern American preoccupations onto the dramatic figures. The DI then objects, "Darwin at that time in his life was more religious and FitzRoy was more scientific", an assertion historically as fatuous as it is redolent of the banal way in which many Americans discuss evolution (all Discovery Institute quotations are from the "executive summary" of DI 2001).

The DI wants to know: Where are the "scientists" who opposed Darwin? Why present "science" in the episode as if it involved "religion"? Discover history! The word "scientist" was not in ready use until the end of Darwin's life (and even then it was regarded in Britain as "a horrible but handy Americanism" — see *The Times*, quoted in Moore and Desmond 1998). To speak of "science" on the one hand and "religion" on the other in Darwin's time is deeply unhistorical; it transposes post-positivist intellectual boundaries into an age when those

boundaries were contested or had yet to emerge. *On the Origin of Species* was itself the last great work in the history of science for which theology was an active ingredient. The word "evolution" does not appear in the text (except once in the 6th edition) but Darwin used "creation" and its cognates over one hundred times. Almost all the opposition to his work in the 19th century was religious in origin, inspiration, or sentiment. "Men of science", even non-Christians, professed themselves religious. Religious leaders, Christian or not, took pride in being scientific. The vast majority of them, particularly in Britain, openly acknowledged the political affinities of their beliefs, and natural selection, accordingly, was often judged "dangerous". Reactions to Episode 1 suggest that Daniel Dennett is right — the theory remains politically and morally dangerous — though many religious and non-religious people believe that it is not necessarily so.

"We are given no hint of the great range of religious views between that of the Bible-thumping FitzRoy and the evolution-friendly Miller." "The makers of *Evolution* have ignored this rich and fascinating history."

Alas, more bunk from the Discovery Institute. Episode 1 convenes a broad church of witnesses. Daniel Dennett and Stephen Jay Gould are notorious rivals, and Gould has dubbed Dennett's ideas "Darwinian fundamentalism" (Gould 1997). I myself am a historian with religious sympathies who, while admiring Dennett's work, has charged *Darwin's Dangerous Idea* with "epistemological ethnic cleansing" (Moore 1995). The episode represents real historical complexity, situating Darwin between his free-thinking brother Erasmus and Thomas Huxley on the one hand, and the Tory-Anglican Owen-Wilberforce axis on the other. Richard Owen receives full credit (from Darwin and Wilberforce alike) as the nation's "most brilliant anatomist" and "leading ... paleontologist", and for the

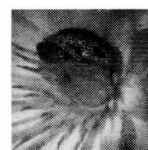
first time on-screen Owen's notion of transcendental design with "continuous ordained becoming" figures as an alternative to natural selection. Not least, Emma Darwin's heart-felt faith is portrayed with dignity and understanding, as it deserves to be; and finally creation and evolution are reconciled in the words of the *Origin of Species* as the church reclaims Darwin's body and buries it in Britain's noblest shrine, Westminster Abbey.

### FITZROY AND DARWIN

In the opening scene, FitzRoy and Darwin are young men, still in their 20s. Their relationship at this time was volatile, and after the *Beagle* voyage they mercifully drifted apart. What each of them said about the other, as well as himself, in later years must be weighed in the light of contemporaneous evidence. And what we may infer about their relations during the voyage depends, not just on these few "facts", but on seasoned judgments about late-Georgian naval life, personal religion, psychosexual development, self-representation, and English-language usage. In other words, the subject is complex.

There are reasons to believe that during the voyage FitzRoy and Darwin saw religiously eye-to-eye, for the most part. Both of them esteemed the Bible, though they also appear to have shared doubts, in 1834, about certain passages concerning the extent of the Flood. But FitzRoy, unlike Darwin, felt uneasy in doubting. "I suffered much anxiety", he wrote in 1839; "wavering between opinions" produced in him "an unsettled, and therefore unhappy, state of mind" (FitzRoy 1979: 368).

For instance, FitzRoy had read freethinkers who denied the unity of the human races as taught in scripture. "Until I had thought much on the subject, and had seen nearly every variety of the human race" — that is, until the voyage with Darwin was over — "I had no reason to give in opposition to doubts excited by such skeptical works, except a conviction that the Bible



was true, that in all ages men had erred, and that sooner or later the truth of every statement contained in that record would be proved" (FitzRoy 1932: 506). Given the brittleness of his belief in human unity, FitzRoy might well have cracked in a "unhappy" moment, sided with the freethinkers, and, assuming blacks to be a separate inferior species, defended the practice of slavery. If so, this would help to explain FitzRoy's first and most famous row with Darwin, whose belief in human unity never wavered — he was a passionate abolitionist.

The race row probably occurred in 1832. It was a year later that Darwin discovered the *Toxodon* skull, as shown in the first scene. Here dramatic license was used judiciously. FitzRoy did not accompany Darwin on the trip to Mercedes in Uruguay, where the skull was acquired, nor did the find occur within sight of the Andes. However, FitzRoy's suggestion about *Toxodon*'s extinction — "perhaps the Ark was too small to allow them entry, and they perished in the Flood" — was painstakingly crafted. The words are not only consonant with a view he repeated six years later; they also accurately represent his contemporaneous "wavering" faith in scripture. For his suggestion implies either that Noah failed to take two of every "kind" — including the species of *Toxodon* — into the Ark, or that "these creatures" remained outside because the Flood was not in fact universal, contrary to the literal sense of Genesis. FitzRoy, unsure, says, "Perhaps."

Either way, the remark presupposes something less than a caricatured, knee-jerk orthodoxy. And when Darwin laughs (indefinitely)

*James Moore is Reader in History of Science and Technology at the Open University, Milton Keynes, United Kingdom. With Adrian Desmond he is the author of Darwin: The Life of a Tormented Evolutionist (New York: WW Norton, 1994). He acted as a historical consultant for PBS's Evolution series.*

at the suggestion, rising to the bait ("perhaps"), FitzRoy's retort is entirely consonant with what is known of his character: "Do you mock me? Or the Bible?" The captain was prickly, authoritarian, a perfectionist with knife-edge moods. His first thought is of insubordination, not heterodoxy. In a "wavering" state of mind, he mixes up his own word with the Word of God, evincing the same rigidity that Darwin encountered in their race row the year before. FitzRoy became "excessively angry," Darwin recalled, "and he said that as I doubted his word, we could not live any longer together" (Barlow 1958: 74). Thus in the present scene, when asked by FitzRoy "what kind of clergyman" he would become, Darwin replies, full of ambiguity and portent, "Dreadful." A dreadful clergyman by FitzRoy's standards, yes, but equally it was a sneer at the captain for his dreadful impertinence. PBS and the program-makers cannot be held responsible if individuals mistake themselves or their own beliefs for what the actors portray.

#### DARWIN AND DIVINE WORSHIP

In the next scene, Darwin is not wholly attentive during divine worship aboard the *Beagle*. He may be contemplating God in His creation rather than His Word — a time-honored activity among English naturalists — but in any case there is no reason to suppose that Darwin's religious practice during the voyage was other than gentlemanly and conventional. Neither pious nor negligent, he behaved as the Cambridge-educated son of a wealthy Whig-Unitarian family.

Janet Browne, in her exhaustive account of the voyage, concludes that Darwin "went to church regularly ... attending the shipboard ceremonies conducted by FitzRoy and services on shore whenever possible." She also explains why the "last and greatest" painting by Darwin's shipmate, August Earle, "Divine Service as It Is Usually Performed on Board a British Frigate at Sea" (1837), probably portrays the *Beagle* company, for it is a subtle

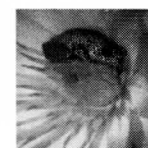
panorama of the wide range of theological opinion that could be embraced by just such a set of travelers. The captain is seated in a flag-draped chair below decks intent on the Bible before him. Except for his grey sailor's queue, he looks like FitzRoy. A woman close by, otherwise unusual on a ship, is probably Fuegia Basket in her royal bonnet. Another figure, who must be Darwin, sits to one side hardly looking at his book although following the words for all that, and the junior officers, the young midshipmen, and sailors show varying degrees of intentness (Browne 1995: 326-7).

Even if the painting is not of the *Beagle*, the artist surely composed the panorama drawing on memories of his life at sea with Darwin.

This contemporaneous visual record (in the National Maritime Museum, Greenwich) directly inspired the scene in Episode 1. And Darwin's own expressions in the scene are based on his known doubts about creationist biogeography during the latter part of the voyage. By this time he had ample reasons to dismiss a reading of Genesis as literal, historical truth.

#### ERASMUS AND CHARLES

The Darwin brothers have never played opposite each other on-screen — until now. Scripting them was entrusted to a English writer acclaimed for his TV adaptation of *Anna Karenina*, Alan Cubitt, and his portrait of Erasmus is a master stroke. Erasmus Alvey Darwin was born in 1804, on the fifth anniversary of his uncle Erasmus's suicide and two years after the death of his paternal grandfather Erasmus. Young "Ras" too was a freethinker — or "free-drinker," he tells FitzRoy in their dockside encounter (but his real weakness was opium) — and as a bachelor he may have indulged a libertine tendency evident in his grandfather's soft-porn poetry. In any case, Emma Darwin feared that Ras had blazed a trail of unbelief for his brother, removing "some of that dread & fear which the feeling of doubting first gives" (Burkhardt and others 1986: 172). And Ras was





indeed something of a radical. In 1832 he deplored Charles's future prospects in "a 'horrid little parsonage', declaring, 'My only chance is the Established Church being abolished' (Burkhardt and others 1985: 259).

Beyond a few such remarks, we know little about Ras, partly because much of the brothers' communication was face-to-face, partly also because Ras's health failed and he became depressed, writing infrequently. But his quip at the end of the episode about being "naturally selected" and his previous playful jab, "if the facts won't fit, well, so much the worse for the facts", neatly sum up his character. Both phrases, from a letter in 1859, evince a man physically and mentally in a rut that Charles himself never got into (Burkhardt and others 1991: 390).

Ras was radical, single, sarcastic and dissipated, with little in life to lose — in short, the perfect foil for a churchgoing brother with a devout wife, a large family, and a growing scientific reputation. Ras was overtly out-of-tune with the same Anglican establishment that Charles was covertly undermining even as he sought recognition from it. No wonder then that, plausibly enough, the episode has Ras singing from a different hymn-sheet, as it were, in Down parish church, a dyed-in-the-wool Dissenter.

So why did *Evolution's* religious critics watch a different program? Maybe because they had seen it all beforehand, playing in contemporary America. Now we hope that they will discover that history is not just *déjà vu*.

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# UPDATES

**California:** Posted on the web site of the Creation Science Association of Orange County is the text of a speech that veteran creationist activist Nell Segraves gave to an unidentified group of junior and senior high-school students on July 29, 2001 (<<http://www.creationscienceoc.org/segraves.htm>>). The speech described Segraves's recent complaint with the Civil Rights Division of the Department of Justice, which requested that it order "all new science textbooks based on the 1990 and the 2001 science frameworks to be recalled and sent back to the publishers for a full refund." Segraves contended that "publishers were ordered by the court twenty years ago ... not [to] bring into California any textbooks favoring evolution ever again." NCSE learned from the Justice Department that on June 12, 2001, Segraves's complaint was transferred to the Civil Rights Division of the Department of Education. While her complaint is being investigated, further information will be unavailable; NCSE will follow events as they unfold.

**Minnesota:** On January 7, 2002, the United States Supreme Court unanimously voted to deny Rodney LeVake's petition for a writ of *certiorari*, refusing to hear his appeal and putting a decisive end to the Minnesota science teacher's attempt to argue that he has free exercise, free speech, and due process rights to teach "evidence against evolution". The unanimity of the Court's vote was especially welcome, since its vote in *Tangipahoa Parish Board of Education v Freiler* to deny *certiorari* to the Tangipahoa, Louisiana, Board of Education was 6–3, with Chief Justice Rehnquist and Justices Scalia and Thomas wishing to hear the case (see RNCSE 2000; 20 [1–2]: 4–5). For the background of *Rodney LeVake v Independent School District 656*, see RNCSE 1999; 19 (3): 24–6, RNCSE 1999; 19 (6): 8–9, RNCSE 2000; 20 (1–2): 13–14, RNCSE 2000; 20 (4): 15, and RNCSE 2000; 20 (5): 8–9.

**Ohio:** Science Excellence for All Ohioans (SEAO), a group described on its web site (<<http://www.sciohio.org>>) as a project of the American Family Association of

Ohio, is lobbying for changes in the newly introduced statewide science standards, calling for the removal of references to the age of the earth, presentation of "intelligent design" as a scientifically valid alternative to evolution, and discussion of William Paley's *Natural Theology* (1802) and Michael Behe's *Darwin's Black Box* (1996) alongside discussions of the scientific work of Darwin, Mendel, and Lamarck. Working with NCSE members and other concerned Ohioans, NCSE's Network Project Director Skip Evans prepared a response to SEAO's proposed changes to the standards, which may be found at <[http://www.ncseweb.org/resources/news/2002/OH/884\\_ncse\\_analysis\\_of\\_ohio\\_standard\\_1\\_2\\_2002.asp](http://www.ncseweb.org/resources/news/2002/OH/884_ncse_analysis_of_ohio_standard_1_2_2002.asp)>. A parody of SEAO's web site — devised independently of NCSE — is at <<http://www.sciohio.com>>.

**Ohio, Gahanna:** In their responses to a questionnaire circulated by Gary Martin of the local Young Earth Creationist Club (<<http://www.creationists.org>>), 3 of the 4 candidates for the Gahanna-Jefferson school board

FitzRoy R. Remarks on the early migration of the human race. In: FitzRoy R. *Narrative of the Surveying Voyages of His Majesty's Ships "Adventure" and "Beagle"* (1839), vol. 2, quoted in Barlow N. Robert FitzRoy and Charles Darwin. *Cornhill Magazine* 1932 Apr; 72 430: 493-510.

Gould SJ. Darwinian fundamentalism. *The New York Review of Books* 1997 Jun 12; 44(10): 34-7.

Moore J. Keeping faith with Darwin. *The Times Higher Education Supplement* 1995 Nov 3; nr 1200: 20.

Moore J, Desmond A. Transgressing boundaries. *Journal of Victorian Culture* 1998 Spring; 3(1): 147-68.

#### AUTHOR'S ADDRESS

James Moore  
Department of the History of  
Science and Technology  
The Open University Faculty of Arts  
Walton Hall  
Milton Keynes MK7 6AA UK

## EDITORIAL ALABAMA EDUCATION INITIATIVE

[Ed: The following "editorial" comment appeared in the *Annals of Irreproducible Results* recently. We reproduce it here with permission for the edification of our readers.]

The Alabama Board of Education has voted to keep putting stickers on biology textbooks to warn that evolution is "a controversial theory". (The board has been doing this since 1996.)

In our view this is commendable. It is one of the few actions any stuffy government committee has ever taken that might actually encourage students to become curious about what is in their textbooks.

Our criticism — yes, we do have one — is that this move does not go far enough. If the Alabama Board of Education truly wants students to be aware that the subject is worth discussing, we urge them to add a second sticker, printed in bold red type, saying:

### WARNING: EVOLUTION INVOLVES S E X

[From Marc Abrabams, *Annals of Irreproducible Results*, November 11, 2001.]



endorsed teaching creationism along with evolution. Marlene Eader, an incumbent serving a two-year term, responded, "I think both sides should be presented to give students a balanced view about evolution and creationism." Kevin Hairston, a marketing specialist with the Mid-Ohio Regional Planning Commission, said that both should be taught together. Clarice Yoder believed that presenting both evolution and creation together would encourage "students to be critical thinkers". The only answer welcome to proponents of evolution education came from 18-year-old Ryan Jolley, who later won his election to the board by a scant 14 votes. "Evolution should be taught as a scientific theory and nothing more", Jolley stated. "I'm a strong proponent of separation of church and state. Teaching creationism in a specific manner would not be a true interpretation of creationism because it is not a universal theory" (*Gahanna News*, 2001 Oct 31).

**Pennsylvania:** With their publication in the *Pennsylvania Bulletin* on January 5, 2002, the

new Academic Standards and Assessment for Science, Technology, and Environment and Ecology became final (<<http://www.pabulletin.com/secure/data/vol32/32-1/9.html>>). The report details the concerns with and attacks on evolutionary theory in the standards and gives the rationale for rejecting these attacks.

**Washington:** Senate Bill 6058 was introduced yet again in the Washington state legislature on January 14, 2002. The bill would require "all science textbooks purchased with state moneys" to contain an evolution disclaimer very similar to that required in Alabama since 1995. The bill received its first reading in February 2001 and was referred to the Education Committee where it stalled. It was then reintroduced in April 2001 in the legislature's first special session, but again no action was taken. Washington residents who wish to express their opinions on this legislation may write to the following Education Committee members:

Senator Rosemary McAuliffe  
(D-1), Chair

Senator Tracey Eide (D-30),  
Vice Chair

Senator Bill Finkbeiner  
(R-45), Ranking Minority  
Member

Senator Don Carlson (R-49)

Senator Mike Hewitt (R-16)

Senator Harold Hochstatter  
(R-13)

Senator Stephen Johnson  
(R-47)

Senator Jim Kastama (D-25)

Senator Jeanne Kohl-Welles  
(D-36)

Senator Margarita Prentice  
(D-11)

Senator Marilyn Rasmussen  
(D-2)

Senator Debbie Regala (D-27)

Senator Joseph Zarelli (R-18)

For the full text of the bill, see <<http://www.leg.wa.gov/wsladm/billinfo/dspBillSummary.cfm?billnumber=6058>>; the Pacific Northwest Skeptics web site contains a brief history of the legislation at <<http://www.eskimo.com/~pierres/6058.html>>.

# Doubting Darwinism through Creative License

Skip Evans, NCSE Network Project Director



In October and November 2001, the Discovery Institute (DI), a Seattle-based public policy institute, placed advertisements in at least three periodicals, including *The New York Review of Books*, *The New Republic*, and *The Weekly Standard*. The advertisement in *The New York Review of Books* appeared under the headline "A Scientific Dissent from Darwinism" followed by this text:

Public TV programs, educational policy statements, and science textbooks have asserted that Darwin's theory of evolution fully explains the complexity of living things. The public has been assured, most recently by spokespersons for PBS's *Evolution* series, that "all known scientific evidence supports [Darwinian] evolution" as does "virtually every reputable scientist in the world."

The following scientists dispute the first claim and stand as living testimony in contradiction to the second. There is scientific dissent to Darwinism. It deserves to be heard.

After this brief statement is a gray box taking up the majority of the page, which contains in small print a list of names followed by the names of the institutions at which the signatories work, previously worked, or attained doctoral degrees. In a cleared space in the middle of this display is an area containing the statement to which the signatories attest:

We are skeptical of the claims for the ability of random mutation and natural selection to account for the complexity of life. Careful examination of the evidence for Darwinian theory should be encouraged.

Under close examination, the text of both the leading paragraphs and the statement attested to appear to be very artfully phrased. The first paragraph tells readers that spokespersons for the PBS series *Evolution* have assured the public that "all known scientific evidence supports [Darwinian] evolution." But notice that "Darwinian" appears in brackets. That "all known scientific evidence supports evolution" is a different claim than "all known scientific evidence supports [Darwinian] evolution." Exactly who is equating *Darwinian* evolution and evolution? And do the signatories to the second declaration, who are described as dissenting from "Darwinism", reject *evolution* as well? NCSE decided to go to the source to ask the questions.

## THE QUOTE

On October 31, 2001, Mark Edwards of the DI responded to an e-mail request for the source of the quote. He stated that he did not know offhand the source of the quotation in the first paragraph but would make an effort to track it down. As of this writing, he has not supplied that information.

Personnel from public television station WGBH, the coproducer of the PBS *Evolution* series, were unable to find the exact quotation in any of their published literature. An internal memorandum providing background information on the *Evolution* series to PBS stations nationwide contains an almost identical sentence: "All known scientific evidence supports evolution." The modifier "Darwinian" is conspicuously absent.

Let us assume that this internal memorandum (described on the DI web page <<http://www.reviewevolution.com/press/LeakedMemo.pdf>>) is the source of the quote used in the advertisement. If the

word "Darwinian" does not occur in the original quote, why was it added here? In the rest of the memorandum from which the quote was evidently taken there is a discussion of "new discoveries over the past 150 years", including much of the fossil record, DNA, and the process of genetic replication. The paragraph goes on to state that any of these discoveries could have potentially discredited evolution, but they did not. In fact, they have provided even more evidence for descent with modification and common ancestry. The paragraph concludes by acknowledging that there certainly are things about evolution we do not yet know, just as with "all comprehensive scientific theories, from the theory of gravity to quantum mechanics."

It appears that the Discovery Institute intentionally modified the sentence and thereby changed its meaning. The original PBS sentence focused on *evolution* — the theory that living things have common ancestors. It would *not* be equivalent to say that "all known scientific evidence supports *Darwinian* evolution"; by adding "Darwinian", the meaning of the quotation is changed. Is there healthy scientific debate about the role natural selection plays in evolution? Absolutely, and this is widely recognized. The discoveries of genetics have led to a better understanding of the sources for variation, and the latter half of the 20th century has witnessed a vigorous debate about the roles of proposed additional mechanisms — including genetic drift, gene flow, and developmental processes. These are some of the most interesting topics in modern evolutionary science. But arguments within the scientific community about *how* evolution occurs should not be confused with arguments — conspicuously absent from the scientific community — about *whether* evolution occurred.

## THE STATEMENT

The signatories appear to attest to a statement about the ability of natural selection to "account for the com-





plexity of life" — in other words, a statement about *how* evolution takes place. Given the anti-evolutionary tone of the introductory paragraphs, a layperson reading the advertisement might well assume that the signatories objected to evolution itself, rather than to the universality of natural selection as its mechanism. But did the scientists themselves object to evolution? Any of them? All of them? Or were some of them only questioning the importance of natural selection? Many scientists — including many associated with NCSE — could in good conscience sign a statement attesting to natural selection's not fully explaining the complexity of life!

### THE SIGNATORIES

The list consists of 41 biologists (over half of whom are biochemists), 16 chemists, 4 engineers, 2 geologists/geophysicists, 8 mathematicians, 10 medical professionals, 4 social scientists, 15 from physics or astronomy, and 3 whose specialties we were unable to determine. Few were from biological subfields associated with organismic and population-level biology — the divisions of biology most closely associated with the study of evolution. None was recognizable as a prominent contributor to the scientific literature debating the role of natural selection in evolution. (The list published on the <<http://www.reviewevolution.com>> web site, which we analyzed, originally contained 103 names. The ads published in the print media contained 105 names, with the addition of Stephen Meyer and Paul Nelson of the Center for Renewal of Science and Culture, the creationist arm of the DI, both of whom hold PhDs in philosophy.)

NCSE contacted a sample of the signatories and asked them specific questions about their attitudes concerning evolution, namely whether or not they accepted "evidence for common ancestry, meaning that different species today shared common ancestors in the past", and whether or not they were convinced "that humans and chimps both share a common ancestor".

We anticipated that signatories working for Christian anti-evolution ministries — especially those who are young-earth creationists, such as David A Dewitt, PhD, an adjunct faculty member at the Institute for Creation Research — would answer in the negative, but responses from some of the other signatories were quite revealing. One signatory responded to each of the two questions with "I don't have a problem with this", and went on to elaborate that his "dissent mainly concerns the origin of life". But, of course, evolution is not a theory of the origin of life, nor is "Darwinism" in any of its forms; evolution concerns what happens after life appears.

Although another signatory responded that "the definition of species is very troublesome", he added that "I certainly do accept that SOME (perhaps most) modern species shared at least a recent common ancestor". On the question of whether chimps and humans share a common ancestor, he said, "I believe the genetic evi-

dence is overwhelming...". Another signatory has elsewhere written, "I am not a creationist and have no reason to doubt common descent."

Therefore, although the signatories represent a diverse range of opinions about the role of natural selection in evolution, the list is nothing more than careful word play — what is known as "spin". Should one draw the conclusion from the advertisement that there is a growing movement of scientists who doubt evolution? Hardly; many of the names on the list are not new to anti-evolutionary activity. Ironically, if one were to conduct a survey of scientists who *accepted* evolution, the size of that list would swamp by tens of thousands this list assembled by the Discovery Institute!

It is regrettable that the public is likely to be confused by these advertisements and be misled into thinking that all of these scientists reject evolution or that there is a groundswell of scientists rejecting evolution. Neither is true.



## AIG CRIES WOLF OVER STUDY GUIDE

*Skip Evans, Network Project Director*

**I**n the introduction to NCSE's Congregational Study Guide, author Phina Borgeson remarks, "While Darwin's theory of evolution may have challenged religious organizations, especially their sense of authority and control of human activities, it also has, for those open to the possibilities, expanded our notions of God."

On November 6, 2001, Answers in Genesis (AIG) posted an article on its web site warning: "Atheists — infiltrating churches!" (see <<http://www.answersingenesis.org/docs/2001/1106lead.asp>>; the same article appeared in AIG's newsletter *Answers Update* 2001 Nov; 8 [11]: 1-3). In the article, AIG states, "It's interesting to note that the NCSE ... [has] made statements indicating they are not against those who believe in God — yet at the same

time they make statements vehemently attacking Christianity."

For the record, NCSE has never made any statements "vehemently attacking Christianity" or any other religion. AIG may not agree with our position on teaching evolution in public schools, but that hardly justifies these wild unsubstantiated accusations.

In the closing of the article, AIG says, "Who would have thought ... that atheists would be writing a 'Congregational Study Guide' to understand our origins!"

Here, predictably, AIG is simply wrong on the facts. The Congregational Study Guide was not written by an atheist. It was written by a Christian. Borgeson is an ordained deacon in the Episcopal Church. She earned a Master of Divinity degree from the Church

# NCSE NEWS

## Phina Borgeson

As Faith Network Project Director for NCSE, Phina Borgeson works to strengthen ties with religious leaders who advocate the teaching of evolution in the public schools and who participate in science and theology dialogues. Her first project for NCSE was the Congregational Study Guide (see related articles on p 23 and 24). Her work also includes developing and reviewing resources for use in congregational organizing and adult education, working with denominational and professional groups concerned with NCSE's issues, and connecting with science and religion conversations.

Phina brings to her current responsibilities experience in inter-faith work on religious liberty issues for Project Freedom of Religion, a grassroots Unitarian-Universalist group in Southern California. She also served on two Episcopal diocesan staffs, Los Angeles and Nevada, with an emphasis on adult education and strengthening volunteer ministries. She maintains those interests through consulting and teaching, including as adjunct faculty at the Church Divinity School of the

Pacific, from which she holds the Master of Divinity degree. She is an ordained deacon in the Episcopal Church.

Phina's undergraduate work was in evolutionary biology, and much of her young adult employment was in teaching natural history, ecology, and general science. Never having seen a conflict between faith and science, she welcomes the opportunity offered by NCSE to bring good theology and good science together in ways that can make a practical impact on congregations and communities around the country.

## NCSE's Congregational Study Guide for Evolution

Glenn Branch  
NCSE Office Manager

Are evolution and religion compatible? For many people of faith, that question lurks at the back of their minds as they watch PBS's 8-hour series *Evolution*. Appropriately, it is the central question explored in the final episode, entitled "What about God?". But where can people of faith go for more information?

Ironically, Borgeson seems to have described the AIG pretty accurately in her introduction. Does it not seem that evolution challenges AIG's "sense of authority and control" over deciding who is the right kind of Christian?

[As this issue of RNCSE was going to press, it was discovered that AIG substantially revised the article "Atheists — infiltrating churches!" on its web site, apparently in reaction to NCSE's posting the foregoing article on our web site. In particular, AIG no longer claims that the Congregational Study Guide was written by atheists, although it describes its author's denomination, the Episcopal



Help is at hand. Now available from the National Center for Science Education is a Congregational Study Guide for *Evolution*, consisting of suggestions and activities for group discussions of each episode. The Congregational Study Guide is the work of NCSE's Faith Network Director, the Reverend Phina Borgeson.

Borgeson, an ordained deacon in the Episcopal Church and a lecturer at the Church Divinity School of the Pacific in Berkeley, California, explained, "There are, of course, people of faith who are dogmatically closed to accepting any fraction of evolutionary science. There are also people of faith who, having thought the issues through, have no problem in reconciling evolution with their religious beliefs. It is for the people in the middle, who may be provoked by *Evolution* to explore the dialogue between evolution and faith, that the Congregational Study Guide is intended."

Divinity School of the Pacific, where she now teaches, and served on two Episcopal diocesan staffs, in Los Angeles and Nevada.

In fact, NCSE is quite a religiously diverse organization, with both nonbelievers and believers on our staff, on our board of directors, and among our members and supporters. Although we come from many different backgrounds, from atheists to evangelical Christians, we respect one another's beliefs. What unites us is our firm belief in the importance of evolution in any sound science education.

Church, as "one of the most apostate denominations around". And although AIG no longer accuses NCSE and the PBS Evolution series of making statements "vehemently attacking Christianity", it complains that they "endorse websites that vehemently attack Christianity", citing only the Committee for the Scientific Investigation of Claims of the Paranormal's web site (<[www.csicop.org](http://www.csicop.org)>). NCSE was unable to locate any attack, vehement or otherwise, on Christianity on CSICOP's web site. It is noteworthy that AIG did not see fit to indicate anywhere in the revised version of "Atheists — infiltrating churches!" that it previously contained errors of fact. NCSE is happy to mail a photocopy of the original article to anyone who wishes to have it.]



Said NCSE's Executive Director, Eugenie C. Scott, "The National Center for Science Education's mission is to defend evolution as a powerful, mainstream, widely-accepted science from sectarian attack. So from its beginnings, NCSE has been reaching out to the faith community to reinforce the message that evolution is not a threat to faith. In our publication *Voices for Evolution*, for example, we assembled statements from 15 major religious denominations acknowledging that evolution is compatible with their beliefs. The Congregational Study Guide is another way for us to help people realize that the theory of evolution need not be regarded as antireligious."

Borgeson added, "People of faith want to make sense of the world, using all of the resources available, including the evidence of science and the perspective of faith. That's why it's important that people of faith speak up for science education, including evolution, in our public schools."

Both the Congregational Study Guide and *Voices for Evolution*, available at the NCSE web site, <<http://www.ncseweb.org>>, may be freely downloaded and distributed.

## GSA Announces Public Service Medals for Scott and Dalrymple

The Geological Society of America (GSA) awards its Public Service Medal each year in honor of two dynamic scientists, Gene and Carolyn Shoemaker, whose scientific work and generosity in sharing it inspired and stimulated the public's curiosity about the universe around them. This year's award is shared by two similarly dynamic scientists, G. Brent Dalrymple and Eugenie C. Scott, who have been highly effective in battling the inclusion of "creation science" and its various disguised forms within our public science-

education curriculum. They also have been outstanding spokespersons for promoting the value of teaching evolution, the scientific evidence for the age of the earth, and the concept of science as a way of knowing.

Genie Scott left an academic career in 1987 to become executive director of the National Center for Science Education, a not-for-profit membership organization in Oakland, California, that works to improve the teaching of evolution and of science as a way of knowing. She is in great demand as a spokesperson for this cause and has appeared on numerous television and radio programs. She has received numerous awards for her efforts, including the Issac Asimov Science Award from the American Humanist Association. She is a member of the California Academy of Sciences and is president of the American Association of Physical Anthropologists.

Brent Dalrymple is a geochronologist who, throughout his career at the US Geological Survey and Oregon State University, has been involved in the development, improvement, and application of isotopic-dating techniques. Brent also has been active in the creation/evolution debate for more than two decades. He served as an expert witness for the American Civil Liberties Union in an Arkansas creationism trial and in the Louisiana lawsuit that resulted in the US Supreme Court's banning as unconstitutional all "equal time for creationism" laws. Brent is a member of the American Academy of Arts and Sciences and the National Academy of Sciences and is past-president of the American Geophysical Union.

[Adapted with permission from GSA's citationist, Mary Lou Zoback, writing in *GSA Today* 2002 Feb; 12 (2): 18-9.]



## News from the Membership

Glenn Branch  
NCSE Office Manager

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

**Adrian Melott**, Professor of Physics and Astronomy at the University of Kansas, has been awarded the 2002 Joseph A. Burton Forum Award of the American Physical Society, which will be formally presented this spring at a special session. Recipients of the award give an invited talk and are awarded a cash prize of \$3000. The citation reads, "For his outstanding efforts in helping to restore evolution and cosmology to their proper place in the K-12 scientific curriculum. As both a distinguished cosmologist and respected member of the clergy, he played a key role in helping the people of Kansas reverse their State Board of Education's anti-science action."

**Susan Offner's** article "A universal phylogenetic tree" appeared in *The American Biology Teacher* 2001 Mar; 63 (3): 164-70. Offner, who teaches at Lexington High School in Lexington, Massachusetts, presents a universal phylogenetic tree featuring three domains: bacteria, archaea, and eukarya. The tree is suitable for use in high school and college biology classrooms, which, in her words, "enables students to understand the entire sweep of the history of life. It vividly illustrates the antiquity of life, and the fact that all life is related, even if the relationship goes back about 3.5 billion years to a universal ancestor. It also illustrates the important principle that classification should reflect evolutionary relationships."

**Gregory S. Paul**, editor of *The Scientific American Book of Dinosaurs* and author of the forthcoming *Dinosaurs of the Air: The Evolution and Loss of Flight in Dinosaurs and Birds*, contributed an op-ed piece, "Natural selection is



## Join Scott and "Gish" on a Creation/Evolution Tour of the Grand Canyon!



Sorry, but we could not resist the headline opportunity. We mean, of course, that members, their friends, and their families are cordially invited to join executive director Eugenie C Scott and NCSE's own postdoctoral scholar paleontologist Alan "Gish" Gishlick on our second wonderful trip down the Grand Canyon. Now, since this is an NCSE trip, we offer more than just the typically grand float down the Canyon: the spectacular scenery, exciting rapids, delicious meals, and good companionship. This will be a "two-model" raft trip, where we will provide both the creationist view of Grand Canyon, and the evolutionist view (and let you make up your own mind). The standard scientific view of the history of the Canyon will be provided by Gish, who is a trained geologist with several trips to the Canyon under his belt. The creationist view will be presented by Scott, who has never had a geology class in her life but who assures us that this will be no impediment to her presenting the creationist perspective on the Canyon.

The excursion is all-inclusive from Las Vegas, with travel to the Canyon provided by the outfitter. Participants provide their own sleeping bags and tents (or they can be rented from the outfitter). This will be an 8-day motorized trip from Lee's Ferry to Lake Mead.

**DATES:** August 2–10, 2002

**COST:** \$1,990 (members); \$2,200 (nonmembers)

**FIRST RESERVATION DEADLINE:** April 15, 2002.

If you think an NCSE Creation/Evolution Grand Canyon trip would be an exciting way to spend a week this summer, write or call for more information, or visit our web site: <http://www.ncseweb.org/>.

Make your reservations now! A \$500 deposit, payable by April 1, 2002, will hold your reservation.

### **PAYMENT SCHEDULE:**

April 15, 2002	\$500
May 15, 2002	\$500
June 1, 2002	\$990 (members)/\$1200 (nonmembers)
Total	\$1990 (members)/\$2200 (nonmembers)

For more information, call us at 1-800-290-6006, e-mail [ncse@ncseweb.org](mailto:ncse@ncseweb.org), or write us at 420 40th Street, Suite 2, Oakland CA 94609-2509.

happening all the time", to the Fairfax (VA) *Journal* (2001 Aug 23), in which he trenchantly criticized creationists' misunderstandings and misrepresentations of the theory of evolution. In his conclusion, he posed the following choice: "So nonscientists can listen to people who adhere to an ancient creation myth so devoutly that the end up misinforming people about the facts of modern science. Or they can have confidence in the vast body of research accumulated by multitudes of scientists that shows that the universe and our planet are immensely old, and that life has been evolving, and continues to evolve, under the influence of natural selection." [Thanks to Doug McNeil for the news.]

**Robert T Pennock**, author of *Tower of Babel: The Evidence Against the New Creationism* (Cambridge [MA]: The MIT Press, 1999), spoke to an audience of about 100 at a meeting of the Freethought Association of West Michigan; his talk was cosponsored by the Michigan Scientific Evolution Education Initiative. According to a report in the *Grand Rapids Press* (2001 Oct 21), Pennock said that the proponents of intelligent design "don't want to talk about God, because if you do, then it becomes obvious there won't be a hope of getting this in the public schools", adding that "[t]hey try to poke holes in the theory of evolution with the thought that if you can cast enough doubt on the other, theirs will be seen as the only option." Pennock's talk was timely, as two "intelligent design" bills introduced before the Michigan legislature's summer 2001 recess (see *RNCSE 2000*; 20 [5]: 10) are still pending.

In his two-part essay "Saving us from Darwin" (*The New York Review of Books* 2001 Oct 4; 48 [15]: 24–7 and Oct 15; 48 [16]: 51–5), Frederick Crews praised **Robert T Pennock's** "comprehensive and consistently rational" *Tower of Babel* as "the best book opposing creationism in all of its guises"; he also applauded

*continued on page 31*

# Top 10 Lines of Evidence For Human Evolution\*

Martin Nickels, Illinois State University

**H**uman evolution is clearly the most problematic and difficult proposition in evolutionary biology for nonscientists to accept. At the same time, the biological history of our species clearly supports the predictions and patterns of similarity and differences through time that derive from evolutionary theory. Teaching *human* evolution offers an unparalleled opportunity to engage the most important aspects of the creation/evolution controversy — demonstrating both the power of evolutionary theory and the close fit between the evolutionary explanation and the historical record of humans and our biological relatives. There are 10 major lines of evidence that confirm the evolution of humans — 6 are biological and 4 are geological and/or historical.

## 1 HIERARCHICAL TAXONOMIC CLASSIFICATION

Descent from common ancestry produces only one arrangement of related organisms — a “nested” pattern in which each member of an evolutionary branch shares specific sets of certain diagnostic features derived from among those of the ancestral population. All humans have upright walking adaptations — the specific uniquely derived traits that divide our branch from the apes — but we also *share* dental, cranial, and upper-limb anatomies with apes; and we share other, but more general, features with other non-ape primates, and so on, throughout the whole animal kingdom.

## 2 COMPARATIVE ANATOMY

Evolutionary theory also requires that anatomy should reflect the recency of common ancestry, with the caution that some adaptations require significant remodeling of anatomical structures. As with the examples in item 1, we observe these anatomical similarities in humans and their primate relatives even in light of special adaptations for upright walking in humans or knuckle-walking in African apes.

## 3 COMPARATIVE EMBRYOLOGY AND DEVELOPMENT

As predicted, fetuses of African apes and humans resemble each other more and for longer than they do fetuses of other primate species — and more so for other primate than for other vertebrate species. More important, however, are the biological and cognitive development processes that humans share with African apes — we see

that the human emphasis on brain elaboration and development is an extension of a process started in other primates, emphasized in the African apes, and further accentuated in humans. The special human features are produced by a modification of embryonic developmental processes already used by common ancestors with the apes.

## 4 COMPARATIVE BIOCHEMISTRY

Only in the last few decades have we been able to compare organisms in detail based on the structural details of their molecules. While this ability is still improving, the pattern that emerges in biochemical studies overwhelmingly reveals the nested pattern of common descent.

## 5 ADAPTIVE COMPROMISES

There are several examples of “poor engineering” — evidence that a structure was not designed for the purpose, but modified from some other structure in a common ancestor. In humans, the pelvis and lower back are engineering compromises — less-than-ideal adaptations that reshape inherited parts into a workable solution for upright walking, even though they present other problems (such as lower backs that are prone to injury and birth canals that barely allow for delivery of big-brained babies).

## 6 VESTIGIAL STRUCTURES

Some structures have no obvious use in descendants, but persist in part because they do not present any selective risk. Ear muscles are such an example — these muscles are attached to the same parts of the skull and ears as in animals that move their ears to locate sounds around them, yet in humans all they can do is wiggle the ears a little.

## 7 BIOGEOGRAPHY

Based on the geographical distribution of modern apes, we are able to infer that humans most likely emerged in Africa. This is because humans most nearly resemble the African apes, not the Asian apes. This makes evolutionary sense if humans and the African apes are descended from a more recent common ancestor than they share with the Asian apes. Therefore, we ought to be able to infer that the earliest human fossils should be found in Africa — and that *is* where we found them. The most ancient human fossils have all been found in Africa. Furthermore, the paleontological record of

ecological specializations within Africa and of movement out of Africa shows the same pattern of descent with modification shaped by environmental influences as that predicted by evolutionary theory.

## 8 THE FOSSIL SEQUENCE

In the human fossil record there is a sequence through time that shows the steps in the transformation from ape ancestor to modern human. First there is the change to upright walking, later a change in ability to make and use stone tools, still later a decrease in tooth size, and finally a significant increase in brain-to-body ratio and a decrease in sexual dimorphism. In the human fossil record, a number of species exhibit some, but not all, of the features that diagnose later humans and are intermediate between the ancestral populations and living descendants. There are innumerable specimens that show upright walking, but large teeth and relatively small brains, or hands modified for tool use, reduced (but larger-than-modern) teeth and jaws, and slightly larger (but not yet modern-sized) brains, and so on. The human fossil record is particularly rich in such fossil intermediates.

## 9 ECOLOGICAL COHERENCE OF FOSSIL ASSEMBLAGES

The plant and animal remains associated with the human fossils collected by paleontologists show intact ecological communities — the plants and animals *belong* together in that environment at that time. These plants and animals also represent more ancient forms, indicating that humans evolved in concert with other members of their ecological communities *and* that the fossil deposits do not support either the rapid deposition or the sudden appearance of these organisms.

## 10 HIERARCHICAL RECORD

Unique to human natural history, stone tools (and other artifacts) also show change over time. These changes represent technological improvements, cultural innovations (such as trade), and evolutionary changes in the human species itself. The older, cruder tools are found in the earliest formations; the newer, more sophisticated tools are found later.

\* This note is adapted from “Humans as a case study for the evidence for evolution” by Martin Nickels, which appeared in *RNCSE* 1998 Sep-Oct; 18 (5): 24-7.

# DISCOVERING HUMAN EVOLUTION

**H**omo sum, humani nihil a me alienum puto, wrote the Roman playwright Terence in *Heautontimorourmenos*: I am human, and I consider nothing human foreign to me. If the sentiment resonates with you, then the following books are just the ticket to help you to understand the human condition — in the light of evolution. From the earliest fossil evidence for human evolution to the latest findings in primatology, in formats ranging from the scholarly resource to the coloring book, our featured authors explain it all with scientific accuracy and literary verve. All of these books are now available on the NCSE web site: <http://www.ncseweb.org/bookstore.asp>. And remember, every purchase benefits NCSE!



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

## THE FOSSIL RECORD

### *From Lucy to Language*

by Donald Johanson and Blake Edgar  
Paleoanthropologist (and NCSE Supporter) Johanson and science writer Edgar discuss human history from the appearance of bipedal walking to the origin of language in a volume lavishly illustrated with original (and often life-size) photographs of fossils and artifacts. Part 1, "Central Issues of Paleoanthropology", concentrates on interpretation of the evidence, considering such topics as migration, diversity, anatomy, society, bipedalism, tools, customs, and "imponderables" (such as clothing and the problem of consciousness). Part 2, "Encountering the Evidence", comprehensively summarizes the evidence on which our knowledge of human prehistory is based.

### *The Neandertal Enigma: Solving the Mystery of Modern Human Origins*

by James Shreeve  
Weaving together interviews with scientists, compelling descriptions of fossils and fossil sites, and a survey of the literature, James Shreeve offers a thought-provoking explanation of what caused the disappearance of humanity's closest relatives and the implications for what it means to be

human. As the reviewer for the *Washington Post* writes, *The Neandertal Enigma* is "an elegantly written, passionate and absorbing examination of a fascinating subject." The author is also the coauthor, with Donald Johanson, of *Lucy's Child: The Discovery of a Human Ancestor*.

### *The Fossil Trail*

by Ian Tattersall

"Most popular books about evolution in recent years", Tattersall comments, "have been based on the experience of individual paleoanthropologists in the field, and ... the notion that reconstructing the past is essentially a matter of discovery ...." Tattersall, however, follows a different trail: remarking that "the starting point for any new set of hypotheses is the set of hypotheses that preceded it", he interweaves the story of the discoveries with accounts of the changing theoretical concerns of the discoverers and the conflicting interpretations of paleontological evidence, explaining how these change in the light of new discoveries and new analytical techniques.

### *Extinct Humans*

by Ian Tattersall and

Jeffrey H Schwartz

Designed for the general public, *Extinct Humans* covers the general

scope of the human fossil record in about 250 pages, illustrated mainly by original photographs of fossil skulls. The authors are known within anthropology for their recognition of many fossil species and lineages. They state their theme as follows: "A linear mindset pervades most work in paleoanthropology, as if the story of human evolution has essentially been one of a single-minded struggle from bestial benightedness to uplifted enlightenment... But if we proceed like paleontologists studying other groups ... a very different picture emerges ... a story of repeated evolutionary experimentation, diversification, and, ultimately, extinction."

## LESSONS FROM PRIMATE BEHAVIOR

### *The Ape and the Sushi Master: Cultural Reflections of a Primatologist*

by Frans de Waal

One of the world's experts on chimpanzee behavior considers the nature of culture and its relationship to who we are. "We define ourselves as the only cultured species, and we generally believe that culture has permitted





us to break away from nature. We are wont to say that culture is what makes us human", de Waal explains: "The possibility that animals have culture is the topic I wish to explore in this book." The reviewer for *Scientific American* recommends that we "look over his shoulder and learn what the animals tell us about ourselves."

*Tree of Origin: What Primate Behavior Can Tell Us About Human Social Evolution*

edited by Frans de Waal

Nine primatologists — Richard W Byrne, Robin I M Dunbar, William C McGrew, Anne E Pusey, Charles T Snowdon, Craig B Stanford, Karen B Strier, and Richard W Wrangham — consider the implications of primate behavior for understanding human evolution. Topics of the individual essays include reproduction, food and diet, tool use, intelligence, communication and language, and culture. "If you want a source that cogently discusses human intelligence in the context of the behavior of other primates", writes Ian Tattersall, "*Tree of Origin* is the place to turn."

*Mother Nature: A History of Mothers, Infants, and Natural Selection*

by Sarah Blaffer Hrdy

A review of motherhood and infancy from an evolutionary point of view, written by a leading researcher who has spent her career investigating these topics. With extensive notes and bibliography. From the preface: "For better or for worse, I see the world through a different lens than most people. My depth of field is millions of years longer, and the subjects in my viewfinder have the curious habit of spontaneously taking on the attributes of other species: chimps, platypuses, australopithecines. This habit of thinking about mothers in broad evolutionary and comparative — as well as cross-cultural and historical — perspectives distinguishes my examination of motherhood from those of the psychoanalysts, psychologists, novelists, poets, and social historians whose work I build on."

*Significant Others: The Ape-Human Continuum and the Quest for Human Nature*

by Craig Stanford

Stanford, an experienced field primatologist, "argues that the gap between apes and humans is very narrow indeed, and the insistence on seeing it as vast and unbridgeable is more a product of fashion and prejudice than of clear thinking." Divided into three sections, dealing with "the forces that drive the societies of great apes and other primates", "contentious questions about the connection of great ape behavior to our understanding of what people do", and "the fate of the apes". The author is associate professor of anthropology at the University of Southern California, codirector of the Jane Goodall Research Center, and director of the Great Ape Project in Uganda's Bwindi Impenetrable National Park.

## TEXTS, INTRODUCTIONS, AND REFERENCES

*Biology, Evolution, and Human Nature*

by Timothy H Goldsmith and William F Zimmerman

Goldsmith and Zimmerman's interdisciplinary textbook is just the thing for introducing students to the significance of evolution for our understanding of human nature. "Using evolution as the unifying theme, this book traces the connections between levels of complexity, showing how both the study of other organisms and a variety of perspectives from biology, psychology, and anthropology provide complementary insights", Goldsmith and Zimmerman explain. Steven Pinker describes their book as "[a]n excellent introduction to a body of knowledge and concepts that should be mastered by every educated person."

*The Human Career: Human Biological and Cultural Origins*, second edition

by Richard G Klein

Simply the single best reference and

advanced introduction to paleoanthropology (the subject of human biological and cultural evolution, the area where physical anthropology and prehistoric archeology overlap). Writing in *Evolution*, Henry McHenry describes it as "by far the best book of its kind"; writing in *Antiquity*, RA Foley describes it as "the best introduction to the problems and data of modern palaeoanthropology yet published". And no wonder: unmatched for breadth, range, and reliability, with more than 2500 references cited in 800 pages, *The Human Career* is indispensable for any serious student of human evolution.

*Human Evolution: An Illustrated Introduction*, fourth edition

by Roger Lewin

As Kenneth Kennedy writes, Roger Lewin is "one of the very few scientific journalists I know who has been successful in relating, with accuracy and an exciting writing style, the principles of paleoanthropology to a broad reading audience of scholars and laymen." Unsurprisingly, then, his *Human Evolution* is a good introduction to its subject. Containing brief but accurate accounts of contemporary research and results, as well as copious references and illustrations, it is eminently useful both as a general source of information and as a supplementary textbook.

*The Human Evolution Coloring Book*, second edition

by Adrienne L Zihlman

In preparing the book, Zihlman realized that "many of the human characteristics I would be writing about are perfectly adapted for this kind of book — namely, color vision, hand-eye coordination, manual dexterity, and a brain especially evolved for tool-using!" Where else would you get the opportunity to use all of these at once? The plates to be colored in illustrate evolution in general, genetics, the living primates, primate evolution, and fossil evidence for human evolution. Now in a revised and expanded second edition.





# NCSE on the Road

## A CALENDAR OF SPECIAL EVENTS, PRESENTATIONS, AND LECTURES

**DATE** March 24, 2002  
**CITY** Arlington VA  
**PRESENTER** Eugenie C Scott  
**TITLE** What's New in the Anti-evolution Movement?  
**EVENT** AIBS annual meeting  
**TIME** 8:30 PM  
**LOCATION** Key Bridge Marriott  
**CONTACT** Richard O'Grady, rograd@aibs.org

**DATE** March 26, 2002  
**CITY** New York NY  
**PRESENTER** Eugenie C Scott  
**TITLE** Evolution and Education  
**EVENT** Presentation in "Intelligent Design" Series  
**TIME** 8:30 PM  
**LOCATION** American Museum of Natural History  
**CONTACT** Nathaniel Johnson Jr, natj@amnh.org

**DATE** March 27, 2002  
**CITY** San Diego CA  
**PRESENTER** Eugenie C Scott  
**TITLE** Teaching Evolution  
**EVENT** National Science Teachers Association meeting  
**TIME** TBA  
**LOCATION** TBA  
**CONTACT** Eugenie C Scott, scott@ncseweb.org

**DATE** April 9, 2002  
**CITY** Amherst NY  
**PRESENTER** Eugenie C Scott  
**TITLE** Intelligent Design Creationism:  
 The New Kid on the Block  
**TIME** 7:00 PM  
**LOCATION** Center for Inquiry  
**CONTACT** Barry Karr, 716-636-1425

**DATE** April 11, 2002  
**CITY** Buffalo NY  
**PRESENTER** Andrew J Petto  
**TITLE** Education Committee Workshop  
**EVENT** American Association of Physical Anthropologists  
**TIME** 8-11 AM  
**LOCATION** TBA  
**CONTACT** Martin Nickels, mnickels@ilsu.edu

**DATE** April 25, 2002  
**CITY** Kirksville MO  
**PRESENTER** Eugenie C Scott  
**TITLE** Evolution and Creationism: A Continuing Debate  
**EVENT** Public lecture at Truman State University  
**TIME** TBA  
**LOCATION** TBA  
**CONTACT** Nancy Sanders, nsanders@truman.edu

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

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**Kenneth R Miller's** *Finding Darwin's God*, "whose brilliant first half reveals in bracing detail that 'intelligent design' is out of touch with recent research." Crews was not so enthusiastic about the second half of *Finding Darwin's God*, **Michael Ruse's** *Can a Darwinian Be a Christian?*, or **Stephen Jay Gould's** *Rock of Ages*, all of which he apparently regards as ill-conceived accommodations to religious dogma. Nevertheless, it was the proponents of "intelligent design" — specifically, Phillip Johnson, Jonathan Wells, Michael Behe, and William Dembski — who bore the brunt of Crews's withering critique: for example, Crews wrote, "'intelligent design' — the theory that cells, organs, and organisms betray unmistakable signs of having been fashioned by a divine hand — bears only a parodic relationship to a research-based scientific movement." Although it was not under review, **Philip Appleman's** *Darwin*, now in its third edition, was described as "the most convenient collection of readings surrounding Darwin's career and its significance."

Also in the Fairfax (VA) *Journal* (2001 Jul 19) was **David Persuitte's** dissection of a column by Bill Wheaton asking "Did random chance or intelligent design start it all?" Persuitte noted that "His arguments against evolution are the same tired ones that creationists have been using over and over, and that have been refuted over and over. He is just recycling them under the current catchword 'intelligent design.'" Later that month (2001 Jul 27), the indefatigable Persuitte responded to another creationist, who had accused him of displaying "extraordinary ignorance of how God created our universe" in a previous letter to the editor. Persuitte patiently explained the scientific untenability of the creation story to be found in Genesis. Amusingly, his interlocutor was under the impression that the universe was arranged to benefit from the sun, prompting Persuitte to remark that "with respect to the rest of the universe, the sun is of

considerable less significance than is a fireplace spark with respect to the earth." [*Thanks to Doug McNeil for the news.*]

**Andrew J Petto**, editor of *RNCSE* and member of NCSE's board of directors, contributed "Teaching evolution" to the March 2001 issue of the newsletter of the Philadelphia Center for Religion and Science; the article is available on the PCRS web site, <<http://www.pc4rs.org/>>, and was subsequently reprinted as "Andrew J Petto says evolution needs to be taught" in *Research News in Science and Theology* 2001 Jul; 1 (11-2): 20 and as the centerfold article in *RNCSE* 2001; 21 (1-2). Petto argued that "What we need to do is to be sure that evolution is taught completely and accurately, so that our public discourse on evolution-related issues can be informed by current scientific practice and understanding." He added, "We teach evolution because it is the theoretical basis of modern biology — and there is no way to understanding biology completely or correctly without understanding evolution."

Included in the special evolution issue of *The Natural Selection* (Fall 2001), the newsletter of the Biological Sciences Curriculum Study, were an edited version of NCSE Executive Director **Eugenie C Scott's** essay "Not (just) in Kansas

any more" (25-26; originally printed in *Science* 2000 May 5; 288: 813), NCSE Supporter **John A Moore's** essay "The domains of science and human preferences" (27-8), in which Moore incisively discusses the source, nature, and future of the creation/evolution controversy, and an interview of **Susan Epperson** (the Epperson of the Supreme Court case *Epperson v Arkansas*) by **Randy Moore**, taken from his book *In the Light of Evolution: Science Education on Trial* (29-30). There were also a number of interesting news pieces, essays, and letters concerning evolution education.

**David E Thomas**, president of New Mexicans for Science and Reason, was recently elected to be a Fellow of CSICOP, the Committee for the Scientific Investigation of Claims of the Paranormal, where he joins NCSE executive director Eugenie C Scott, NCSE board member John R Cole, and NCSE Supporters Stephen Jay Gould and Paul MacCready. Constant readers of *RNCSE* will remember several of Thomas's articles, including "The tangible benefits of evolution" (*RNCSE* 1999; 19 [6]: 13) and "Nuclear isochrons" (*RNCSE* 2000; 20 [3]: 26-9).

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



## NEW WEB-BASED "DESIGN" RESOURCE

William Dembski, the author of *The Design Inference* and *No Free Lunch*, recently announced the launch of a new organization, the International Society for Complexity, Information, and Design (ISCID). The announcement read, in part:

ISCID is a cross-disciplinary professional society that investigates complex systems apart from external programmatic constraints like materialism, naturalism, or reductionism. The society is fully web-driven and can be reached via the Internet at <<http://www.iscid.org>>.

*RNCSE* readers can reach their own conclusions as to whether the society is also free from *other* programmatic constraints by connecting to <<http://www.iscid.org/about.php>>.



# RECAPITULATION



## A TALE OF TWO ENTITIES: WHALES AND HIPPOS

Gregory S Paul

**R**aymond Sutura's article on the early evolution of whales (RNCSE 2000; 20 [5]: 33-41) missed one effective and entertaining way to rebut anti-evolutionist arguments about the impossibility of whale evolution. During their presentations on intermediate forms, anti-evolutionists often use a picture of a cow and a whale to prompt their audience into laughing at the silly notion that one could have evolved from the other. It is a classic comparison of irrelevant extremes, carefully crafted to leave a false impression via gross omission of important facts.

Recent research has provided us with a ready-made answer for the "Bossie-to-Blowhole" challenge. To begin, show an audience pictures of a cow and a whale. But then ask if anyone knows what living hoofed mammals — even-toed artiodactyl ungulates, specifically — *do* exhibit a form intermediate between cows and whales. Mention that they have all probably seen them at the zoo and on television, and, if they are lucky enough to have traveled, in Africa.

Then show a photograph of the so-obvious-how-could-anyone-not-think-of-it answer — hippos — both the standard *Hippopotamus* and the pygmy *Choeropsis*. These living artiodactyls are as adapted for life in the water as for life on land. Although the legs remain functional, they are reduced to the point that hippos can go no faster than a trot; they cannot gallop. There is also some webbing between the toes. As in whales, the bones are unusually dense, allowing the beasts to submerge easily. The overall form of hippos is much more hydrodynamically streamlined than in other ungulates because they are encased in smooth, hairless skin and thick coats of fat similar to the blubber coverings of whales. The result of all these adaptations is that hippos swim better than other ungulates, but not as well as whales. Hippos give birth both on land and in the water, and the young nurse underwater.

Of course whales did not directly evolve from modern hippos any more than humans evolved from living

chimpanzees. Hippos serve as a living demonstration that hoofed beasts can have whale-like aquatic adaptations, thus directly refuting the creationist claim that the anatomical and lifestyle gap between modern ungulates and modern whales is far too great to be bridged. The opposite is true — hippos exhibit many of the intermediate terrestrial-aquatic features and habits predicted for the ancestral protowhales.

Furthermore, it now appears that the phylogenetic relationship between hippos and whales may be much closer than previously realized. The fossil evidence seemed to favor the extinct carnivorous mesonychids as the closest relatives of whales, but it turns out that this was due to lack of some critical evidence. Molecular data links hippos and whales (Luo 2000). New fossil remains, including key data from the ankle region, verifies that whales are not closely related to mesonychids. Instead, whales evolved from primitive artiodactyls (Gingerich and others 2001; Thewissen and others 2001), and although exact details remain obscure, the closest living relatives of whales may be hippos.

But even if hippos are not the *closest* living ungulate relative to modern whales, they *are* the kind of whale-like hoofed mammals that anti-evolutionists dare not mention, so it is up to us to be sure that everybody knows about the existence of an "impossible" intermediate between hoofed land animals and whales. And after doing so, ask the audience why they should have confidence in the claims of anti-evolutionists who fail to inform their audiences of such fundamental information.

### REFERENCES

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### AUTHOR'S ADDRESS

Gregory S Paul  
3109 N Calvert St  
Baltimore MD 21218  
GSP1954@aol.com

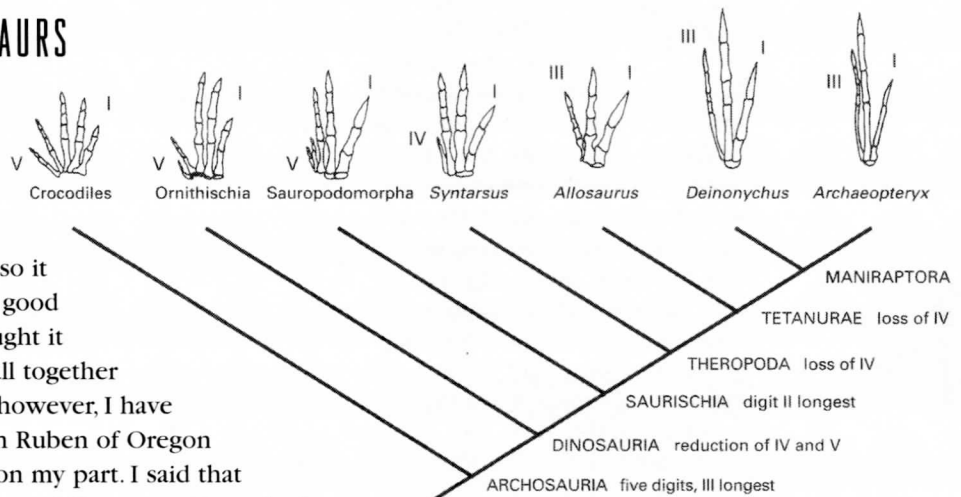
Gregory S Paul is an NCSE member and an independent paleontologist and evolutionary scientist. His book on bird origins, *Dinosaurs of the Air*, will be released by the Johns Hopkins University Press at the beginning of 2002.

# RECAPITULATION

## MORE ON BIRDS AND DINOSAURS

Kevin Padian  
NCSE President

The topic of the evolution of birds always interests NCSE readers, and so it was not surprising to find so many good questions in our mailbox that we thought it would be interesting to collect them all together and respond in a single column. First, however, I have to apologize to readers and thank John Ruben of Oregon State for pointing out a misstatement on my part. I said that some dinosaurs such as *Beipiaosaurus* and *Sinosauropteryx* had beta-keratins in their integumentary coverings (RNCSE 2000; 20 [5]: 28-31). Sorry! Rather, the alvarezsaurid dinosaur *Shuvuuia*, which is close to oviraptorids, has beta-keratin in the filamentous, featherlike integumentary structures on its head (Schweitzer 2001). More importantly, like birds and unlike other reptiles, these structures lack the alpha-keratins found in reptile scales and all vertebrate skin. *Beipiaosaurus* and other feathered and "fringed" non-avian dinosaurs are in the same clade of birds and closely related theropod dinosaurs, but, contrary to what I noted, they have not yet been tested for keratins. They have the same kinds of integumentary structures, which appear to be homologous to the feathers on today's birds as well as to those of ancient birds such as *Archaeopteryx* and *Confuciusornis*. Because all these animals have the same kinds of structures, and they are in the same clade of closely related animals, we infer that all these structures lacked alpha-keratins, and that hypothesis must be tested by future discoveries. I apologize for creating confusion: I was thinking of one animal and writing about another, and my fingers got ahead of my brain (or vice versa). For more information on feather biochemistry and evolution see Brush (2001 and his previous papers cited therein).



## READERS ASK

### What is a bird in the first place?

Any taxon, or group of organisms, has a definition and a diagnosis. The definition is expressed as a function of descent, or relationship. For example, most of us (but see papers in Gauthier and Gall 2001) define Aves as living birds, plus *Archaeopteryx* and every animal that evolved from the common ancestor of *Archaeopteryx* and living birds. This would include extinct forms such as *Confuciusornis* and *Hesperornis* (Cretaceous birds that are more distantly related to living groups) as well as birds such as the moa and the dodo (which are within the group of living birds).

The diagnosis of a taxon such as birds proceeds from the definition, in part, and it comprises the diagnostic features that were present in the common ancestor of the

group as it is defined. What features did that common ancestor have that its relatives outside birds did not? These are the diagnostic features. To reason this out, we do not have to find the exact common ancestor. Rather, we infer from these features what the most basal ("primitive") members of the bird lineage shared that non-birds do not share.

As you can imagine, it is more difficult to give birds the easy diagnosis of "feathers", now that we have full-blown feathers on dinosaurs that are not birds but are closely related to them (and these feathers, like bird feathers, lack alpha-keratins). However, *Archaeopteryx* and the other basal birds had a full complement of flight feathers, with primary and secondary feathers, and they also had arms that were approximately as long as their legs, unlike their

non-flying feathered dinosaurian relatives. There are other more technical features of the skull, vertebrae, girdles, and limbs that separate birds from other dinosaurs (see Padian and Chiappe 1998).

#### How did feathers evolve?

We are getting closer to a fuller understanding of how feathers evolved. The simplest structures that seem to be related structurally to feathers are seen in the dingy, fur-like, thick covering of *Sinosauropteryx* and its relatives. The first specimens discovered were not preserved well enough to reveal what later discovered specimens did: that these structures were branched (Xu and others 1999). Moreover, there are several kinds of feathers, in addition to these fringe-like structures, on some related non-avian dinosaurs such as *Caudipteryx* and *Protarchaeopteryx* (Xu and others 2001; Padian and others 2001). Some of these are flattened, with vanes composed of highly aligned barbs, like typical bird feathers of today. Others have a more down-like aspect, and still others seem to be almost brush-like, gathered at the base into a distinct stalk. *Archaeopteryx*, the first known bird, preserves no evidence of the latter two types, but has fully developed flight feathers. Many beautifully preserved specimens of the early Cretaceous bird *Confuciusornis* seem to have a "halo" of feathers that are not flight feathers, but rather look like simpler filamentous structures. And the development of actual feathers has much in common with this evolutionary transition from branched, filamentous structures to vaned, barbed feathers. Of course, we have no records of the actual developmental patterns involved in these ancient structures, and there are many differences between them and the feathers of living birds, too.



#### Don't other extinct animals have feathers?

The bizarre integumentary structures of the (presumed diapsid) Triassic reptile *Longisquama* have recently been likened to feathers (Jones and others 2000), and have even been called "para-feathers" (Maderson and others 2001). They are long, frond-like structures, but their resemblance to feathers is superficial at best (Reisz and Sues 2000, 2001). They appear to have a central stalk with intermittent, internal pith-like structures superficially like feathers (and also to some plant stems). However, the vane-like structures on either side of the stalk appear to be solid, with wavy corrugations that lack barbs, and the whole thing is surrounded by a discrete band of tissue. The entire structure is not planar but three-dimensional. Nothing of their composition is known, and only one specimen is adequate to provide good details. For these reasons, although *Longisquama* has been known for over 30 years, no one has considered its structures feathers or feather-like until recently, and this claim has not met much acceptance — to the contrary, there is considerable skepticism. Most qualified observers agree that the similarities to feathers are merely superficial. Because, as I noted in my previous piece, there is so little support for this hypothesis, *Longisquama* cannot be claimed to have feathers. Moreover, if these were feathers, birds should be closely related to *Longisquama*, but no one claims this or offers any additional evidence in support. So, if there is no relationship to birds, how can these be feathers?

#### How do we know that the feathered *Caudipteryx* and *Protarchaeopteryx* are non-avian dinosaurs instead of secondarily flightless birds?

Good question, especially since they share some morphometric features with true birds (Jones and others 2000). They could indeed be flightless birds, but phylogenetic analyses of the entire range of skeletal features (as opposed to a few morphometric similarities) do not imply this. *Caudipteryx* is considered related to the oviraptorids by several independent studies (reviewed in Sereno 2001). Isolated morphometric features are interesting, but they have to be assessed as part of a phylogenetic analysis before we can use them to help to determine relationships. Sometimes these similarities are misleading. For example, hummingbirds have unusually short wings, even for their size. Their backs have not become longer, though, and we know this because we can compare a lot of different measurements in the skeletons of other birds related to hummingbirds to demonstrate that it is the wings that have shortened. We also have an explanation: hummingbirds produce lift on both upstroke and downstroke, which are far more symmetrical actions than in other birds. Like any features, morphometric ratios can change, often for very different reasons. We must examine the context of the morphometric difference in order to use it as a character in phylogenetic analyses.

#### What if these specimens are all faked?

Indeed. Was not *National Geographic* embarrassed by the specimen of "Archaeoraptor" that turned out to be a mixture of two or more animals assembled by the Chinese villagers who sold the specimen? Yes, but the specimen was still being studied by computerized tomography (CT-scan) to check just this question when *National Geographic* went ahead with its report. The specimen was never described scientifically, the artifice was quickly discovered (Rowe 2001), and part of the find became the new small dromaeosaur *Microraptor* (Xu and others 2000). For details on the history of this specimen, see Padian (2000). Tampering has come to be almost automatically suspected in many cases of specimens discovered from certain areas, because they are collected and prepared by local people who know that more complete or more attractive specimens will bring more money when sold to commercial fossil dealers. When there is doubt, the pieces are disassembled, more closely examined microscopically, and CT-scanned if possible. Usually this happens only when there is reason to suspect that some features are unexpected or out of proportion.

#### Birds are said to have fingers that represent II, III, and IV of the pentadactyl hand, whereas theropod dinosaurs have I, II and III, so they cannot possibly be related, can they?

Some inferences from limb development have been used to support this conclusion (Burke and Feduccia 1997). However, no bird embryo appears with the developmental precursors of all 5 fingers (and not simply the cartilage condensations associated with the developing digits). Unfortunately the remaining 4 fingers do not come with numbers on them, so this evidence is inconclusive. Sadly,





# Panel Discusses “Intelligent Design Theory”

Lloyd Davidson, Northwestern University

Science is too precious a commodity to allow people to get away entirely unscathed in their attempts to undermine and destroy this exceptional field of endeavor simply in order to replace it with their own privileged brand of fundamentalist religious beliefs. I wish we had the luxury of ignoring them, and were they as underfunded as the National Center for Science Education, the only national body dedicated to fighting anti-evolutionism, they could be treated as simply one more misguided, marginal collection of zealots, but they are, in fact, well-funded and well-organized, with a number of important friends in the government and a way of appealing to the hearts and minds of the general public. Therefore, I was eager to accept an invitation to participate in a

panel on “intelligent design theory” at Northwestern University on the evening of May 11, 2001.

The panel was sponsored by a student group, the Public Affairs Residential College, at Northwestern University and was what is called a Key Event. These events are organized to include at least three speakers with opposing views who each give a brief presentation of their positions, and then serve as a panel for audience questions. The purpose is to provide general information to the student body, but also to challenge students’ firmly held viewpoints on a given subject. The focus of the session was to explore models of evolution by natural selection compared to models of “intelligent design” as the scientific basis for understanding the complexity of living things.

The particular session that I participated in turned out to be very worthwhile, at least from my perspective. The audience contained perhaps 30 students, 3 skeptical faculty (two from biological anthropology and one from geology), an engineering faculty member (who gave a campus talk himself on religion and evolution a few days later to counter our presentation) and about 6 friends I had invited.

## PANEL PRESENTATIONS

It began with a presentation by Del Ratzsch, an old-earth creationist and philosophy professor from Calvin College in Michigan. This is the same school where Dr Terry Gray used to teach. Gray was a biochemistry professor who had the temerity to speak out in support of evolution and in opposition to Phillip Johnson’s book *Darwin on Trial*, for which crime he was tried for heresy in the early 1990s by the Midwestern Orthodox Presbyterian Church. He lost, was removed from his position as church elder, and finally left the college.

we have no prospects of developmental series from Mesozoic dinosaurs. What we do have, however, is a robust phylogeny of archosaurian reptiles (Padian and Chiappe 1997, 1998; see accompanying figure) that shows (on the basis of trees constructed from many other characters) how the hand was reduced from a 5-fingered ancestor. In all archosaurs (including crocodiles) the 4th and 5th digits are smaller than the other two. In the first dinosaurs this is still true; in theropods the 5th is at first reduced to a nubbin (*Dilophosaurus*) and then lost, and the 4th is only represented by the metacarpal (palm bone). This too is lost in all more derived theropods, in which only I, II, and III are preserved. III is lost in tyrannosaurs, and both III and II are lost or greatly reduced in alvarezsaurids such as *Mononykus*. What is interesting is that the three digits of *Archaeopteryx* and the other birds preserve the exact forms, proportions, numbers of phalanges, and wrist connections as those of the three-fingered theropod dinosaurs. Coincidence? Not likely.

However, there may be a resolution even to the embryological problem. Wagner and Gauthier (1999) suggested that a mutation may have shifted the embryological II-III-IV series in theropods to a I-II-III position such as we see

in living birds. A plausible mechanism, based on other developmental examples; it remains to be seen whether tangible evidence in this case will emerge.

## What’s the take-home message?

Glad you asked. We often encounter creationist arguments that science cannot be authoritative because scientists disagree about the answers to many major questions. Science does not command unanimity or even consensus; as scientists, we do not have to (and should not) accept conclusions that we do not understand or have no expertise in. Though science does not demand consensus, the fact is that science does produce consensus — not by commanding it, and not by ignoring important discrepancies among positions, but by working hard to answer unanswered questions and find conclusive evidence. Most of all, science works by conducting scientific business out in the open in the forum of peer-reviewed scientific research literature. The consensus is not forced but persuaded. However, there is no rule that scientists have to agree. A corollary is that the fact that not everyone agrees on a conclusion does not mean that the conclusion is incorrect. We like to say that science is open-minded but not empty-

Ratzsch began by complaining that science forbids any consideration of supernatural forces and launched into a very strange analogy about spacemen landing on Mars, finding a perfect replica of the Eiffel tower there, and then not being allowed to consider aliens as a possible source of its origin. The audience was a bit confused by this example. Of course science does not reject "intelligent design theory" (ID) simply because of a dislike for the extranatural forces that it invokes, but because ID has yet to provide any decent evidence for the phenomena they believe exist or for the forces that are supposedly behind them. "Intelligent design" creationists, like Behe, Dembski, Johnson, and the rest, can think up no experiments that would adequately test for "intelligent design"; while this is a serious weakness in the scientific community, it is also a strength in the arena of public opinion because it means that it is impossible for opponents to falsify claims based on ID.

*Lloyd Davidson heads the Access Services at the Seeley G Mudd Library at Northwestern University and has a PhD in zoology from the University of California, Berkeley. Besides his interest in confronting anti-evolutionists, he works on the impact of electronic publishing on libraries and the future of scholarly communication.*

Following Ratzsch was an undergraduate student named Mary Kelaita, who is Roman Catholic and an evolutionist. Normally the religion of a speaker would not matter, but this fact is significant in light of the claims of Johnson and Dembski that evolution and the scientific method undermine religion and morals. She described the very amusing review by Jerry Coyne in *Nature* of Jonathan Wells's book *Icons of Evolution* and also presented and distributed a well-written handout from Kansas Citizens for Science. She demonstrated an excellent understanding of how science operates and later gave a wonderful answer to a question from the audience about how science guards against any bias that may be present in a hypothesis. Kelaita described such standard scientific methods as hypothesis testing and the willingness of researchers to change hypotheses based on new evidence, the importance of the repeatability of experiments, and the need to obtain results that lead to accurate predictions. She also explained the system of honest review of evidence in published papers by critical peers. None of these is in evidence in the writings of those who espouse ID.

The next speaker was Paul

Nelson, the editor of *Origins & Design* — the official journal for the "intelligent design" movement. Nelson spoke at some length on the complexity of life and showed slide after dull slide showing how many proteins exist in even the simplest bacterium (about 300). This was meant to convince the audience that life was far too complex to have arisen on its own and must have been planted here by some ancient designer. He also pointed out that no one has succeeded in creating life from its component parts in the laboratory, even by homogenizing living cells and then allowing this slurry to incubate in a sterile environment — as though this observation provided strong evidence for creationism. He told the audience that Francis Crick — a co-discoverer of the structure of DNA — holds that life most likely arrived on earth from elsewhere (the panspermia hypothesis). However, it has never been clear why anti-evolutionists think this helps their case. At best it simply moves the problem of life's origin to another location and somewhat earlier time.

Nelson also attacked perceived sources of evolutionary "authority", including Darwin himself, as if no one else would have discovered natural

headed. Contrary ideas and opinions can be held; no vote is taken, no censure given to those who disagree.

However, as conclusions become stronger, the bar becomes higher for those who wish objections to be taken seriously. They have more evidence to explain away. They have to come up with a better hypothesis that explains all that evidence and more. And they have to show us that they are using methods of science that the community of scientists in that field accepts. I made the argument that in the case of the origin of birds, the vocal opponents (who actually are far fewer than their representation in the "even-handed" media suggests) do not treat the vast majority of evidence that birds evolved from theropod dinosaurs; they have no rival hypothesis to be tested; and although they do not use cladistic analysis (which is standard for all branches of systematic biology), they do not provide or justify a better method. This debate, which began scientifically in the modern sense in 1973, has gotten to the point where it is no longer scientific, for the reasons just noted.

Many creationists use a literal reading of the Bible as a litmus test for scientific pronouncements. This reading is their authority in all matters, and so it is sometimes diffi-

cult for them to understand how science can be authoritative if it is not authoritarian (that is, if there is no governing body deciding the validity of scientific conclusions). How can scientists disagree about something this important and expect us to respect their work? As I noted previously, the scientists involved in this debate do not disagree that birds evolved from reptiles; the questions are which reptiles and how. However, not all views are equally supported by evidence or equally justified by methods. In 1971 we could easily say that the origin of birds was an open question; this is much more difficult to say in 2001. On the other hand, most scientists from many disciplines used to think, on the basis of good evidence, that there was no way that the continents could move.

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selection if that beastly Mr Darwin had not been born. Anti-evolutionists scarcely ever mention that *two* people in fact formulated and proposed evolutionary theory based on natural selection approximately simultaneously in the mid-1800s. They also tend to overlook the 150 years of research that has confirmed and expanded evolutionary theory since Darwin's original publication.

In my own presentation, I focused on a few examples to illustrate the problems with ID and the promise of contemporary scientific research. One was a recent cartoon from the *New Yorker* showing a kid standing before a formula on the blackboard on which he had written, " $2 + 2 = 5$ ". In the caption, he was explaining to his teacher, "Maybe it's not a wrong answer, maybe it's just a different answer." I pointed out that some answers were, in fact, wrong and that ID was one of them.

Nelson was quite incensed about one of my slides that challenged whether life is, in fact, well designed or not. Using the example of the panda's thumb, I pointed out that the wrist bone the panda uses instead of a thumb was a weird and unnecessary one, since the panda has the same 5 digits that we have and could have

just as easily have been "designed" with one of them as an opposable digit — as have most other vertebrates with grasping hands and feet. But that did not satisfy him.

Another example focused on *Hox* genes — one of the more exciting discoveries in science over the last 20 years or so and one that demonstrates patterns of deep homology among groups. The example I presented was the *OTX* gene that determines head development in fruit flies and humans — two quite disparate, long-separated groups. It turns out that if one deactivates the *OTX* gene in a *Drosophila* embryo and replaces it with a copy taken from a human embryo, then the fly head develops almost entirely normally. I went on to say that the reverse experiment is even more interesting — deactivating the *OTX* gene in a human embryo and replacing it with one from a fly, will produce ... Well, you have probably seen the movie.

#### THE OUTCOME

The question-and-answer period went quite well for science; anti-evolutionary arguments were disposed of with alacrity, either by pro-evolution panelists or by members of the audience. Frankly, I found the experience quite

exhilarating and a lot of fun, as did Mary Kelaita. It also proved useful in that it gave me incentive to look at ID arguments, such as they are, in more detail. This, in turn, gave me even greater insight into the confused state of the ID movement. ID claims really depend only two arguments: Behe's arguments for irreducible complexity and Dembski's dense mathematical treatises, which unsuccessfully attempt to show, among other things, that the Second Law of Thermodynamics does not allow evolution. Vic Stenger, David Roche, Wesley Elsberry, and others have shown the obvious errors and fallacious assumptions in Dembski's calculations. Behe's claims have been disproved on so many fronts — both biochemical and philosophical — that he should retire them for good. However, the continued success of ID among anti-evolutionists despite its failure to gain acceptance in philosophy or biology (or mathematics) is a sure sign that this issue will not be resolved on its scientific or scholarly merits.

#### AUTHOR'S ADDRESS

Lloyd A Davidson  
Head, Access Services  
Northwestern University  
Seeley G Mudd Library for Science and Engineering  
2233 N Campus Drive, Evanston IL 60208  
ldavids@northwestern.edu



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#### AUTHOR'S ADDRESS

Kevin Padian  
University of California Museum of Paleontology  
Berkeley CA 94720-4780  
kpadian@socrates.berkeley.edu





## New "Intermediate Form" Ties Seacows Firmly to Land

Daryl P Domning

Howard University, Washington DC.



Anti-evolutionists never tire of insisting that there are no forms of organisms in the fossil record that are intermediate between major taxonomic groups (despite the fact that evolutionists have described many such fossils). They often entertain audiences with caricatures purporting to show what such "missing links" would have to look like, such as cartoon "hybrids" between cows and whales. Their special-creation model, of course, predicts that real intermediate forms will never be found, because they never existed. Unfortunately for the creation model, however, the earth keeps bringing forth fossils undreamt of in the creationists' philosophy — fossils that are exactly what paleontologists using the evolution model have predicted.

This has been happening particularly often of late among the marine mammals: cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions, and walruses), and sirenians (manatees and dugongs) — all of which still have living relatives — as well as in extinct groups such as desmostylians and sea sloths. Marine mammals have a good fossil record that keeps getting better. It documents many clear exam-

ples of evolution between different species, genera, families, and orders, and demonstrates as well as that of any group of organisms that the boundaries between these taxonomic categories are unavoidably fuzzy and arbitrary, less distinct as one traces them backward through time — just as their descent from a common ancestor would lead us to expect.

Perhaps more than any other scientific discoveries, these "fuzzy" fossils put creationists into a corner — challenging them, in effect, to specify just what kind of intermediate fossil (if any) would ever falsify their model, or why a particular fossil actually in hand does not fit any reasonable description of an intermediate. Some examples from marine mammals are particularly embarrassing to creationists, because they bridge former "gaps" in the fossil record in such obvious and dramatic fashion. When animals in an evolutionary lineage are so strikingly different as are, on the one hand, four-legged land mammals, and on the other hand, totally aquatic whales or manatees with only flipperlike front legs and no hind legs at all, it is clear to any layperson that the theory of evolution requires, somewhere between the ancestral and modern forms, the former existence of intermediate species that combined more or less land-capable legs with other anatomical features that are indisputably recognizable as those of cetaceans or

sirenians. To creationists' chagrin, over the past decade, exactly such intermediates have repeatedly been found — giving incontrovertible proof of terrestrial origins, first for whales, and now for seacows.

### NEW SIRENIAN FOSSILS

Seacows or sirenians (manatees and dugongs) are among the species most highly modified from the primitive land-dwelling ancestors of all mammals. Like the whales and dolphins, all their living representatives are totally aquatic animals with forelimbs modified into flippers, no externally visible hind limbs, and no ability at all to haul themselves out of the water and move about on land. From the creationist viewpoint, they would surely qualify as at least one "created kind" separate from all other mammals. Hence, the special-creation model would certainly not predict the former existence of an animal with the head and body of an indubitable sirenian but with the four stout legs of a land mammal capable of walking on land.

That, however, is precisely what my coworkers and I have discovered in 50-million-year-old rocks in Jamaica: a true "missing link" intermediate between major "kinds" (in this case, taxonomic orders), of just the sort that creationists insist does not exist. This new animal has been named *Pezosiren portelli*, in honor of Florida Museum of Natural History paleontologist Roger

*Daryl Domning is Professor of Anatomy at Howard University, Washington, DC. He is a paleontologist specializing in the evolution of sirenians and other marine mammals.*

Portell, who discovered the site where it was found (Domning 2001b). (The Greek name *Pezosiren* means "the sirenian that walked".)

The fossil locality is a drainage ditch cut through early middle Eocene deposits in the hills south of Montego Bay. Our excavations there (which are supported by the National Geographic Society) have turned up hundreds of bones of seacows, as well as those of fish, turtles, crocodiles, and even a primitive rhinoceros of a type then common on the North American mainland — demonstrating that Jamaica was close, if not actually connected, to Central America at that time. Most of the bones, however, represent *Pezosiren*, a pig-sized beast with a somewhat dachshund-like build: a long trunk supported on four short legs (see Figure 1).

These bones had come to rest in what was apparently a shallow, brackish lagoon close to the ancient seashore. Although in a couple of cases we have found clusters of bones that represent parts of a single individual, most of the seacow

present; so I feel confident in concluding that all the bones used to assemble the composite skeleton illustrated here do represent the same species. Except for the feet (of which we have only three bones), nearly all parts of the skeleton are well represented in our collection.

The skull and trunk of *Pezosiren* show a combination of features found only in sirenians, including an enlarged snout or rostrum, a large nasal opening located well back from the tip of the snout, and an absence of air sinuses in the skull. The two halves of the lower jaw are joined in front by a long, deep, and narrow symphysis, or front section of the lower jaw. The incisor and canine teeth are in two parallel, longitudinal rows — typical of primitive seacows — rather than in a single, more or less transverse row — which is more typical of other land mammals.

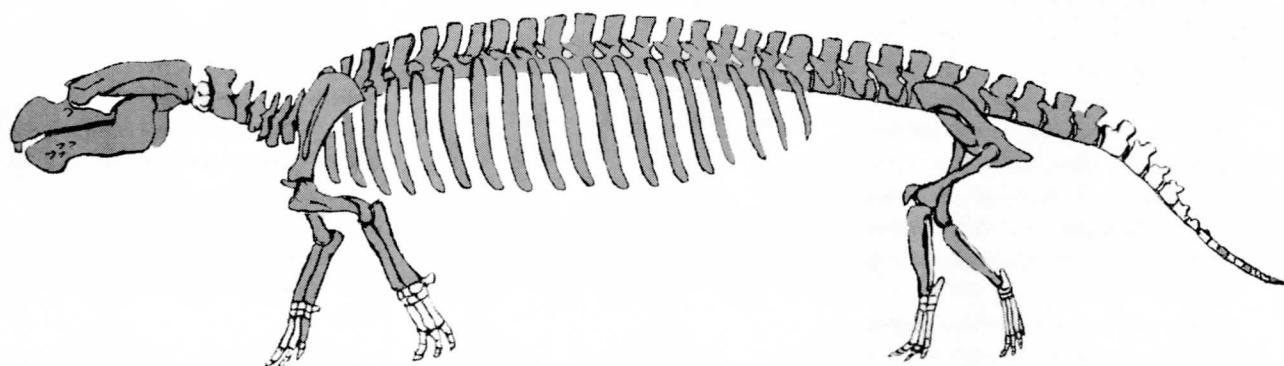
The rest of the skeleton is mostly made up of solid, dense bones, including in particular a large number of heavy, banana-shaped ribs — 20 pairs of them. These ribs, frag-

mentary, and probably spent most of its time there.

In several other details of its cranial anatomy, *Pezosiren* is distinctly more primitive than other sirenians, which is consistent with its being geologically older than almost any of them. Its more primitive status, however, is most dramatically displayed in its limb bones. Unlike any later seacow ever found, it has both a complete hind leg and a pelvis that was securely attached to the backbone by a strong sacroiliac joint like that found in land mammals. This arrangement of bones shows that *Pezosiren* could still support its body's weight on dry land when it wanted to — something no other known sirenian could do.

### AMPHIBIOUS ADAPTATIONS

As a truly amphibious animal, *Pezosiren* also had a style of swimming intermediate between terrestrial and marine mammals. Unlike the "dog-paddle" of typical four-legged land mammals, or the swimming style of modern whales and



**Figure 1.** Reconstructed composite skeleton of *Pezosiren portelli*. Length roughly 2.1 m.

Shaded elements are represented by fossils; unshaded elements (jugal, atlas, fibula, most bones of the feet, and most caudal vertebrae) are not. The length of the tail and the form and posture of the feet are partly conjectural. After Domning (2001b).

carcasses had decomposed and their bones had been scattered by waves and scavengers before burial; hence we have no single complete skeleton. In at least the three lowest of several distinct bonebeds present at the site, however, there is no evidence that more than one species of seacow, or any other mammal of comparable size, was

ments of which are what first drew our attention to the site, are highly characteristic of sirenians, because they give these shallow-diving animals needed ballast, like a diver's weight belt. With features like this bony ballast and the nasal opening on top of its snout, this early seacow was already more adapted to the water than an otter or hip-

seacows, which use up-and-down strokes of a powerful tail, *Pezosiren* used undulations of its back and hind limbs in otter-like fashion, with its modest-sized tail playing a distinctly subordinate role. This is the same intermediate mode of swimming that has been hypothesized for the contemporary early whale *Ambulocetus* (Thewissen and oth-

ers 1994, 1996), which shows that sirenians and cetaceans were coincidentally though independently evolving through the same stages of aquatic adaptation at the same time (early and middle Eocene).

Furthermore, the swimming of *Pezosiren* had already progressed beyond that of otters in that the four vertebrae of its sacrum (the part of the backbone connected to the pelvis) were no longer fused to each other to form a solid bony structure, as in land mammals. Although tightly jointed together by connective tissues, they remained unfused and slightly movable until late in life, showing that the flexibility of the backbone was increasing. The same condition is seen in another primitive whale, *Rodbocetus* (Gingerich and others 1994). In later cetaceans, and in all later sirenians, the sacrum comprises just a single vertebra; the other vertebrae have become completely separate and are now effectively parts of the tail, so that no rigid connections exist any longer between vertebrae in the back part of the now-fully-flexible spine.



### THE REST OF THE STORY

But the story does not end there. We now have many more sirenian fossils, now representing every conceivable major stage of limb loss (and several minor stages) from the complete hind limbs of *Pezosiren* to the total leglessness of a modern manatee (see also Domning 2000, 2001a).

There is general scientific agreement that sirenians, along with elephants and several other kinds of mammals, arose from the group of early hoofed mammals called "condylarths", though so far we have not identified the particular member of this group that gave rise to sirenians. *Pezosiren*, however, has a skeleton that is for all intents and purposes that of a condylarth, with only a few aquatic modifications; so it more than suffices to show that sirenians came from some sort of condylarth-like land mammal. What came next? Some of the fossils we have now in hand document suc-

cessive stages of hindlimb loss leading to modern sirenians:

Hind limb and pelvis complete and unreduced; sacrum with 4 vertebrae that fuse late in life, if at all: *Pezosiren portelli* (early middle Eocene; Domning 2001b).

Sacrum comprising only a single vertebra, never fusing to other vertebrae but firmly connected to pelvis: a single specimen from one of the upper (younger) bonebeds at our early middle Eocene Jamaican site (Domning, unpublished).

Hind limb and pelvis complete, but reduced in relative size and complexity; sacrum only loosely connected to pelvis: *Protosiren* spp., especially *Protosiren smithae* (late middle Eocene; Domning and Gingerich 1994).

Pelvis further reduced, pubic bones barely in contact in midline: an undescribed primitive dugongid (late middle Eocene; Gingerich and Domning, unpublished).

Pelvis still more reduced, pubic bones no longer in contact, obturator foramen vestigial; femur vestigial; more distal limb bones probably absent, and hind limb probably no longer visible externally: *Eosiren libyca* (late Eocene; Siegfried 1965).

Pelvis and femur further reduced, pubis vestigial, obturator foramen absent: *Halitherium schinzii* (early Oligocene; Lepsius 1882).

Pelvis rodlike, consisting only of ilium and ischium, with vestigial acetabulum (hip socket); vestiges of pubis often not discernible: *Metaxytherium krabulezzi* (early Miocene; Domning and Pervesler 2001).

Pelvis rodlike, acetabulum absent: *Metaxytherium flori-*

*danum* (middle Miocene; Domning 1988); *Dusisiren jordani* (middle Miocene; Domning 1978); *Hydrodamalis gigas* (Steller's sea cow) and *Dugong dugong* (the modern dugong), both recent.

Ilium mostly lost; pelvis no longer with a distinct ligamentary connection to vertebral column; pelvis consists mostly of ischium: Recent *Trichechus* spp (modern manatees).

Not all of these species are related in a direct ancestor-descendant lineage, but they demonstrate that practically every conceivable stage of pelvic and limb reduction *is in fact* represented by known fossils — and these fossils are found in the rocks in the *right* stratigraphic sequence. The overall pattern is of rapid reduction and loss of functional hind limbs during the middle and late Eocene; thereafter (once external hind limbs were no longer present and the pelvis was close to its final small size) the rate of further simplification slowed down greatly: there was far more change in the first 15 million years than in the last 35 million.

This too agrees with the predictions of the evolutionary model: the rate of evolutionary change should be directly proportional to the intensity of selection, and once the hind legs no longer existed and the remaining bones were nearly as small and light as they would ever become, the pressure of natural selection for further change was greatly relaxed (Domning 2000). (Since the pelvic bones still serve as points of attachment for genital and other muscles, we would not expect them to be lost entirely; so it is not surprising that these small bones persist in cetaceans as well as sirenians.)

### THE STEPS TOWARD MACROEVOLUTIONARY CHANGE

For a land-dwelling mammal, a more dramatic *macroevolutionary* change than the complete loss of hind



# Creationism in the Comics

Jon P Alston, Texas A&M University

## INTRODUCTION

A contemporary source of fundamentalist religious education, including creationism, is Jack T Chick's Chick Publications (PO Box 3500, Ontario CA 91261). In addition to books and videotapes, Chick Publications publishes a series of 32-page full-size comic books and a series of small 24-page black-and-white tracts in picture form. Millions of these comics and tracts have been distributed, published in English and more than 90 foreign languages; the cover of the comics claim that over 450 million tracts have been printed during the last 35 years. One of the aims of the publications is to reinforce already-established young-earth creationist beliefs; it is assumed that the reader already believes in a literal 6-day creation roughly 10 000 years ago. At 13 cents apiece, the tracts are also intended to be inexpensive yet

effective witnessing tools. Perhaps the most startling use of these comics-format materials was to support anti-evolution legislation in Arkansas (see RNCSE 2000; 20 [5]: 5-6).

For readers who have never seen these materials, I describe and analyze three Chick publications — one tract (*Big Daddy?*) and two comic books (*Primal Man?* and *The Ark*). The last two resemble the Classic Illustrated Comics® popular a generation ago.

All three have very clear messages. For example, *Big Daddy?*, in addition to "informing" readers that evolution is false, coaches students to reject evolution in their classes and to present anti-evolution arguments to their teachers. The comics also repeat a theme common to creationist thought: evolution is false and has been disproved by both science and Scripture, but many, if not most, evolutionists are liars and

refuse to admit the falsity of their position (Morris 1985; Whitcomb and Morris 1961).

Robert T Pennock (1999: xvi-xvii) has noted that *Big Daddy?* offers students protection from being "brainwashed" into accepting evolution and is representative of creationists' current aggressive rhetoric. These publications also reflect a mindset that is prepared to accept very simplistic messages presented in a very dogmatic form. In addition, these comics include an implicit minor theme: that the theory of evolution and those who "believe in" it are evil. The theory of evolution, according to some of the most vocal creationists, was promulgated by Satan following the collapse of the Tower of Babel: "The real author of this vast religious complex — this great world religion of pantheistic, polytheistic, demonistic, astrological, occultistic, humanistic evolutionism — can be

limbs and the acquisition of a fish-like body form could hardly be imagined. And here we have the actual fossils to show beyond reasonable doubt that it *did* occur, to show *when* and *by what steps* it occurred, and to show that the *pattern* of these steps through time accords neatly with Darwinian concepts of the *mechanism* by which it occurred. *This is what the fulfillment of a scientific prediction looks like.*

Draw your own conclusions: is this *Pezosiren* what you would expect a transitional form between land mammals and fully aquatic sirenians to look like? If not, what characteristics *should* such an interme-

diate form have? It will be interesting to see how creationists try to answer these questions, and on what basis they will try to deny that *Pezosiren* is yet another large nail in the coffin of creationism. Or perhaps they will argue instead that other "links" in other groups are still missing from the story of evolution, and that evolution will not be a proven fact until *all* the gaps are filled by fossils. It is safe to assume that this state of perfect knowledge will never be fully achieved by human science; but creationists are wrong if they take comfort in this. Their assertion, after all, is the universal claim that macroevolution cannot, does not, and has never

occurred — not merely that it has not occurred in this or that particular kind of organism. Therefore, their claim is falsified by even a single case in which it demonstrably *has* occurred, beyond reasonable doubt — and we already have a long and growing list of those, including the sirenians and cetaceans.

It is time to lay to rest the notion that evolution is not a demonstrable fact, and get on with the job of addressing the true reasons for the continuing creation/evolution controversy, which are to be found not in science but in creationists' very human concerns about suffering, evil, and human destiny (Pennock 1997, Domning 2001c).

none other than ... the Devil" (Morris 1984: 109).

### THE ARK

*The Ark* opens with a bemused Russian diplomat ordering a collection of books on the Ark for his superior, Colonel Solkov. After reading the Genesis 8: 2-4 account of the Flood aloud to his staff, Solkov announces that a recently discovered photograph taken by a Russian pilot in 1945 shows Noah's Ark on Mount Ararat. This photograph is proof that atheism, and therefore communism, is false. The Russians fear that a current expedition of Christian scientist-explorers to Mount Ararat will prove the existence of the Ark, causing people to reject communism and become interested in the Bible.

The next sequence of panels shows the expedition of Christian explorers taken into custody by Colonel Solkov. Alerted to the crisis, the sponsor of the expedition prepares to send someone to rescue the explorers. First, however, the prospective rescuer is briefed about the Ark. The briefing includes a discussion of the evil that existed before the Flood, including pornography, divorce, and homosexuality. This is followed by the story of Noah, a discussion of the size of the Ark (with appropriate pictures), and a pseudoscientific explanation



of the water vapor canopy and underground water that made the flood possible. Finally, the prospective rescuer hears how the animals entered the Ark, all the people except for Noah and his family drowned, and the Ark eventually settled on Mount Ararat.

The briefing then presents modern accounts of witnesses who have seen the Ark. Following an aerial sighting in 1916, a party of 150 military engineers was sent by Czar Nicholas II to Mount Ararat. A group of 100 men reached the Ark, entered it, and inspected cages large enough to hold dinosaurs. Unfortunately, in the chaos of the October Revolution, the documents proving that the Ark was discovered fell into the hands of the Bolsheviks, and Trotsky ordered the messenger to be shot. Another set of panels illustrates another discovery of the Ark under ice; a piece of hand-tooled timber is dated to be 4000 years or more old. A photograph of the Ark is reproduced in one of the last panels.

This section of the comic book parallels two of the accounts of discoveries of the Ark found in Charles Berlitz's (1987) book — either the discoveries have been suppressed by authorities or the evidence for them has been lost in one way or another. The idea that the Ark has been located and can be reclaimed

derives from the notion that locating the remains of the Ark would establish once and for all the claim by young-earth creationists of the primacy of Scripture in historical and scientific, as well as theological, knowledge.

*The Ark* quite clearly states that there are conspiracies to hide the truth about the Ark. It claims that the KGB has convinced many Americans through its agents "penetration" of Christian seminaries that the Ark is a "fairy tale"; it claims also that through the KGB, most professors and teachers in the US came to believe and teach that the Bible is wrong and evolution is true. It is only because of conspiracies of communists, atheists, liberal Christians, and secular teachers that evolution is accepted. There is a cold war to keep the "truth" from the public. Thus readers of the comic book will finish convinced that there are numerous proofs for the existence of the Ark on Mount Ararat; they will also be convinced of a secular conspiracy to keep knowledge of the Ark from the world of believers.

### PRIMAL MAN?

The second comic, *Primal Man?*, starts with seven pages of ape-like men and women fighting and hunting; only on page 8 is it revealed that the events all took place on a

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### AUTHOR'S ADDRESS

Daryl P Domning  
Department of Anatomy  
Howard University  
Washington DC 20059  
ddomning@fac.howard.edu

movie set, supervised by a lavender-clad effeminate director. A group of creationists (one of whom, Jim Carter, also appears in *The Ark*) visits the movie set and challenges the expert consultants on the truth of evolution ("one of the cruelest hoaxes ever invented"). There is mention that many professors reject evolution but do not say so because they are afraid of either being ridiculed or losing their jobs.

The next series of panels "prove" that evolution is false. Radiometric dating techniques are rejected, as are various pieces of fossil evidence. There is mention of the human footprints supposedly found with dinosaur footprints in Texas, a finding later found to be spurious but often not disavowed by creationists. Several panels present arguments that the earth is only 10 000 years old, including familiar claims about erosion and dust on the moon.

Following his discussion with the creationists, one actor decides that if evolution is wrong, then he must have a soul; he then realizes that he must become saved in order to be able to go to heaven. In contrast, the last panels show the movie's producer admitting that films depicting evolution brainwash and morally damage children, but asserting that because he serves his god — money — he will continue to make evolution movies.

The lessons in this comic book are clear. Those who believe in evolution are venal; only a sinful or misguided person can believe in evolution. There are proofs that evolution is wrong, a number of which are presented in order to reinforce creationist beliefs.

### BIG DADDY?

The tract *Big Daddy?* is cruder but just as effective. It begins in a classroom with a vaguely Semitic profes-

sor, behind whom is a painting of an ape eating a banana with the caption "Our Father". The teacher asks his students, "How many of you believe in evolution?" One student in the class says that he does not believe in evolution. Unlike the other students, he is neat and well-dressed; his hair is short and carefully combed. He is polite, a demeanor that other tracts and videos (see for example Hovind 1997) recommend for those wishing to witness the creationist position to teachers and fellow students.

Shouting, sweating, and gesticulating, the professor decides to "systematically tear your [the student's] little beliefs to shreds in front of the class!" The student is called a "fanatic" and threatened with jail for referring to the Bible. Yet he goes on calmly and politely to demolish the "basic concepts" of evolution, dismiss the Lucy fossils as "an unusual chimpanzee", and present the class with a reproduction of a Chick Publications poster of nine pictures illustrating bogus claims of evidence of human evolution, including Piltdown Man. For more information, the reader of the tract is referred to a video of Kent Hovind's series "The Creation Seminar".

The student continues to demolish the theory of evolution with standard well-worn creationist arguments. He ends by suggesting that atomic nuclei could not hold together without divine intervention, adducing Colossians 1: 17 ("by him all things consist") as evidence.

The professor admits that all of his evolutionary beliefs have been falsified, and then tells a university official that he cannot teach evolution any more. The response is "What? Are you crazy? **GET OUT** of OUR university! After you've apologized to everyone for your rudeness and ignorance, we **MIGHT** let you back in" (emphasis in original). This statement is a close paraphrase of what the professor first told the student defending creationism. The last page states that evolution is "the big lie" and that people have souls; people therefore need to repent of their sins and acknowledge Christ

in order to be saved and go to heaven when they die. Jack Chick's theological position is that the "lie" of evolution leads to eternity in Hell. (An image in another comic is of a large conveyor belt full of people who will be dropped into Hell's abyss unless they are saved.)

Though crude, this tract repeats many of the creationists' arguments against evolution and its supporters. It implies that most evolutionists know that evolution is false and that their arguments can easily be defeated. Teachers are defensive and irrational about their evolutionary beliefs.

The creationist, anti-evolution tract and comics by Chick Publications claim that much evidence exists for their viewpoint. They support a type of voodoo science with irrelevant or mistaken information. They buttress their arguments with conspiracy theories, unproven "data", and *ad hominem* attacks.

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### AUTHOR'S ADDRESS

Jon P Alston  
Department of Sociology  
Texas A&M University  
College Station TX 77843-4351  
alstonj@unix.tamu.edu

*Jon P Alston is Professor of Sociology at Texas A&M University. His research interests include the creationism/evolution controversy and Asian cultures. He has published 6 books on international business, Japan, and China.*





# Cloning Shows Why Schools Must Teach Evolution

Steve Rissing, *The Ohio State University*

“Someday, they’re even going to clone pigs as human organ donors!”

The image was Orwellian, but I needed a hook to tell my students why they had to *understand* molecular genetics and not just memorize such terms as “meiosis” and “mitosis” as they prepared for their final exam in my introductory biology course at Ohio State. The hook worked; we had a productive discussion about genetics, evolution, and the implications of both for society. Two days later, on the morning of the exam, my students and I awoke to a front-page headline: “Dolly’s creator makes first piglet clones”. This “could be a profoundly important advance toward the goal of modifying animal organs for transplant to humans”, the article said.

Biology is moving faster than our public policies can evolve, and much faster than we can educate people to understand this science and respond to its brave new opportunities and dangers. Xenotransplantation is the process of transplanting organs from other animals into humans. It is a dauntingly complex task and will likely entail preparing genetically acceptable “donors” through cloning or similar procedures. Indeed, this news of pig cloning was just a first step.

Pigs are similar enough to humans in size, physiology, and genes to serve as organ donors. Further, we already know how to raise them because many of us eat them. Other potential donors, such as fellow primates, are even closer to us, but that similarity raises problems, as noted in the local newspaper: “The risk of passing diseases from pigs to people is less than the danger from primates such as baboons.”

But if pigs are close enough to us to be good candidates as organ donors, why are not fellow primates

even better? Was that not the heart of a baboon that was transplanted into a little girl? What are these diseases in pigs (and baboons)?

The science behind these questions is easy to understand, but we biology teachers are intimidated from explaining it to our students. We are leaving them (and their parents, who pay our salaries) without the knowledge they need to participate in the development of public policy. To understand the opportunities and dangers of xenotransplantation, one must understand evolution and how it works on populations, including those of pigs and humans.

For some students (and their parents), talking about the forces of evolution is about as appealing as trying a baboon burger with bacon and cheese. Natural selection is one of those forces of evolution that is controversial when it comes to teaching biology in schools and even colleges. But it explains the risks associated with transplanting organs from other animals into humans and why those risks are lower (but still real) if the donor is a pig and not a baboon. All alternative “theories” of natural selection are mute on the subject.

Evolutionary biologists have come to refer to the interactions between animals (pigs) and their pathogens (viruses) as an “arms race”. A really aggressive virus and a weak host pig result in no more pig and no more virus. Biologist Paul Ewald has pointed out that this can lead to several outcomes. One is a spectacularly aggressive virus (or other pathogen) that jumps from host to host before each host dies.

Through natural selection, however, host and pathogen populations can sometimes co-exist. The really deadly pathogens and weak hosts die together; the weaker pathogens and stronger hosts co-exist for ever-longer periods. Eventually, this natural process of selection for less deadly viruses and more resistant hosts results in a truce: the host lives, the pathogen lives, and every time the host reproduces, so does the pathogen.

Technicians sequencing the

human genome and those of other organisms are finding a vast amount of DNA they call “junk”. It does not seem to code for anything other than itself. I suspect that much of this “junk” is the product of truces that natural selection negotiated between our ancestors and their pathogens. These sequences are the results of “peace treaties” we do not understand. And when we transplant “donor” organs containing the DNA text of such treaties into hosts that did not participate in the armistice, we may unwittingly violate it. After all, upon successful transplantation of a pig kidney into a human, the human can survive and perhaps reproduce; the virus can survive but not reproduce with the host if it just stays in the kidney. The treaty and truce are abrogated; the war is joined anew.

Pigs make good candidates for xenotransplantation donors because the genetic treaties they negotiated are so old and the viruses involved are so different from our viruses that the pacts probably do not apply. Baboon genetic treaties and the viruses that negotiated them are closer to us, however. The AIDS epidemic is an example of what happens when a virus is transferred from one host to another; the hosts were closely related primates, and the transfer probably occurred through predation. The treaty apparently was violated, with tragic results.

Are pigs too close to serve as our donors? Congress has considered many bills regulating human cloning. Regulations on xenotransplantation must follow. Hundreds of thousands of people stand to benefit from the technique. Similar numbers could suffer if transplanted viruses decide that their 60-million-year-old treaty is broken, and they can do something about it. In our democracy, such policy must be shaped by the people and their understanding of nature. To achieve this understanding, we must teach about evolution and how it affects us.

[Adapted from Steve Rissing’s commentary on cloning, which appeared originally on April 23, 2000, in the *Columbus (Ohio) Dispatch*. It is reprinted with permission.]

## AUTHOR’S ADDRESS

Steve Rissing  
Department of Evolution, Ecology, and Organismal Biology  
The Ohio State University  
Columbus OH 43210-1294  
steverissing@hotmail.com

Steve Rissing is a professor in the Department of Evolution, Ecology, and Organismal Biology at Ohio State University and director of the university’s Introductory Biology Program.



# BOOKREVIEW

## THE CONCISE ATLAS OF BUTTERFLIES OF THE WORLD

By Bernard d'Abrera. London: Hill House, 2001. 353 pages

Reviewed by Arthur Shapiro, Center for Population Biology, University of California, Davis

In 1997 I introduced Bernard d'Abrera to readers of this publication (Shapiro 1997); in those days he still spelled his surname with a capital "D" — he is very fussy about that now. d'Abrera is an Australia-based lepidopterist who over the past 30 years has produced 25 books of color photographs of the butterflies and larger moths of the world, intended as guides for identification. They are indispensable for this purpose and have sold well. d'Abrera is an idiosyncratic neo-Thomist who rejects evolution on purely logical grounds. In recent years, his occasional expressions of doubt have expanded into lengthy rants, written in a characteristic florid style.

The *Concise Atlas* is concise when it comes to the main text — which is limited to the captions of the 150 full-page color plates. It is not concise at all when it comes to the anti-evolution rant, which has expanded to 43 full pages, with scattered comments in a similar vein appearing elsewhere. Many butterfly aficionados will undoubtedly buy this book believing it to be just another beautiful coffee-table volume and will be amazed to find the embedded rant. It appears from this volume that d'Abrera is his own editor; he is also a cofounder of the publishing company, Hill House, so the usual restraint that would be applied by a professional publisher is absent.

As d'Abrera's fulminations continue to grow in length and venom, he has shown increasing signs of detachment from mainstream science. I am reminded of Wilhelm Reich, the psychiatrist and disciple of Freud, whose work deteriorated from a fascinating interpretation of fascism as caused by repressed sexual tension to the belief that he had identified a new form of energy, "orgone", which was elemental sexual free energy in the universe. d'Abrera's version of orgone is his discovery of the true nature of time,

along with a new principle of nature — he calls it the "Theorem/Law of Bio-Temporal Decay". He hinted at this in Appendix II of *Butterflies of Ceylon* (1998) but has now expanded it to a 5-page manifesto. Here are some excerpts from page 93:

What, in effect, evolutionists are proposing, is that while Time might well be decaying, species, on the contrary, do not, but increase in number and complexity. Thus while the Time ice-block melts away to nothing, the species ice-block has both proliferated and grown, and continues to proliferate and grow, while Time runs out. The mind boggles! When the universe finally comes to an end, then (according to the logic of evolutionists) we could safely expect to find millions and millions of ultra-complex superspecies, with no Space to occupy and no Time to spend in it. ... For those who are mathematically inclined, I intend to publish the mathematics of my new theorem in full at a later date, and in a more appropriate vehicle.

I have defined Time as a dimension of functionality at the service of a universe which, by its nature, is changing. From this definition follows a sub-definition, in that *Time is a measure of the intervals between events* [emphasis in original].

...At this juncture I am going to respectfully propose a second new theorem of Time, and that is, that within Creation Time has existed in two successive states. The first I propose to call Primordial Time; the second, I propose to call Post-Primordial, or Dynamical Time. I define Primordial Time as being that quantity and quality of the dimension of Time imposed upon the created universe at the moment of its creation. Its quality of difference from Post-Primordial Time is that it was non-catabolic, or steady, and that its intervals, while being in a state of flow, were of such a nature (indeed preternatural) as to provide neither a sense of past or future, but an indefinitely expanded present.

And so on.

Sadly for d'Abrera, his discovery of the true nature of time is not new

after all. The same discovery was in fact made by another lepidopterist — one who accepted evolution and built it into his scientific and literary work: Vladimir Nabokov. Here is Nabokov in chapter 5 of *Ada*:

The scene is Eocene and the actors are fossils. It is an amusing instance of the way nature cheats but it reveals as little relation to essential Time, straight or round, as the fact of my writing from left to right does to the course of my thought.

And speaking of evolution, can we imagine the origin and stepping stones and rejected mutations of Time? Has there ever been a "primitive" form of Time in which, say, the Past was not yet clearly differentiated from the Present, so that past shadows and shapes showed through the still soft, long, larval "now"? Or did that evolution only refer to timekeeping, from sandglass to atomic clock and from that to portable pulsar? And what time did it take for Old Time to become Newton's? Ponder the Egg, as the French cock said to his hens.

Pure Time, Perceptual Time, Tangible Time, Time free of content, context, and running commentary — this is my time and theme (1969: 539).

Same idea; different soul. What a pity there is no whimsy in d'Abrera, who — like Reich — truly believes that he has proven something new about the universe and is obliged to promote his discovery with bombast. Poor d'Abrera: he could be having fun, instead of becoming a figure thereof.

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### AUTHOR'S ADDRESS

Arthur M Shapiro  
Center for Population Biology  
University of California  
Davis CA 95616

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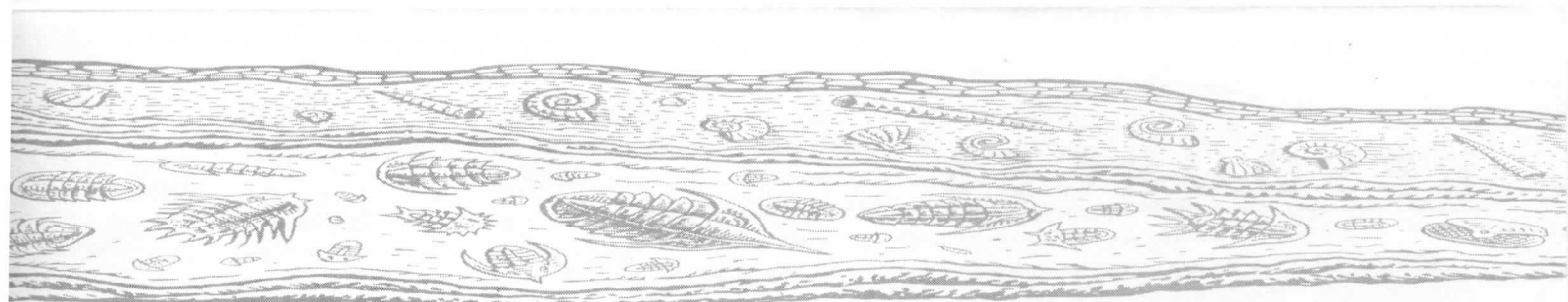
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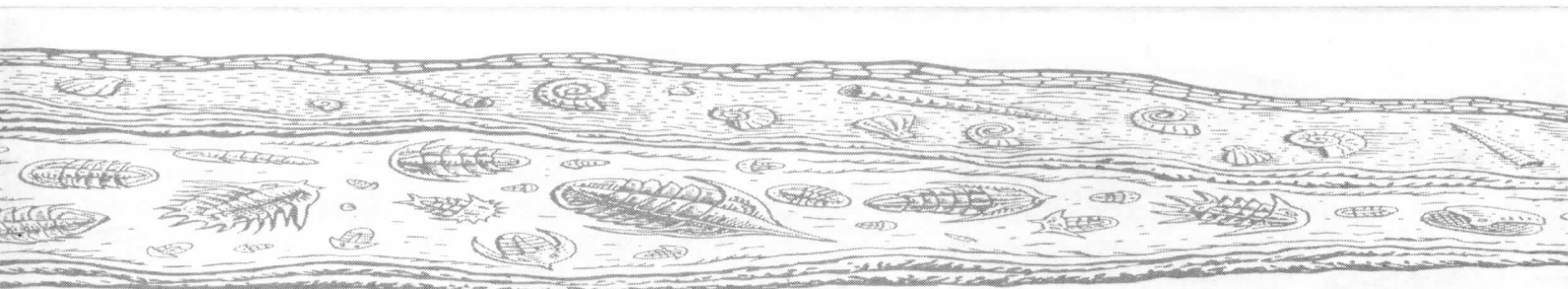
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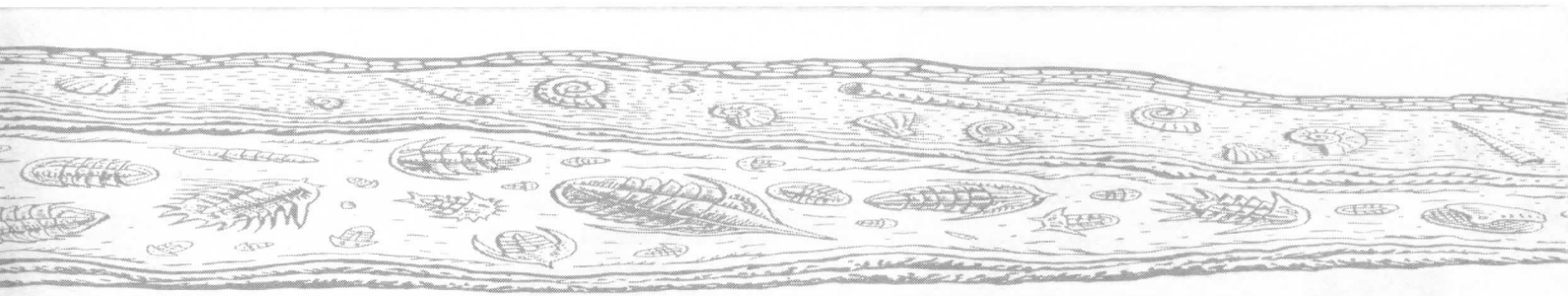
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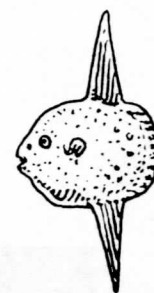
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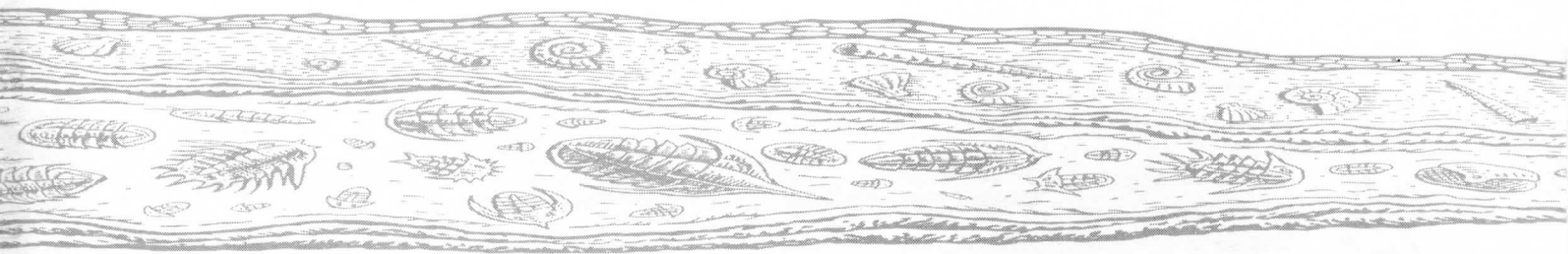
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## Washington-Area Grants Program Supports Teaching Evolution

In honor of this year's celebration of Darwin Day (February 12, 2002), and in support of the study of evolution at our public schools, the Washington Area Secular Humanists (WASH), through its Fred Benjamin Memorial Fund, is making money available to science teachers under the Evolution in Teaching 2002 Grant Program.

This program will be open to middle and high school teachers at public schools in Maryland, Virginia, and the District of Columbia, and will award up to \$1000 to cover materials and supplies for an educational program (lecture, lab project, experiments, and so on) that demonstrates the importance of biological evolution at the micro- or macro-evolutionary scale. In addition to the monies directed toward the classroom, this program has allocated funds for the donation of an educational version of the PBS series *Evolution* to the institution's library.

Applications for the 2002-2003 school year will be accepted until April 15, 2002. For information or an application, contact Dr Steven F Goldberg, Washington Area Secular Humanists, e-mail [evolution@wash.org](mailto:evolution@wash.org), or visit the WASH web site: <http://www.wash.org/evolution.htm>.







## WEB LOCATIONS VISITED IN THIS ISSUE

### NEWS

TOPIC	PBS Broadcasts <i>Evolution</i> Series
OWNER	Public Broadcasting System (PBS)
LOCATION	< <a href="http://www.pbs.org/evolution">http://www.pbs.org/evolution</a> >
LAST VISIT	January 31, 2002
TOPIC	<i>Evolution: The Creationist Backlash</i>
OWNER	Discovery Institute
LOCATION	< <a href="http://www.reviewevolution.org">http://www.reviewevolution.org</a> >
LAST VISIT	February 1, 2002
TOPIC	<i>Evolution: The Creationist Backlash</i>
OWNER	NCSE
LOCATION	< <a href="http://www.ncseweb.org/article.asp?category12">http://www.ncseweb.org/article.asp?category12</a> >
LAST VISIT	February 4, 2002
TOPIC	<i>Evolution: The Creationist Backlash</i>
OWNER	Answers in Genesis
LOCATION	< <a href="http://www.answersingenesis.org/docs2001/0924news.asp">http://www.answersingenesis.org/docs2001/0924news.asp</a> >
LAST VISIT	January 31, 2002
TOPIC	Anti-Darwinian Bulldog
OWNER	Answers in Genesis
LOCATION	< <a href="http://www.answersingenesis.org/pbs_nova/default.asp">http://www.answersingenesis.org/pbs_nova/default.asp</a> >
LAST VISIT	January 31, 2002

### NCSE NEWS

TOPIC	AIG Cries Wolf over Study Guide
OWNER	Answers in Genesis
LOCATION	< <a href="http://www.answersingenesis.org/docs2001/1106lead.asp">http://www.answersingenesis.org/docs2001/1106lead.asp</a> >
LAST VISIT	November 30, 2001
TOPIC	NCSE's Congregational Study Guide for <i>Evolution</i>
OWNER	NCSE
LOCATION	< <a href="http://www.ncseweb.org">http://www.ncseweb.org</a> >
LAST VISIT	November 30, 2001

### RESOURCES

TOPIC	New Web-Based "Design" Resource
OWNER	International Society for Complexity, Information, and Design
LOCATION	< <a href="http://www.iscid.org">http://www.iscid.org</a> >
LAST VISIT	December 2, 2001
TOPIC	New Evolution Website Launched
OWNER	Evolution, Science, and Society
LOCATION	< <a href="http://www.evolutionandsociety.org">http://www.evolutionandsociety.org</a> >
LAST VISIT	January 3, 2002
TOPIC	Washington-Area Grants Program Supports Teaching Evolution
OWNER	Washington Area Secular Humanists
LOCATION	< <a href="http://www.wash.org/evolution.htm">http://www.wash.org/evolution.htm</a> >
LAST VISIT	January 15, 2002

## INSTRUCTIONS FOR CONTRIBUTORS

*Reports of the National Center for Science Education (RNCSE)* welcomes contributions from its readers and from anyone interested in issues related to evolution as the foundation for the biological sciences, to the place of evolution in the science curriculum, or to the public perception of scientific method and practice. These contributions may be submitted in one of two forms.

*News, commentaries, and features* describe events or experiences that we wish to relate to our readers and members. These may include reports of school-board elections or local organizing by parent and teacher groups, political or governmental decisions and policies, first-person accounts of experiences with anti-evolutionist speakers, curricula, or organizations, other reports of information related to our primary concerns of promoting good science in education and public life, and, of course, humor related to creation/evolution issues.

*Articles* include book reviews, scholarly articles, and formal essays. These may explore specific arguments raised by anti-evolutionist scholars, relate new information that may be helpful in promoting evolution, or present original research related to the public understanding of evolution. We also welcome case reports and classroom action research that assess the outcome(s) of strategies for strengthening the understanding of evolution in educational practice.

All articles should be written for a general audience, and authors should provide definitions or descriptions for technical terms and concepts that might not be understood by a non-specialist. All article manuscripts are submitted to reviewers for comments on their technical content and suitability for a general audience. Acceptance for publication does not take into account the author's formal academic background or profession. We encourage query letters from any prospective author.

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3. A printed original and two copies should be supplied by the author(s). Names of the author(s) should appear only on the cover page if blind review is desired. Manuscripts submitted on computer diskette will greatly expedite the editing and publication process. Acceptable diskette formats include WordPerfect 5.1, MS-Word, Rich-Text (RTF), or ASCII formats in DOS/Windows or Macintosh versions. Manuscripts and other notes submitted by electronic mail should be in plain text format. Please contact the editorial office for information about other word processing and diskette formats that might be acceptable.

4. Citations within text referring to reference section should be limited to author, date and (when appropriate) page, for example (Smith 1982: 21). Multiple references within text appear in chronological order, for example, (Thomas, Peters, and others 1925; Smith 1943, 1947; Smith and Jones 1983a, 1983b, 1984). Citations of electronic resources should include author(s) and date accessed. References to internet locations should be enclosed in angle brackets, for example, <<http://www.ncseweb.org>>.

5. Reference sections are alphabetical and should conform to the citation-sequence format in *Scientific Style and Format: The CBE Manual for Authors, Editors, and Publishers*, 6th ed., illustrated in the following examples:

Kehoe AB. Modern anti-evolutionism: The scientific creationists. In: Godfrey LR, ed. *What Darwin Began*. Boston: Allyn and Bacon; 1985. p 165-85.

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

Smith FZ. Geocentrism re-examined. *Journal of Nice Things* 1985; 21 (3): 19-35.

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

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

Do not abbreviate names of publications. Include location of book publishers, and use the abbreviation "nd" for undated material. Multiple entries by the same author are listed in the bibliography in chronological order and those in same year are listed as: 1982a, 1982b, and so on.

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Andrew J Petto  
Division of Liberal Arts  
University of the Arts  
320 S Broad St, Philadelphia PA 19102-4994  
(215) 717-6276; FAX (215) 717-6620

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