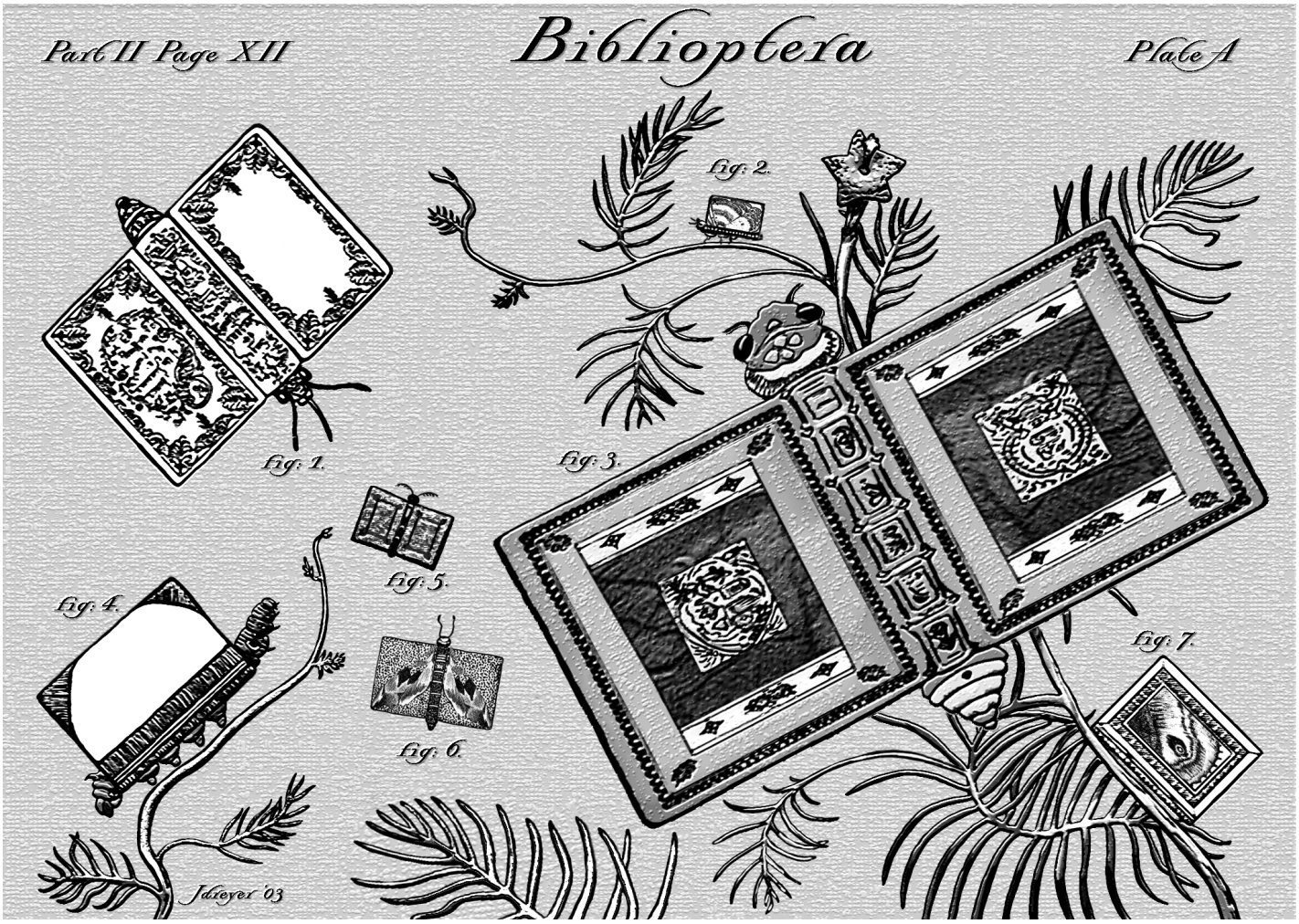
REPORTS OF THE NATIONAL CENTER FOR SCIENCE EDUCATION

DEFENDING THE TEACHING OF EVOLUTION IN THE PUBLIC SCHOOLS

Volume 23, Number 1 **JAN–FEB, 2003**

CONTINUES *NCSE REPORTS* & *CREATION/EVOLUTION*



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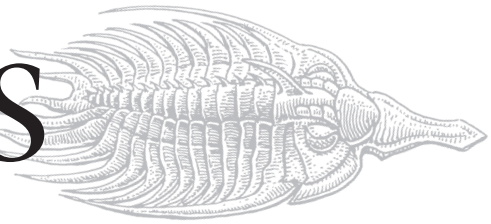

REPORTS OF THE
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For more information on Janet's work explore her web site at <www.genies.com>.

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

Welcome to Volume 23 of *Reports of the National Center for Science Education.* This means that *RNCSE* and its "ancestral" publications — *Creation/Evolution* and *NCSE Reports* — have been coming to you for 22 years! The good news is that we are receiving more and more news and contributions from members and friends all over North America (and even some in other places). The bad news is that there is still a great need to support evolution education practically everywhere. So, with renewed dedication and a strong sense of mission, we launch into our 23rd year of keeping you informed and up-to-date on anti-evolutionism from all over.

Executive Director Eugenie Scott recounts her first experiences with "creation science" and how it led to the professional journey that culminated in her taking the reins of a brand-new organization called the National Center for Science Education. Readers will recognized that many of the issues that motivated Scott to take up the challenges of opposing creationism are still with us today, although in somewhat different trappings.

IN THE NEWS

Despite some rumblings in the conservative press about the expropriation of Lincoln's Birthday, February 12, 2003, saw a wide variety of "Darwin Day" celebrations. (For what it is worth, the Lincoln's Birthday holiday was folded into a President's Day Monday holiday over 30 years ago.) We report briefly on several Darwin Day celebrations around the country. If we missed yours, please tell us about it.

Elsewhere in the news, the school board in Cobb County, Georgia, has clarified its "Theories of Origins" policy. The board pointed out that the policy acknowledges that the controversy over evolutionary theory is social, not scientific. Check out the Updates column to see where else evolution education is making progress — and where it is experiencing setbacks.

In this issue, we also confer the Friend of Darwin awards. Each year, NCSE recognizes individuals whose support of evolution, science education, and/or NCSE distinguishes them in their promotion of the ideals that embody the NCSE mission. As our report on the regular activities of NCSE members shows, it is quite an accomplishment to stand out in this crowd. It is in the community-based activities of our NCSE members that the real work of NCSE gets done — and you, our members, are a formidable bunch.

THE WRITTEN WORD

Members and friends are voracious readers and often willingly read and review books to help us (and you) to navigate through the sea of publications out there on science, evolution, education, and related topics. We devote most of this issue to catching up with the many reviews that we have received over the past year. We hope that you enjoy the scope and breadth of these reviews.

And, coming soon … two special thematic issues. One will focus on the current understanding of origin-of-life research and the contributions made to these studies by astrobiology. The other focuses on how the study of plant evolution can improve the learning and acceptance of evolution among students and the general public.

— Anj Petto

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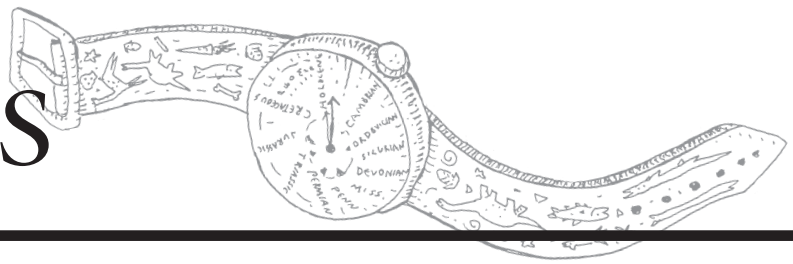
NEWS



Cobb County Clarifies: Teach Only Science in Science Classes

Skip Evans
NCSE Network Project Director

On January 8, 2003, the Cobb County, Georgia, School District issued guidelines that clarify the new "Theories of Origins" policy (*see* RNCSE *2002 Sep/Oct; 22 [5]: 11–2*). The guidelines are available on-line at <http://www.cobbk12.org/~boardpolicies/I_Policies/idbd_r.htm>.

Although the "Theories of Origins" policy — adopted by the Cobb County Board of Education on September 26, 2002 — explicitly stated that it is "not to be interpreted to restrict the teaching of evolution; [or] to promote or require the teaching of creationism", its treatment of evolution is not entirely satisfactory. Although it is certainly true, as the policy states, that evolution is a "subject [that] remains an intense area of interest, research, and discussion among scholars", no attempt is made to clarify that evolution, as the common descent of living things, is not a matter of dispute within the scientific community. The "interest, research, and discussion among scholars" is about controversies over how — not whether — evolution occurred. Thus the policy as worded is likely to encourage those wishing to promote "alternatives" to evolution.

The new guidelines largely rectify the problem by clarifying the nature of the controversy over evolution: "It is recognized that instruction regarding theories of origin is difficult because it is *socially* controversial and potentially divisive" (emphasis added). There is no mention in the guidelines of any supposed scientific controversy over evolution or of any supposed scientific "alternatives" to it. Curt Johnston, the chairman of the Cobb County Board of Education, told the Atlanta *Journal-Constitution* (2003 Jan 9) that "Encouraging discussion of that might be illegal", evidently alluding to faith-based views such as "intelligent design".

Reviewing the guidelines, Eugenie C Scott, the executive director of the National Center for Science Education, commented, "When the 'Theories of Origins' policy was adopted, I said that the Cobb County Board of Education was sending mixed signals to teachers and citizens. With these guidelines, the board's message is loud and clear: teach only science in science classes. This is good news for the education of the children of Cobb County."

The clarification of the "Theories of Origins" policy also won approval from the American Civil Liberties Union. Michael Manely told the Marietta *Daily Journal* (2003 Jan 9) that, in light of the guidelines, the ACLU has decided not to file suit over the "Theories of Origins" policy. "It certainly seems that the board is telling the teachers to back down on the teaching of creationism, 'intelligent design' or other faith-based theories", he said. In August 2002, the ACLU filed suit over the textbook disclaimer mandated by the Cobb County Board of Education that refers to evolution as "a theory, not a fact" (*see* RNCSE *2002 Sep/Oct; 22 [5]: 9–11*).

Prominently mentioned in the *Daily Journal*'s article was the recently formed Georgia Citizens for Integrity in Science Education <www.georgiascience.org>, a grassroots organization dedicated to promoting scientific literacy and excellence in science education in Georgia's public schools. "The members of GCISE have worked hard to ensure that evolution is taught in the Cobb County public schools as the unifying, important, and vital science that it is", said NCSE's Scott. "Everyone who cares about a quality science education for the students of Georgia's public schools is indebted to them."

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Darwin Day Around the Nation: A Sampler

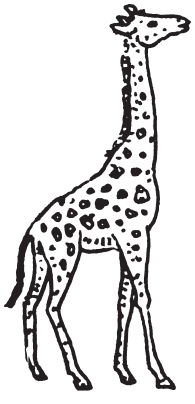
Supporters of science education around the country have been part of a groundswell to use Charles Darwin's birthday, February 12, as a day for demonstrating public support for evolution and evolution education. From organizers and friends around the country, here is a sampling of the events that occurred on Darwin Day.

CALIFORNIA

On February 12, NCSE Postdoctoral Scholar Alan Gishlick gave a talk entitled "Tapestry of life: How Darwin changed the way we view the natural world" to Students for a Non-Religious Ethos, a student group at the University of California, Berkeley. On February 16, the Bay Area Communities of Reason and NCSE held a Darwin Day fair at the Rockridge branch of the Oakland Public Library.

GEORGIA

The Atlanta Freethought Society held a Darwin Day event including a demonstration and celebration in



Marietta Square on February 12. Marietta is in Cobb County. For more details, see <http://www.atlantafreethought.org/>.

Illinois

REALL (Rational Examination Association of Lincoln Land) celebrated its 10th anniversary with a Darwin Day celebration on February 11, in Springfield. The program included free food, fun, and even some primordial soup! For more details, see <www.reall.org>.

Robert T Pennock gave a keynote address, "The evolutionary design of organs of extreme perfection", for the Darwin Day Celebration at Augustana College in Rock Island.

Iowa

On February 12, 2003, Iowa Governor Tom Vilsack quietly signed a proclamation officially recognizing that day as Darwin Day. The proclamation cited the dependence of Iowa's economy on agriculture and the biological sciences that support it, pointed out that modern biological sciences trace the foundations of their work to Darwin's theory, and recognized that evolution today continues to be the cornerstone of biological sciences and related fields — in particular, medicine, agriculture, paleontology, and conservation.

A list of Darwin Day events sponsored by the Iowa Community Science Initiative can be found at <http://www.iowacsi.com/modules.php?name=News&new_topic=5>.

Kentucky

The Kentucky Paleontological Society (KPS) held its Darwin Day celebration on April 9, 2003. The program featured a lecture by Chris Brochu of Iowa State University, who recently authored a monograph on the osteology of the *Tyrannosaurus rex* specimen known as "Sue". For details, see <http://www.uky.edu/ OtherOrgs/KPS>.

Louisiana

The New Orleans Secular Humanist Association celebrated Darwin Day on February 15 with a keynote address by Michael Ruse at the University of New Orleans. For more details, see <http://nosha.secularhumanism.net/calendar.html>.

New Mexico

New Mexicans for Science & Reason (NMSR) celebrated Darwin Day with a special presentation at the New Mexico Museum of Natural History: "Would my career be different if Darwin had never lived?" The program featured Spencer Lucas of the New Mexico Museum of Natural History and Science, and Cosette Wheeler of the Molecular Genetics and Microbiology division of the University of New Mexico's Health Sciences Center. Dave Thomas introduced the meeting with a reading of the last paragraph from the *Origin of Species*. Amanda Chesworth, International Darwin Day Coordinator, was on hand to pass out bumper stickers and postcards commemorating Darwin Day. She also brought 15 copies of the Darwin Day commemorative book (see box above).

Ohio

Free Inquirers of Northeastern Ohio commemorated Darwin Day with a lecture by Patricia Princehouse. Her lecture, "Darwin and his legacy", was presented at the Independence, Ohio, Public Library. For more details, see <http://www.freeinquirers.org>.

The Department of Biological Sciences at Ohio University in Athens held a Darwin's birthday party and social. Prizes were awarded for the best tasting dessert and best thematic dessert.

South Carolina

The College of Charleston sponsored a "Darwin Week" celebration from February 10 through 13. The week featured talks by paleoanthropologist Milton Wolpoff, biologist Tim Mousseau, geologist Paul Fullagar, and political scientist David Mann. The week culminated with a viewing of the 1960 film *Inherit the Wind* followed by commentary and discussion. For more details, see <http://www.cofc.edu/%7Edillonr/DarwinWeekIII.html>.

Wisconsin

The University of Wisconsin–Whitewater College of Letters and Sciences and the Tri-Beta Biological Honor Society presented a lecture by Margo Wilson, entitled "Marital conflict and violence: An evolutionary perspective". At a reception before the lecture, students brought desserts shaped as their favorite plants or animals. Participants included students and faculty from high schools and colleges as far as 50 miles away. For more details, see <http://www.uww.edu/NPA/news_releases/2003/01/27_ darwin_day.shtml>.

Australia

A report of events associated with Darwin Day celebrations in Australia can be found at <http://home.austarnet.com.au/stear/darwin_birthday.htm>.

Worldwide

Check the list of other worldwide events at the Darwin Day Program web site, <http://wwwdarwinday.org/>.

Darwin Day Collection, Volume 1

The Darwin Day Program has announced the publication of *The Single Best Idea, Ever*, an anthology of works in honor of the life, work, and influence of Charles Darwin. To view the table of contents and a list of contributors, or to order a copy of the book, connect to <http://www.darwinday.org/tbp/collection-one.html>.

"Father" of Bigfoot Dies

Ray L Wallace, the man credited with — or accused of — igniting the "Bigfoot" legend died late last year. In December 2003, his family admitted that Wallace had asked a friend to carve giant wooden feet that he and his brother used to fabricate Bigfoot tracks. The Associated Press quoted Wallace's son Michael: "The reality is, Bigfoot just died." Wallace was 84 at the time of his death. Most observers expect Bigfoot "sightings" to continue despite this admission.

[*Thanks to NCSE board member R Mac West for alerting us to this story.*]

UPDATES

Georgia: On January 26, 2003, the *Atlanta Journal-Constitution* published the results of its December 2002 "Voice of Atlanta" survey. The question asked was: "Do you agree or disagree:The theory of evolution should be taught in public schools to the exclusion of all other theories, such as creationism or 'intelligent design'." The respondents are Atlanta-area residents who volunteer to answer questionnaires on the internet; the results of such a survey cannot be regarded as scientifically accurate or generally representative. Of the 1147 respondents, 41% agreed and 57% disagreed. Blacks, women, and regular churchgoers were more likely to disagree (69%, 61%, and 77%, respectively) as opposed to whites, men, and those who attend church sometimes or never (55%, 54%, 54%, and 31%, respectively). The *Journal-Constitution* also reported that "respondents identifying themselves as Democrats were much more likely than Republicans to support the teaching of evolution exclusively" but provided no percentages.

Mississippi: House Bill 1397, sponsored by Representative Carmel Wells-Smith, was introduced in the Mississippi House of Representatives and referred to the Education Committee on January 20, 2003. HB 1397 would have required the inclusion of a version of the Alabama disclaimer in every textbook that discusses evolution:

> The word "theory" has many meanings: systematically organized knowledge, abstract reasoning, a speculative idea or plan, or a systematic statement of principles. Scientific theories are based on both observations of the natural world and assumptions about the natural world. They are always subject to change in view of new and confirmed observations.
>
> This textbook discusses evolution, a controversial theory some scientists present as a scientific explanation for the origin of living things. No one was present when life first appeared on earth.Therefore, any statement about life's origins should be considered a theory.
>
> Evolution refers to the unproven belief that random, undirected forces produced living things.There are many unanswered questions about the origin of life that are not mentioned in your textbook, including: the major groups of animals suddenly appear in the fossil record (known as the Cambrian Explosion), no new major groups of other living things appeared in the fossil record, major groups of plants and animals have no transitional forms in the fossil record, and all living things possess a complete and complex set of instructions for building a living body. Study hard and keep an open mind.

On February 4, the bill died in committee. For the status and text of HB 1397, see <http://billstatus.ls.state.ms.us/2003/html/history/HB/HB1397.htm#history>. Wells-Smith introduced two anti-evolution bills in the 2002 legislative session; both died in committee (*see* RNCSE *2002 May/Jun; 22 [3]: 8–11*).

Oklahoma: On February 3, 2003, House Bill 1504, sponsored by Representative Bill Graves, was introduced in the Oklahoma legislature. Like Mississippi's HB 1397 (see above), Oklahoma's HB 1504 would require the inclusion of a version of the "Alabama" disclaimer in every textbook that discusses evolution.The full text of the bill is available on-line at <http://www.lsb.state.ok.us/2003-04HB/HB1504_int.rtf>. In 1999, the Oklahoma State Textbook Committee voted to require such a disclaimer (*see* RNCSE *1999 Sep/Oct; 19 [5]: 7–8*). After the state's attorney general ruled that the committee had no authority to impose such a requirement, there were several legislative attempts to grant the committee the necessary authority (*see* RNCSE *1999 Nov/Dec; 19 [6]: 11–2 and 2000 Jan–Apr; 20 [1–2]: 20–1*); none succeeded. Kenneth R Miller criticized the proposed Oklahoma disclaimer in "Dissecting the disclaimer" (*RNCSE* 2000 May/Jun; 20 [3]: 30–3).

South Carolina: On December 11, 2002, the South Carolina Board of Education voted 10–5 to approve a number of new biology textbooks for local adoption across the state next fall. Several board members had objected to the way evolution was presented in some of the books, but a motion to remove two biology textbooks from the list failed by a 9–6 vote. Some board members were quoted in a December 22 news story in the *Charleston Post & Courier* as opposing one book because its preface referred to "creation science" and "intelligent design" as "pseudoscience". Local school districts are free to use any books they want, but the state will only pay for those on its approved list. Local school districts will be deciding in the spring of 2003 which books to use.

Tennessee, Knoxville: According to a news article in *Nature* (2002 Dec 12; 420: 597), Robert Gentry sued the operators of the arXiv preprint server — a forum for advance publication of papers in physics, mathematics, non-linear science, and computer science — for refusing a series of 10 of his papers (collectively entitled "Flaws in the Big Bang point to GENESIS:A new millennium model of the cosmos"). Gentry, a Seventh-Day Adventist young-earth creationist known for his work on polonium halos as expounded in his *Creation's Tiny Mystery* (Knoxville [TN]: Earth Science Associates, 1992 [third edition]), complained that the papers were refused by arXiv (currently owned and operated by Cornell University) because of their religious content. Cornell's counsel denies the charge, saying that the rejection was based on Gentry's lack of academic affiliation: "[t]he religious views of the plaintiff are completely irrelevant." NCSE member Adrian Melott, Professor of Physics and Astronomy at the

University of Kansas and cofounder of Kansas Citizens for Science, was quoted in the *Nature* article as saying that "he's noticed a rise in 'flaky' publications" on arXiv.The papers in question and a collection of documents relevant to the case are posted at the web site of the Orion Foundation, <http://www.orionfdn.org/>, with which Gentry is affiliated.

Virginia, Purcellsville: On January 10, 2003, the young-earth creationist ministry Answers in Genesis announced that Patrick Henry College joined its list of "creation colleges" (<http://www.answersingenesis.org/docs2003/0110ph.asp>; the list itself is at <http://www.answersingenesis.org/Home/Area/Tools/colleges.asp>). Such colleges assent to AIG's Statement of Faith and agree to teach in accordance with it (<http://www.answersingenesis.org/Home/Area/About/faith.asp>); the two most famous colleges on the list are Liberty University in Lynchburg, Virginia, and Bob Jones University in Greenville, South Carolina (BJU, however, is unwilling to subscribe to AIG's view of "the gap theory"). Patrick Henry College was in the news in 2002 because it was refused accreditation by the American Academy for Liberal Education, a private accreditation agency, due to its requirement that faculty sign its Statement of Biblical Worldview (*see* RNCSE *2002 May/Jun; 22 [3]: 8*); after the college revised the offending portion of the statement, it was granted pre-accreditation status (*see* RNCSE *2002 Nov/Dec; 22 [6]: 10–1*). AIG added, "In the past, Michael Farris [the founder of Patrick Henry College] has strongly supported AiG's effort to proclaim the message of biblical authority."

Washington DC: Sitting in the First Lady's Box during the State of the Union Address, delivered by President Bush on January 28, 2003, was Tonja Myles, who runs a faith-based program in Baton Rouge, Louisiana, that seeks to help people to overcome drug addiction; her program was approvingly cited during the address. The Associated Press reports that in 2001, Myles "testified before a legislative committee in support of a resolution branding Charles Darwin's theory of evolution as racist. She said she hoped the Legislature would make Louisiana the first state in the nation 'that asks people to discuss this theory'" (the Baton Rouge *Advocate* 2003 Jan 29). For a report on the Louisiana resolution, see *RNCSE* 2000 Sep/Oct; 20 [5]: 9–10.

Wisconsin: According to a story in the *Milwaukee Journal-Sentinel* (2003 Jan 26), the Badger Poll, conducted by the University of Wisconsin Survey Center, reveals that half of the 514 respondents surveyed in January 2003 would support a law requiring the teaching of "the biblical theory of creation as an alternative to the theory of evolution" (50% said yes, 43% said no, 6% expressed no opinion; the margin of error was plus or minus 4%). The *Journal-Sentinel* added, "The poll did not explore more controversial details of how much emphasis or credibility to give creationism."The respondents also favored requiring school time for voluntary prayer (58% in favor, 38% opposed) and allowing teachers to post the Ten Commandments (56% in favor, 41% opposed), but not allowing teachers to post a picture of Jesus and the Virgin Mary (40% in favor, 58% opposed).

NCSE NEWS

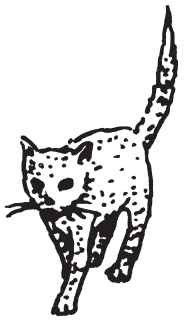
NCSE Honors "Friends of Darwin"

Eugenie C Scott
NCSE Executive Director

Recent NCSE "Friend of Darwin" awards went to a distinguished group of individuals "for support of evolution and science education, and for service to NCSE".

Philip Appleman, Emeritus Professor of English at Indiana University, is perhaps best known to NCSE members for his marvelous *Darwin* anthology, now in its third edition.This definitive collection of articles by and about Darwin and his contemporaries has been brought up to date with the addition of a section on the newest form of anti-evolutionism, "intelligent design". Appleman is also the author of a number of books of poetry, often on evolutionary themes, including *Darwin's Ark*. A long-time member of NCSE, Phil has been a staunch supporter of and contributor to NCSE's mission of improving the public understanding of evolutionary sciences.

Local activist **Ken Atkins** is a founder of the Burlington–Edison Committee for Science Education (BECSE), a regional Washington state group that took a pro-science position during the lengthy controversy in Burlington–Edison over teacher Roger DeHart's attempts to introduce "intelligent design" (ID) and other forms of anti-evolutionism into his biology course. In response, BECSE helped the school district to understand that this was bad science education for the students. By cultivating good relationships with school district officials — balanced with appropriate pressure when needed — BECSE ultimately succeeded in convincing the district to deny DeHart's use of ID materials. DeHart ultimately left the district and is now teaching in a Christian school. Ken is a great example of a local citizen caring enough to devote a great deal of time and effort to an important cause — and getting results.

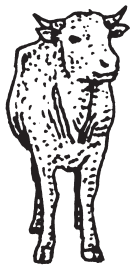


Lawyer **Marjorie Esman** is an active member of NCSE's Legal Advisory Committee. Representing the American Civil Liberties Union, Marjorie argued the case against the Tangipahoa Parish, Louisiana, School District in the US District

Court case *Freiler v Tangipahoa*. This case involved the constitutionality of a policy that directed teachers to read an oral disclaimer to students before engaging in any instruction in evolution. Marjorie argued that the facts and history of the district's decision to impose this regulation clearly indicated that the purpose of the disclaimer was to advance a sectarian religious view. Both the District and Appeals Courts agreed, and the Tangipahoa disclaimer was struck down.

Broome Community College, New York, biology professor **Richard Firenze** has worked hard for many years to improve the teaching of evolution at both the college and high school level. A strong proponent of inquiry and conceptual learning, Firenze has promoted and modeled the use of evolution as a unifying theme in biology courses, and worked hard to communicate these ideas to both his university colleagues and to regional high school teachers. Richard's career has been a clear testimonial to Dobzhansky's dictum that "nothing in biology makes sense except in the light of evolution".

By all rights, programmer **Ira Walters** should be the best-known non-staff NCSE member, since he is the designer and maintainer of NCSE's well-used and highly useable web page! Ira joined NCSE as a teenager — I won't say how many years ago, but it was during the Committees of Correspondence era! He has thus maintained a keen interest in the creationism/evolution controversy for decades. In the mid-1990s, as a professional programmer, Ira volunteered to redesign our web page. We receive countless e-mails from users of our web page, praising its ease of use and navigation, and we have Ira to thank for this vital tool that helps NCSE to get our information out to thousands of people every month.



We thank these and all NCSE members for their support of our organization and our mission. We cannot — and do not — do it alone!

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News from the Membership

Glenn Branch
NCSE Deputy Director

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

NCSE Supporter **Francisco Ayala**, Donald Brin Professor of Biological Sciences at the University of California, Irvine, was interviewed in the *Orange County Register* (2002 Dec 17; available on-line at <http://www2.ocregister.com/ocrweb/ocr/article.do?id=16327&section=NEWS&year=2002&month=12&day=17>) about genetic engineering, cloning, and science education. Asked about students who reject evolution, he replied, "My concern is not so much about science, it is about religion. What very often happens with our freshmen students is that they will come to see me after class and say: 'You know, Professor Ayala, I will put in my exam whatever you expect me [to] put but cannot believe in evolution because my religion contradicts it.' ... I try to persuade the students that there is not a contradiction between science and religion. There is contradiction between certain beliefs which literally negate some conclusions from science. But most of the mainstream religions are not opposed to evolution." And asked whether there is any evidence for "intelligent design", Ayala explained, "Every little bit of evidence that we have says it is not", and added that in his view the theological assumptions behind "intelligent design" amount to blasphemy.

NCSE Deputy Director **Glenn Branch**'s article "In defense of methodological naturalism: Response to Schick" was published in *Philo* (2002 Fall–Winter; 5 [2]: 249–55). Branch was responding to Theodore Schick Jr, who argued (in his "Methodological naturalism vs methodological realism", *Philo* 2000 Fall–Winter; 3 [2]: 30–7) that Eugenie C Scott's acceptance of methodological naturalism was misguided. In the same issue of *Philo* was **Theodore M Drange**'s "McHugh's expectations dashed" (242–8), a response to Christopher McHugh's criticism (in *Philo* 2002 Spring–Summer; 5 [1]: 94–102) of his *Nonbelief & Evil* (Amherst [NY]: Prometheus Books, 1998). Other articles relevant to the creationism/evolution controversy in the same issue of *Philo* are Graham Oppy's "Paley's argument for design" (161–73) and Matthew Tedesco's "Theism, naturalistic evolution and the probability of reliable cognitive faculties: A response to Plantinga" (235–41).

Daryl Domning's review-essay "Evolutionary theology comes of age", which originally appeared in *RNCSE* 2001 May–Aug; 21 (3–4): 34–7, was republished at the science–religion web site *Meta* (2003 Jan 24). Domning is Professor of Anatomy at Howard University School of Medicine; his most recent contribution to *RNCSE* was his review of Patricia A Williams's *Doing without Adam and Eve: Sociobiology and Original Sin* (*RNCSE* 2002 Jul/Aug; 22 [4]: 31–2).

Taner Edis's article "An accidental world" — based on his recent book *The Ghost in the Universe: God in Light of Modern Science* (Amherst [NY]: Prometheus, 2002) — appeared in *Free Inquiry* (2002 Fall; 22 [4]: 57–8). In his article, Edis recommends that "since we ... seem predisposed to see cause and pattern where there are none, we should look a little closer at the notion of randomness before jumping to conclusions", proceeding to explain the role of randomness in modern physics. Edis is Assistant Professor of Physics at Truman State University and *RNCSE*'s associate editor for physics and astronomy.

Writing to *Skeptical Inquirer* to comment on its report (2002 Sep–Oct; 26 [5]: 5–12) on the evolution and "intelligent design" panel at the Fourth World Skeptics Conference, **John G Fletcher** seconded Paul Nelson's suggestion that methodological naturalism not be taken as definitive of science. But, he added, natural explanations are preferable to "all known alternatives, including 'intelligent design' and other 'supernaturalisms'" because they better satisfy metaphysically neutral criteria such as testability, parsimony, and fruitfulness" (*SI* 2003 Jan–Feb; 27 [1]: 67). Two other letters also commented on the report. In the same issue, NCSE board member **John R Cole** added a footnote to Massimo Polidoro's article "Ica stones: Yabba-dabba-doo!" (*SI* 2002 Sep–Oct; 26 [5]: 24–5): "These alleged antiquities were first made

famous by Eric[h] von Däniken — and definitively refuted as evidence for 'ancient astronauts' or anything other than fraud" in the 1978 PBS/Nova show *The Case of the Ancient Astronauts* (*SI* 2003 Jan–Feb; 27 [1]: 69).

Gregory Forbes is the course director for the NSF Chautauqua course "Evolution education: A delicate balance between science, controversy and pedagogy", held from April 30 to May 2, 2003, in Dayton, Ohio. From the course description: "This course will introduce educators to the sociopolitical basis for the continuation of this debate as well as to provide an overview of contemporary evolutionary theory and pedagogical approaches to teaching this very important body of science. ... Upon completion of this course, participants will have a strong understanding of the background of this continuing debate as well as a strong working knowledge of the foundations of contemporary evolutionary theory along with the ability to respond to questions from students, the administration and the community regarding evolution theory and the necessity of its inclusion in a comprehensive science education" (<http://www.engr.pitt.edu/chautauqua/coursedescriptions2003.htm>). Forbes is Director of the Science Education Center at Grand Rapids College and cofounder of the Michigan Scientific Evolution Education Initiative, a federally-funded initiative to provide science educators with the content, pedagogy, and support system to enable them to teach evolution effectively.

NCSE Supporter **Douglas J Futuyma** spoke on "Why we should teach evolution" at the Pittsburgh EcoForum's Eminent Biologist Lecture Series on January 8, 2003. According to *The Pitt News* (2003 Jan 10), he explained the relevance of common ancestry to genetics, arguing "if not for common ancestry, scientists could not expect studies of other organisms to tell them anything about human characteristics." Noting the phenomenon of antibiotic-resistant bacteria, he also argued that "[k]nowledge of evolutionary genetics is going to be enormously important" not only to medical and scientific researchers but also to the general population. Futuyma is Professor and Chair of the Department of Ecology and Evolutionary Biology at the University of Michigan.

Paul Heinrich's article "Buried forests could provide clues to past" appeared in *Louisiana Geological Survey News* (2002 Dec; 12 [2]: 1). In it, Heinrich reports on "an ignored and unstudied aspect of Louisiana geology ... fossil forests buried deep within the surface of the Mississippi Valley and Delta Plain of Louisiana", suggesting that "detailed study of these features while they are exposed could provide significant information about Louisiana geology." Heinrich, a life member of NCSE, is a research associate of the Louisiana Geological Survey.

William F McComas's article "The ideal environmental science curriculum: I. History, rationales, misconceptions & standards" appeared in *The American Biology Teacher* (2002 Nov/Dec; 64 [9]: 665–72); as the subtitle indicates, it is the first part of a two-part article addressing the question "just what should the ideal ecology curriculum contain?" McComas is the founding director of the Center to Advance Science Education in the Rossier School of Education at the University of Southern California.

Jeffrey K McKee wrote to the Mansfield, Ohio, *News-Journal* (2002 Dec 13) to counter a creationist's assertion that evolution and belief in God are irreconcilable: "Nothing could be further from the truth." He also challenged the claim that scientists increasingly accept "intelligent design", suggesting that "[i]t is more accurate to say that creationist 'scientists' who believe in 'intelligent design' are becoming increasingly vocal in the public arena." And he mentioned the practical and forward-looking applications of evolutionary theory, citing the advent of Darwinian medicine in particular. McKee is a board member of Ohio Citizens for Science, Professor of Anthropology at the Ohio State University, and the author of *The Riddled Chain* (New Brunswick [NJ]: Rutgers University Press, 2000).

NCSE President **Kevin Padian** and Postdoctoral Scholar **Alan Gishlick** were both extensively quoted in a report in *The New York Times* (2003 Jan 17) on Kenneth P Dial's recent paper ("Wing-assisted incline running and the evolution of flight", *Science* 2003 Jan 17; 299 [5605]: 402–4) on the evolution of avian flight. Gishlick was quoted as saying that Dial's research "for the first time gives us a modern analogy for terrestrial origin of flight." The NCSE connection was not lost on Jonathan Sarfati of Answers in Genesis, who, in a report on the AIG web site about Dial's paper, commented on Padian's and Gishlick's association with what he called "the pretentiously named Humanist-founded-and-operated National Center for Science Education" (<http://www.answersingenesis.org/docs2003/ 0127birdflap.asp>).

Intelligent Design Creationism and its Critics (Cambridge [MA]: MIT Press, 2001), edited by **Robert T Pennock**, received a favorable review from Ernan McMullin, John Cardinal O'Hara Professor (emeritus) of Philosophy at Notre Dame, writing in *Endeavour* (2002; 26 [3]: 118–9). According to McMullin, "Robert Pennock's compendious (800 page) anthology does ample justice to the often acrimonious debate that has ensued over the last decade. He has aimed at completeness of coverage of a controversy that has, at times at least, reached a level of complexity and hence of philosophical interest that was quite absent in earlier stages of the 20th century debate. ... Pennock's book defines, as no other so far has, the present state of play."

Dan Wivagg, Professor of Biology at Baylor University, and Douglas Allchin contributed a guest editorial to *The American Biology Teacher* (2002 Nov/Dec; 64 [9]: 645–6) on "The dogma of 'the' scientific method". Objecting to the idea that scientific method reduces to a unique simple infallible algorithm, they recommended conceiving of science as relying on a suite of methods, including "model-building, analogy, pattern-recognition, induction, blind search and selection, raw data harvesting, computer simulation, experimental tinkering, chance and (yes) play, among others", and cited the different approaches taken by Watson and Crick, Mendel, Morgan, and Darwin. Wivagg and Allchin concluded, "Viewing science as constrained by one privileged method is greatly impoverished. We do science in many ways. Let's teach the Scientists' Toolbox."

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My Favorite Pseudoscience

Eugenie C Scott
NCSE Executive Director

Paul Kurtz's letter inviting me to write this article suggested that I describe "my own personal involvement" in the skeptical movement. My introduction to skepticism was a fascination with a particular pseudoscience, "creation science". From the day I first heard this phrase, I was hooked.

In 1971, I was a graduate student in physical anthropology at the University of Missouri. One day, my professor, Jim Gavan, handed me a stack of small, brightly colored, slick paper pamphlets from the Institute for Creation Research. "Here", he said, "Take a look at these. It's called 'creation science.'"

Wow. Here I was studying to be a scientist, and here were people calling themselves scientists, but we sure were not seeing the world the same way. They were looking at the same data: the same fossils, the same stratigraphy, the same biological principles, and so on. But from these data, creationists were concluding that all living things had appeared in their present form, at one time, a few thousand years ago. I was concluding that living things had branched off from common ancestors over scarcely imaginable stretches of time. They were concluding that the entire planet had been covered by water, and that all the present-day geological features of earth had been determined by this flood and its aftermath. I could not see any evidence for this at all, and much evidence against it. Why were we coming up with such different conclusions? The data were not all that different, but the philosophy of science and the approach to problem solving sure were.

I began collecting "creation science" literature as an academic enterprise: an interesting problem in the philosophy of science and critical thinking. Due to the pressures of graduate school and my first teaching job, I was not able to pursue it especially deeply, but students would occasionally bring up the topic. I would tell them that even if proponents of "creation science" claimed they were doing science, one cannot claim that one is doing science if one is doing something very different from what scientists are doing. "Creation science" was a good foil to use in teaching students about the nature of science.

Philosophers of science can — and do — argue incessantly over the definition of science. I do not know how many academic papers have been written attempting to solve the "demarcation problem": what qualifies as science and what does not. Some partisans even go so far as to claim that science is impossible to define. I confess to having little tolerance for such "how many angels can dance on the head of a pin" type discussions. In my present job as executive director of the National Center for Science Education, I regularly encounter the public's misunderstanding of the most basic elements of science. I deal with people who nod in agreement with a typical creationist statement that "neither evolution nor creationism is scientific because no one was there to observe it". I deal with people who agree with creation scientists stating that "evolution is not scientific because evolutionists are always changing their minds". A very popular view is that we should "give the kids all the options" in a science classroom, and teach them both data demonstrating that evolution took place and "the evidence" for the "alternate theory" that God created everything at one time in its present form — two mutually exclusive views.

Against such a background, the philosopher's discussion of the nuances of the demarcation problem become an intellectual luxury far removed from what people need to hear. Doubtless to the frustration of my colleagues in the philosophy of science, my job requires me to simplify — probably far beyond what they consider acceptable. But in doing so, I can make a little progress in helping the public to understand why science works, and also why "creation science" is not science. Maybe down the road the nonscientists I encounter can tackle falsificationism and the demarcation problem; right now, I would be happy if they understood two basic rules of science that I believe the majority of scientists would agree upon — however much they might disagree on others. And — more importantly for this discussion — "creation science" can be rejected as science based even on this simplest of understandings of what science is.

The nature of science

There are two basic principles of science that creationism violates. First, science is an attempt to explain the natural world in terms of *natural* processes, not supernatural ones. This principle is sometimes referred to as *methodological naturalism*. In time, a consensus of how some aspect of nature works or came about is

arrived at through testing alternate explanations against the natural world. Through this process, the potential exists to arrive at a truly objective understanding of how the world works.

Please allow a digression here. I am not presenting a cut-and-dried formula — "the scientific method" — as if the process of science were a lockstep algorithm. It is much untidier than that. Of course science reflects the time and culture in which it is found. Of course scientists, being human, have biases and make mistakes. Yet the growth of knowledge in a field is not the result of individual achievement, but rather is a function of a number of minds working on the same and different problems over time. It is a collective process, rather than the result of actions of a solitary genius. Individual scientists may be biased, closed-minded, and wrong, but science as a whole lurches forward in spite of it all thanks to its built-in checks.

An important check is that explanations must be tested against the natural world. Thus there is an external standard against which a scientist's views are measured, regardless of his biases or the biases of his opponents. Unpopular ideas may take longer to be accepted, and popular ideas may take longer to be rejected, but the bottom line determining acceptance or rejection is whether the ideas work to describe, predict, or explain the natural world. The Soviet geneticist Lysenko foisted a "Lamarckian" (inheritance of acquired characteristics) theory of heredity upon the Soviet scientific establishment because Lamarckian genetics was more politically compatible with Marxism than Mendelian genetics. His politically biased science set Soviet genetics back a full generation, but today Russians employ Mendelian genetics. Wheat raised in refrigerators does not grow any better in Siberia than regular wheat, and after a series of 5-year plans gone bust, eventually the Soviet government figured out that Lysenko had to go. "Mendelism" works; "Lysenkoism" does not.

Science is nothing if not practical. The explanations that are retained are those that work best, and the explanations that work best are ones based on material causes. Nonmaterial causes are disallowed.

The second minimal principle of science is that explanations (which is what theories are) are tentative, and may change with new data or new theory. Now, do not misunderstand me: I am not claiming that all scientific explanations *always* change, because in fact some do not. Nonetheless, scientists must be willing to revise explanations in light of new data or new theory. The core ideas of science tend not to change very much — they might get tinkered with around the edges — whereas the frontier ideas of science may change a lot before we feel we understand them well.

Here then are two critical strictures on modern science: science must explain using *natural* causes, and scientists must be willing to change their explanations when they are refuted. Viewed in the light of these two basic tenets of science, "creation science" fails miserably.

Explaining through natural cause

When a creationist says, "God did it", we can confidently say that he is not doing science. Scientists do not allow explanations that include supernatural or mystical powers for a very important reason. To explain something scientifically requires that we test explanations against the natural world. A common denominator for testing a scientific idea is to hold constant ("control") at least some of the variables influencing what you are trying to explain. Testing can take many forms, and although the most familiar test is the direct experiment, there exist many research designs involving indirect experimentation, or natural or statistical control of variables.

Science's concern for testing and control rules out supernatural causation. Supporters of the "God did it" argument hold that God is omnipotent. If there are omnipotent forces in the universe, by definition, it is impossible to hold their influences constant; one cannot "control" such powers. Lacking the possibility of control of supernatural forces, scientists forgo them in explanation. Only natural explanations are used. No one yet has invented a *theometer*, so we will just have to muddle along with material explanations.

Another reason for restricting ourselves to natural explanations is practical. It works. We have gone a long way towards building more complete and, we think better, explanations through methodological naturalism, and most of us feel that if it ain't broke, don't fix it. Also, being able to say, "God (directly) did it" is a "science stopper", in the words of philosopher Alvin Plantinga (2001). To say "God did it" means one does not need to look further for a natural explanation. For example, creationist literature abounds with criticisms of origin-of-life research. Because scientists have not yet reached a consensus on how the first replicating molecule came about, creationists argue, this is an intractable problem that should just be attributed to "God did it". Well, if we stop looking for a natural explanation for the origin of life, surely we will never find it. So even if we have not found it yet, we must nonetheless slog on.

"Creation science", for all its surface attempts (especially in its presentation to the general public) to claim to abide by a strictly scientific approach, relying solely on empirical data and theory, eventually falls back to violating this cardinal rule of methodological naturalism. Sometimes one has to go a bit deep in an argument, but eventually, as in the well-known Sidney Harris cartoon, "then a miracle occurs".

For example, to a creation scientist holding to Flood Geology, Noah's Flood was an actual historical event, and representatives of all land animals plus Noah, his wife, their sons, and their sons' wives were on a large boat. Q: *All* land animals? A: Sure. The Ark is the size of the *Queen Mary*. Q: But there are thousands of species of beetles alone! How could *all* land animals be on the Ark? A: Oh, Noah did not take two of every *species*. He took pairs of each *kind*, and kinds are higher taxonomic levels than species. Q: But how could only 8 people take care of a *Queen Mary*-sized boat full of animals? How

could they feed, water, and clean out the stalls? A: They did not have that much work, because the rocking movement of the boat caused most of the animals to estivate, or go dormant, obviating the need for feeding, watering, and stall-cleaning. Q: But the Ark floated around for almost a year before landing! Small mammals, such as mice and shrews, have a high surface–area: body–mass ratio, and have to eat almost their weight in food each day just to keep their metabolism up. These animals could not have survived estivation. A: Well, then, a miracle occurred.

Push a creationist argument far enough, and sure enough, it will become necessary to resort to a miracle. But miracle-mongering cannot be part of science.

In addition to the familiar "creation science" that got me interested in this particular pseudoscience, in the last ten years or so a newer form of anti-evolutionism has made its appearance: "Intelligent Design" (ID) creationism. ID harks back to the 1802 position of clergyman William Paley that structural complexity (such as the vertebrate eye for Paley or the structure of DNA for his latter-day bedfellows) is too complicated to have come about through a natural process. Therefore it must have been designed by an "intelligence". The "intelligence" of course is God, and attributing natural causality to a supernatural power of course violates methodological naturalism. Recognizing that methodological naturalism is the standard of modern science, ID proponents argue that it should be scuttled, and replaced with what they call "theistic science", which possesses the enviable ability to invoke the occasional miracle when circumstances seem to require it (Scott 1998). ID proponents are content to allow methodological naturalism for the vast amount of science that is done; they wish to leave the possibility of supernatural intervention only for those scientific problems that have theological implications, such as the Big Bang, the origin of life, the appearance of "kinds" of animals (the Cambrian Explosion), and the origin of humans. The strength of methodological naturalism is perhaps best illustrated by its general acceptance by both the ID and "creation science" wings of the anti-evolution movement — except when it comes to religiously sensitive topics.

The importance of changing your mind

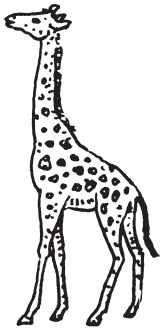
So creationists violate the first cardinal rule of science, the rule of methodological naturalism, but they also violate the second cardinal rule — that of being willing to change or reject one's explanation based on good evidence to the contrary. This is most clearly revealed by the creationist treatment of empirical data. Now, the problem is not that creationists sift through the scientific literature to find data that support the creation "model"; that in itself is not out of line. Scientists do seek confirming data (in the real world, as well as in the literature). But creationists *ignore evidence that disconfirms their view*, because they are not willing to change their explanations in the light of new data or theory.

Judges are not famous for their scientific acuity (witness Justice Scalia's dissent in the 1987 Supreme Court's *Edwards v Aguillard* case), but one judge got it remarkably right. William Overton, in the decision in *McLean v Arkansas,* wrote,

> The creationists' methods do not take data, weigh it against the opposing scientific data, and thereafter reach the conclusions stated in section 4(a).
>
> Instead, they take the Book of Genesis and attempt to find scientific support for it.
>
> While anybody is free to approach a scientific inquiry in any fashion they choose, they cannot properly describe the methodology used as scientific, if they start with a conclusion and refuse to change it regardless of the evidence developed during the course of the investigation.
>
> A theory that is by its own terms dogmatic, absolutist and never subject to revision is not a scientific theory.

For decades now, creationists have claimed that the amount of meteoritic dust on the moon disproves evolution. The argument goes like this: Based on scientific measurements, the amount of meteoritic dust falling on the earth is X tons per year; a proportionate amount must also fall on the moon. If the earth and moon were ancient as evolutionists claim, then the amount of dust on the moon would be several hundreds of feet thick, since in the scant atmosphere of the moon, the dust would not burn up as it does on the earth. When astronauts landed on the moon, they found only a few inches of dust, proving that the moon is young, so the earth is young, so there is not enough time for evolution, so evolution did not happen and therefore God created the earth, moon, and everything else in the universe 10 000 years ago.

Decades ago, creationists were told that the data they use for the amount of dust falling on the earth was inaccurate. More accurate measurements of the amount of meteoritic dust influx to the earth are degrees of magnitude smaller than the original estimates cited by creationists. Before astronauts landed on the moon, satellites had accurately measured the amount of dust occurring in space, and NASA predicted that the surface of the moon would be covered by no more than a few inches of dust — exactly what astronauts found. Even though this information has been available for decades, and evolutionists time and again have pointed out flaws in the creationist argument, the dust on the moon argument still is touted as "evidence against evolution". If this were a normal scientific theory, it would have been abandoned and forgotten long ago, an empirical stake in its heart, but this creationist zombie keeps rising again and again.



It is hard to argue that one is doing science when one can never bring oneself to abandon a refuted argument, and "creation science" is littered with such rejects. More modern forms of creationism such as "intelligent design theory" have not been around as long, and have not built up quite as long a list of refuted claims, but things do not look very good for them at this point. Michael Behe (1996) has proposed the idea that certain bio-

chemical functions or structures are "irreducibly complex": because all components must be present and functioning, such structures could not have come about through the incremental process of natural selection. The examples he uses in his book *Darwin's Black Box*, such as the bacterial flagellum and the blood-clotting cascade, appear not to be irreducibly complex after all. Worse, even granting the theoretical possibility that an irreducibly complex structure could exist, there is no reason it could not be produced by natural selection. A (theoretically) irreducibly complex structure would not have to have all of its components assembled in its present form all at one time. The way natural selection works, it is perfectly reasonable to envision that some parts of such a structure could be assembled for one purpose, other parts for another, and the final "assembly" results in a structure that performs a function different from any of the "ancestral" functions. As complex a biochemical sequence as the Krebs cycle has recently been given an evolutionary explanation of this sort (Melandez-Hevia and others 1996).

I am willing to give "intelligent design" (ID) a little more time to demonstrate that it is, as it aspires to be, a truly scientific movement. To be able legitimately to claim that ID is scientific, however, will require that its proponents be willing to abandon ideas in the light of refuting evidence — something that their ideological ancestors, the "creation scientists", have been unable to demonstrate, and which we have seen precious little of from the leaders of the ID movement.

Logical problems

Needless to say, in addition to violating the two key principles of science, the "science" of creationism demonstrates other weaknesses, not the least important is its logic. "Creation scientists" posit a false dichotomy of only two logical possibilities: one being special creationism as seen in a literal interpretation of Genesis, and the other being evolution. Therefore, if evolution is disproved, then creationism is proved; arguments against evolution are arguments *for* creationism. "Creation science" literature is largely composed of a careful sifting of legitimate scientific articles and books for anomalies that appear to "disprove" evolution.

But of course, to disprove one view is not to prove another; if I am not at home in Berkeley, that does not mean I am on the moon. Accepting the "if not A, then B" form of argument requires that there are only two possibilities. If the only two possibilities are that I am in Berkeley or on the moon, then indeed, evidence that I am not in Berkeley is evidence that I am on the moon, but clearly there are more than two alternatives as to my whereabouts. Similarly, there clearly are far more alternatives to scientific evolution than biblical creationism. There are several Hopi origin stories, several Navajo ones, scores of other Native American views, several dozen sub-Saharan African tribal explanations, and we have not even looked at South Asia, Polynesia, Australia, or views no longer held such as those of the ancient Norse and ancient Greeks. Even if evolution were disproved, biblical literalists would have to find ways of disproving all of these other religious views, so the logic fails.

More than an academic exercise

For many years, then, my interest in creationism was largely academic. It was an interesting exercise in the philosophy of science. But a few years after I left Missouri, my professor Jim Gavan unwisely accepted an invitation to debate the ICR's Duane Gish. Gish had perfected a hugely effective technique for persuading the public that evolution was shaky science, and that folks should really consider his "scientific alternative". I and some of my Kentucky students drove from Lexington to Missouri to attend the debate, and it was an eye-opener. I counted 13 buses from local church groups parked outside the big University of Missouri auditorium, and after seeing the enthusiasm with which the audience received Gish and his message, the cold water of the social and political reality of this movement hit me for the first time. It was no longer just an academic exercise. People were taking this pseudoscience very seriously

The late Jim Gavan was an excellent scientist, a former president of the American Association of Physical Anthropology, a smart and articulate man well-grounded in philosophy of science. He had done his homework: he had studied creationist literature for several months and came as prepared as anyone could be expected to be. Clearly, his scientific arguments were superior, but from the perspective of who won the hearts and minds of the people, Gish mopped him up.

So I realized that there was a heck of a lot more in this creationism and evolution business than just the academic issues. I went back to Lexington and my job of teaching evolution to college students with a new appreciation of a growing movement that had as its goal the undermining of my professional discipline, to say nothing of the scientific point of view. But still — there were pressures to publish, and a high teaching load, and I was still learning my job, so I did not take an active role in the controversy quite yet.

Then in 1976, I went to the University of Kansas in Lawrence, as a visiting professor. As I walked across campus one day, I saw a poster advertising a debate between two professors, Edward Wiley and Pat Bickford with Duane Gish and Henry Morris from the ICR. My first thought was, Do these guys know what they are getting in for? I jotted down the names of the professors and called up Ed Wiley. I told him that I had a collection of creationist materials that I was happy to make available to him, and offered to discuss the upcoming debate with him some time. We met and shared resources, and because of Ed's strategy I began to think that maybe this debate would be different.

Gish's usual stock in trade was to attack Darwinian gradualism because virtually all of his evolutionist opponents defended it. Ed Wiley had recently arrived from the American Museum of Natural History, where he had been converted to some new approaches to evolutionary biology that Gish had not heard of yet. Whereas Gish anticipated that his opponent

would defend Darwinian gradualism, Ed merely sniffed that Dr Gish had not kept up on the latest scholarship and went on to explain punctuated equilibria and cladistics. Worse for Gish, not only did Wiley ignore Darwinian gradualism, he almost ignored evolution completely, concentrating instead on attacking "creation science" as being a nonscience, and as being empirically false.

This debate was a disaster for the creationism side. Gish did not know what to say: his target had disappeared, and he was faced with new information with which he was totally unfamiliar (needless to say, by his next debate, he had figured out a "refutation" of punctuated equilibria, and no other evolutionist opponent would ever catch him unprepared on *this* topic). It was pleasant to behold, especially after having seen my mentor and friend Jim Gavan skunked by Gish a couple of years before.

But the most memorable moment in the debate did not have anything to do with science. Geologist Pat Bickford was paired with the avuncular founder of creation science, Henry M Morris, and did a good job showing the scientific flaws of Morris's "flood geology model" (according to which all the world's important geological features were formed by Noah's Flood), although I do not know how many in the audience understood much of his technical presentation. As with the Gavan/Gish debate, the audience was dominated by people who had arrived on buses from regional churches, and they were there to cheer their champions Gish and Morris. I was sitting behind a young girl of 11 or so and her mother.

Bickford began his presentation by pointing out that he was an active churchgoer, had been one for many years, and found this not at all incompatible with his acceptance of evolution. The girl in front of me whirled to face her mother and said, "But you told me —" and her mother, equally shocked and intent on hearing more, said, "Shhhhhhhh!" They had come to the debate convinced that one had to choose between evolution and religion. Bickford's testimonial exposed them to empirical evidence that this was not true. I suspect that they wondered what else they had been told that was not true. I noticed that they listened to Bickford far more intently than they had listened to Wiley and left with a thoughtful look in their eyes.

But my true baptism into realizing the depth and extent of the social and political importance of the "creation science" movement came in 1980 in Lexington, Kentucky, when the "Citizens for Balanced Teaching of Origins" approached the Lexington school board to request that "creation science" be introduced into the curriculum. Because I had a collection of creationist literature collected over the years, I became a focal point for the opposition to this effort. After over a year of controversy, our coalition of scientists and liberal and moderate clergy (who objected to biblical literalism being presented in the public schools) managed to persuade the Lexington Board of Education to reject the proposal — by a scant 3–2 margin.

Creationism and Pseudoscience

What happened in Lexington has happened in community after community across the United States, although the evolution side has not always prevailed. I learned from the Lexington controversy (and from observing creation/evolution debates) that "creation science" is not a problem that will be solved merely by throwing science at it. And I suspect that this is generally also the case with other pseudosciences. Like other pseudosciences, "creation science" seeks support and adherents by claiming the mantle of science. Proponents argue that "creation science" should be taught in science class because it supposedly is a legitimate science. This point must be refuted, and scientists are the best ones to make the point. But showing that creationism is unscientific (and just plain factually wrong) is insufficient, however necessary. People who support "creation science" do so for emotional reasons, and are reluctant or unwilling to relinquish their belief unless those needs or concerns are otherwise assuaged. I suspect the same thing can be said for believers in UFOs, or out-of-body experiences, or paranormal phenomena in general: these beliefs are meeting some emotional needs, and consequently will be very difficult to abandon.

In the case of creation science, the needs being met are among those associated with religion, which makes the adherence to creationism particularly difficult to give up. Creationism is most closely associated with a particular theology of special creationism; not all religion is inimical to evolution, as demonstrated both by scientists who are religious and religious non-scientists who accept evolution. But if your theology requires you to interpret your sacred documents in a literal fashion (whether the Bible, the Torah, the Koran, or the Vedas), in most cases, evolution will be difficult to accommodate with faith.

Some anti-evolutionists — most of the ID supporters, for example — think that evolution is incompatible with faith not because their theology is biblically literalist, but because they believe that a God who works through evolution is too remote; their theology requires a very personal God who is actively involved with individual human lives and who therefore gives purpose and meaning to life. The God of the theistic evolutionist, the one who uses evolution to construct living things much as Newton's God used gravitation to construct the solar system, is too distant; evolution to them is a step down the slippery slope toward deism.

But whether in the form of biblical literalism or not, religious sensibilities are the engine driving anti-evolutionism. Religion is a powerful force in human lives. If religion did not meet many human needs, it would not be a cultural universal; obviously we are dealing with many complex psychological issues. No matter how sound Jim Gavan's science was during his debate with Gish, he failed to move most of his listeners because they came to the debate convinced that evolution was fundamentally incompatible with their religion. Pat Bickford's casual mention that he was a churchgoer was critical to the success of the Kansas debate, because it forced audience members to grapple with

"Intelligent Design" Visits San Francisco: The Concurrent Sessions

Glenn Branch, NCSE Deputy Director

In the previous issue of *RNCSE* (2002 Nov–Dec; 22 [6]: 6–9), I reported on the plenary sessions of the "intelligent design" conference held at the University of San Francisco on September 27 and 28, 2002, sponsored by the Intelligent Design and Evolution Awareness (IDEA) Center. The concurrent sessions, which I discuss here, were held on September 28 following the fourth and the sixth plenary sessions; with the exception of Cornelius Hunter's, the presentations were the same at both sessions.

Paul Nelson's concurrent session was on "Ontogenetic depth as a complexity metric for the Cambrian Explosion". Alan Gishlick attended the second presentation of it. Neither ontogenetic depth nor the Cambrian Explosion played a major role; rather, Nelson's point was apparently that body plans in particular and development in general present a stubborn chicken-and-egg problem for evolution: "You can't build it till you mutate it, and you can't mutate a new idea: that one could be an evolutionist and also a Christian. In Lexington, scientists could point out that "creation science" was not science, but the clergy could assuage the public's emotional concerns that by "believing" in evolution, they were giving up something important to them. Scientists alone could not have won the day. If 95 clergymen had not signed a petition stating that evolution was fine with them and that they felt that the schools should not be presenting a religious doctrine as science, community sentiment would not have allowed the board of education to make the decision it did.

Those of us concerned about pseudoscience and its attractiveness to the public would be well advised to consider the emotional needs that are met by beliefs in ESP, alien abduction, astrology, psychic powers, and the like, and address them as well as criticizing the poor science invoked by supporters to support the pseudoscience. We skeptics sometimes feel that the people we are trying to reach are impenetrable — and some of them are! The public is divided into 3 parts: confirmed believers, confirmed skeptics, and a much larger middle group that does not know much science, but does not have the emotional commitments that might lead it to embrace a pseudoscientific view. In the case of creation science, the emotional commitment (among many) is to the particular theology of biblical literalism; in the case of UFO abductees, it may be a need for a quasi-religious benevolent protector (or conversely, the fear of an omnipresent threat against which one is powerless). I have found that I am most effective with that large middle group, and hardly ever effective with the true believers; I suspect most skeptics have had similar experiences.

But after all, reaching that large middle group is also the goal of the proponents of pseudoscience. If, like most skeptics, you feel that we would all be better off with more science and less pseudoscience, then that is where we should be focusing our energies, rather than fruitlessly arguing with people who will never agree with us. But to reach that group that is potentially reachable, we must also be aware that a scientific explanation is necessary but not sufficient to change someone's mind; if I have learned anything from over 25 years in the skeptic business, it is that it is necessary to deal with the emotional reasons that make our species susceptible to these beliefs, as well as the scientific.

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[*Reprinted with permission from* Skeptical Odysseys: Personal Accounts by the World's Leading Paranormal Inquirers. *Paul Kurtz, ed. Amherst (NY): Prometheus Books, 2001, p 245–56.*]

it till you build it." Nelson argued that, because the organism is only visible to natural selection after development, the developmental processes themselves cannot evolve. He also argued that, in development, the complete plan of the organism must be present from the start, so body plans themselves cannot evolve. He explained the problem in terms of a marching band analogy: to spell out a word, band members have to be given their individual assignments and shown their individual places. Gishlick, a former marching band member, observes that Nelson's understanding of field marching is on a par with his understanding of development. More important, however, is Nelson's neglect of the rich evolutionary literature that bears on the alleged problems for evolution that he discussed.

Cornelius George Hunter, the author of *Darwin's God* (Grand Rapids [MI]: Brazos Press, 2001; reviewed in *RNCSE* 2002 Jan–Apr; 22 [1–2]: 49–51) and the forthcoming *Darwin's Proof* (Grand Rapids [MI]: Brazos Press, 2003) and a Fellow of the International Society for Complexity, Information, and Design (ISCID — a society founded by William A Dembski), gave different presentations during his concurrent sessions: "One long argument: The religion behind the scientific arguments for evolution" and "Darwinism: Apologetics, natural theology and the religion in evolution (1600–present)". Both Alan Gishlick and Phina Borgeson attended "One long argument"; Skip Evans attended "Darwinism".

Hunter opened "One long argument" with a brief prayer, and then based his presentation on 2 contentions: that the evidence for evolution is spurious and that the only arguments for evolution are purely religious (as the subtitle suggests). Hunter's treatment of the evidence was unimpressive. He claimed, for example, that homology is not reliable on the grounds that the marsupial Tasmanian wolf (*Thylacinus cynocephalus*) and the wolf (*Canis lupus*) are similar yet not reckoned close relations. Of course, anatomists have shown that the resemblances are only superficial and that the many dissimilarities between the animals are more numerous and phylogenetically significant. As for Hunter's contention that the arguments for evolution are purely religious, it apparently trades on conflating the claim of separate origins of the species with the claim of divine responsibility for the species; it is the former, not the latter, that is refuted in the *Origin* and by the bulk of Darwin's successors.

The first part of "Darwinism" was devoted to reviewing post-Renaissance European thought on God's role in natural history, beginning with Descartes and continuing up to the time of Darwin. Hunter then proceeded, in light of his historical discussion, to distinguish various "belief categories around evolution" — including "design theory", process theology, "neo-Gnosticism" (to which category he assigned both Howard Van Till and Stephen Jay Gould), and materialism — present in today's intellectual milieu. Interestingly, according to a diagram of Hunter's, "design theory" is wholly contained in Christianity, although neo-Gnosticism and process theology merely overlap with it. Rejecting process theology and neo-Gnosticism as heretical, Hunter plumped for "design theory", but with the caveat that it fails to explain evil.

John Bracht, a first-year graduate student in biology at the University of California, San Diego, and the managing editor of *Progress in Complexity, Information, and Design* (the journal of ISCID), spoke on "Biological complexity: Invention or evolution? Biological insights from Russian patents and the theory of inventive problem-solving" (a paper on the same topic by Bracht is to be found at <http://iscid.org/papers/Bracht_InventionsAlgorithms_112601.pdf>. Eugenie C Scott attended his first session. Bracht compared the "solutions" of biological "problems" to human problem-solving involving trial-and-error and invention. He argued that trial-and-error is limited to exploring a "probability space" wherein problems are solved by tinkering with known systems and processes. True inventive solutions, he claimed, are "outside the box" solutions in which the solution is found outside of the probability space; genetic algorithms, he claimed, are limited by the encoding of the problem and thus will never discover true inventive solutions. (The case of the genetic algorithm that was intended to produce an oscillator but unexpectedly produced a radio receiver instead seems to refute that claim; see "Radio emerges from the electronic soup", *New Scientist* 2002 Aug 28). The connection with design theory, of course, is that the solution to irreducible complexity "problems" in biology requires the "outside-the-box" approach, which means that the "tinkering" approach associated with natural selection is inadequate, according to Bracht. Design is required to solve such irreducible complexity problems such as the origin of life, the transition from single-celled to multicelled organisms, the origin of sexual reproduction, the appearance of body plans in the Cambrian, and the origin of consciousness — the usual ID stock-in-trade.

For his concurrent session, Eddie Colanter spoke on "The philosophical implications of intelligent design and neo-Darwinism: Bioethics and personhood". Colanter is co-president of the IDEA Center and Associate Professor of Apologetics and Ethics at Faith Seminary in Tacoma, Washington, which is a sponsor of the IDEA Center. Glenn Branch attended his first session. In it, Colanter ambitiously attempted to contrast the philosophical, and in particular the bioethical, implications of "intelligent design" and neo-Darwinism, which he glossed as "sometimes referred to as scientific materialism or atheistic naturalism" or (as he added in conversation) "secular liberalism". In the time available to him, however, he was not able to do much more than read his 4-page outline out loud. The route from "intelligent design" to its supposed bioethical implications — including the impermissibility of abortion — apparently is by way of Colanter's preferred brand of conservative Christianity; it was unclear what of its own "intelligent design" was supposed to contribute to an understanding of bioethics.

Casey Luskin, co-president of the IDEA Center, presented "Promoting design on a college

campus: How to start an 'IDEA Club'" at his concurrent session. Most of Luskin's presentation was devoted to reviewing the IDEA Center's mission statement (<http://www.ideacenter.org/mission.htm>), according to which its purposes are to:

- Promote, as a scientific theory, the idea that life was designed by an Intelligent Designer;
- Hold, through other arguments, that the identity of the Designer is consistent with the God of the Bible;
- Educate people about scientific problems with purely natural explanations for the origins and evolution of life;
- Challenge the philosophical assumptions of Darwinism, naturalism, and materialism.

Luskin repeatedly stated that although everybody is welcome to join a chapter of the IDEA Center, only Christians are eligible to hold positions of leadership. Skip Evans attended the first session, which only 3 other people attended; none appeared to be particularly enthusiastic about starting chapters of the IDEA Center at their schools. (As of February 1, 2003, the IDEA Center's web site claimed that there are 2 active and 5 prospective chapters.) Later in the day, Luskin was overheard saying that nobody attended the second session.

One concurrent session screened *Icons of Evolution*, the video version of Jonathan Wells's book of the same name (for a brief description of the contents of Icons, its premiere, and its broadcast in Ohio, see Skip Evans's article "The Discovery Institute pioneers the *mis*infomercial", *RNCSE* 2002 Jul/Aug; 22 [4]: 9–10). Another concurrent session consisted of a repeat showing of *Unlocking the Mystery of Life* for the benefit of anyone who missed it on Friday night (*see Niles Donegan's discussion of the videotape in* RNCSE *2002 Nov/Dec; 22 [6]: 5–6*).

In the concurrent sessions, there was a noticeable tension between the two foci of "intelligent design" — its attempt to present a scientific "alternative" to evolution and its promotion of a religious renewal of culture. Nelson, in keeping with the general strategy of the Discovery Institute, was careful to present his talk as purely scientific. Bracht followed suit in characterizing the debate between evolution and "intelligent design" as scientific. Hunter, on the other hand, was unabashed about his religious motivations; insofar as he stressed the claim that the only arguments for evolution are essentially religious themselves, it is conceivable that he regards the debate as between two rival religious doctrines — a frequent theme in traditional creationist literature. Unlike Hunter, Colanter and Luskin restricted themselves to nonscientific issues in their presentations; their religious motivation — in particular, their hope to use "intelligent design" in the service of evangelism — was particularly conspicuous as a consequence.

In its heyday, "creation science" struggled with a similar tension between its scientific aspirations and its ideological commitments; the ideological commitments swiftly triumphed. Unless the proponents of "intelligent design" are able to separate their scientific accomplishments, however modest, from their evangelistic goal of replacing "materialistic explanations with the theist understanding that nature and human beings are created by God" (as Bruce Chapman of the Discovery Institute once explained it), it is likely that "intelligent design" will traverse the same arc.

Acknowledgements

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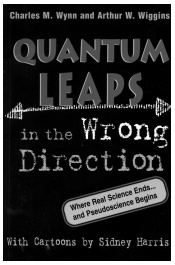
Holy Toledo! Defenders' Club Formed in Ohio

According to a story in the Toledo, Ohio, *Blade* (2003 Jan 18), a "Defenders' Club" held its inaugural meeting on January 18, 2003. Its main goal is to "defend a biblical worldview". Despite its overtly religious orientation, organizers and supporters of the Defenders' Club insist that they are concerned with the *scientific* issues raised by Ohio's new standards, which treat evolution as a central, unifying principle of biology and which specifically disclaim any intention to mandate the teaching of "intelligent design" *(see* RNCSE *2002 Nov/Dec; 22 [6]: 4–5*). One goal of the Defenders' Club is to prepare materials that teachers can take into the classroom so that they can adequately "teach the controversy". Organizers told the *Blade* that teachers do not include these materials because they never learn them. The Defenders' Club attributes this situation to a "cultural bias" against their biblical worldview. Read the *Blade*'s report at <http://www.toledoblade.com/apps/pbcs.dll/article?Date=20030118&Category=NEWS10&ArtNo=101180055&Ref=AR>.

BOOKREVIEWS



Quantum Leaps in the Wrong Direction: Where Real Science Ends and Pseudoscience Begins

by Charles M Wynn and Arthur W Wiggins (with cartoons by Sidney Harris) Washington (DC): Joseph Henry Press, 2001. 226 pages (with glossary, additional reading list, and index).

Reviewed by Andrew J Petto, University of the Arts

Back in Madison, Wisconsin — home of the quadrennial "Psychic Faire" — it should have been no surprise to see the half-page ad for angel medium, and angel *therapist*, Dr Doreen Virtue. She claims that she can see, communicate, and give people access to the power of angels all around us. But how do we know that angels are responsible? Well, because *Dr* Virtue tells us they are. This may seem like a cover story from the *Weekly World News*, but it appeared in a regular daily newspaper, and Virtue's appearance drew a full house at a local theater.

Quantum Leaps is just the sort of book that should be read by anyone interested in psychics, mediums, astrologers, and others who make real-world claims about the effects of invisible powers accessible only to a select few. It gets to the heart of what constitutes science — not only the content and the theory, but also the process and reflection. Using historical and contemporary examples, the authors show us science at work — accepting, modifying, and often rejecting hypotheses, theories, and even *very plausible* explanations for what we observe in the world around us. The strength of the book is in the first 50 pages. Here the authors elucidate the modern scientific process with the aid of abundant diagrams, charts, and the delightful cartoons of Sidney Harris. I do not know of a clearer, more accurate, and more accessible explanation of what science is and how it proceeds than that in the first three chapters of this book.

The second part of the book looks at five major, persistent pseudoscientific ideas, recognizing that there are many more that could be added. The Wynn and Wiggins "Top Five" are UFOs and visits from extraterrestrials, astrology, out-of-body experiences and astral projections, creation "science", and parapsychology. These are important ideas that engage many of our citizens, and Wynn and Wiggins review the main claims and some of the history of these ideas.

Unfortunately, the book misses an opportunity in this section to take the reader through a consistent examination of these ideas based on the characteristics of scientific investigation laid out in the first part of the book. Their rejection of these pseudosciences is often didactic, even authoritarian, and does not shed as much light on *why* we should reject these ideas as the introductory chapters seem to promise. None of their statements about these pseudoscientific ideas is incorrect; it is just that they often do little more than tell us that the pseudoscientific idea is wrong — only occasionally exploring which aspects of good scientific practice are violated by the pseudoscience in question.

Still, the book is valuable overall and a good resource for those interested in (or faced with confronting) pseudoscientific ideas in the classroom, in civic life, or in politics. It provides the framework within which one *could* hold the Wynn and Wiggins "Top Five" up to the scrutiny of the practice of real science, as laid out in the introductory chapters. There is also a solid glossary followed by a good selection of further readings for those more interested in particular topics. During our recent struggle in Pennsylvania over science education standards, I considered buying a copy for each member of the State Assembly's two education committees. It would have been a worthwhile investment.

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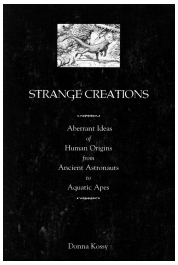


Strange Creations: Aberrant Ideas of Human Origins from Ancient Astronauts to Aquatic Apes

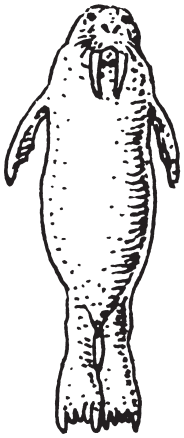
by Donna Kossy
Los Angeles: Feral House, 2001.
264 pages.

Reviewed by Wolf Roder, University of Cincinnati

Creationists often want us to believe the only alternative to the theory of evolution is their own insistence on "scientific" biblical creationism or its alternative, "intelligent design". Donna Kossy has produced a book-length rundown on the wide variety of *other* explanations of biological history, most of them utter crank, which also aspire to be "scientific" alternatives to evolutionary models.

Koss devotes a series of chapters to a number of these extraordinary ideas and addresses their sources in turn. There are extraterrestrial origins or creation by extraterrestrials. Then there is de-evolution: in the beginning humans were perfect, but they "devolved" down to our current condition over the past 72 000 years.

Many origin cranks are hung up on race — describing non-whites as having been created before



Adam by the devil and not really human. The Church of the Creator and Christian Identity religion belong into this category. The "science" of eugenics and German Nazi philosophy drew generously from the same well. Christian creationism, its propagators, and its antecedents before Darwin are laid out in some detail.

Elaine Morgan's treatment of the aquatic ape theory — the idea that human evolution went through an aquatic phase, in which our primate ancestors lived and hunted along a lake or ocean shore — is given a chapter. Her work accepts evolution, but suggests an alternative path to human status. The theory takes some aspects that distinguish humans from apes — diving reflex, fat layers inside the skin, upright walk, lack of fur — and explains them as a consequence of a period of evolution of a small population of apes living in a wading and shoreline habitat. Unfortunately no evidence for such evolution or such a population has been found. Moreover, since Morgan's book first appeared, fossil evidence — for example, the ecological context of the overwhelming majority of early hominin fossils — shows anatomical adaptations for climbing, not for swimming.

In one of the more interesting and original parts of the book, Kossy examines *The Urantia Book*, and its connection to various cults. The weird anthropology of the *Urantia Book* does not fit easily into any one category. The book itself was supposedly dictated or channeled between 1923 and 1955 by a higher intelligence to former Seventh Day Adventists. In some 1000 pages, the book tells a complex cosmology of gravity bodies, superuniverses, and new mankinds — all of which continue to evolve. *The Urantia Book* is understood by its devotees "as an amendment to the Bible, not a replacement for it" (p 216). Kossy comments that it sounds like "what the Bible would have been like if it had been written by lawyers and businessmen, rather than by priests, prophets and poets" (p 217).

According to *The Urantia Book,* life, including human life, does not originate spontaneously; it has to be constructed. And it has to be constructed separately and over again on each world (it is not clear whether these are physical planets or some imagined spirit worlds). Evolution on each world is then directed by higher beings — for example, Adam and Eve, Moses, or Jesus — who visit these worlds. Something, however, went wrong on this world, and the divine powers are struggling to set it right. David Koresh's Branch Davidians of Waco (Texas) fame, were apparently influenced by these ideas — some of which were taken over from Seventh Day Adventism.

More directly influenced by *The Urantia Book* were the people looking for "Human Individual Metamorphosis", better known as the Heaven's Gate cult. These people's desire to ascend to a higher world above led to their joint suicide in 1997. The leading idea was that they would be picked up by a spaceship following in the tail of the comet Hale–Bopp.

This is just a taste of what *Strange Creations* has to offer. It is a very useful source on a wide variety of pseudoscientific ideas, oddball groups, and their writings.

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[*Reprinted with permission from* The Single Best Idea, Ever, *ed. Amanda Chesworth and others, Albuquerque: Tangled Bank Press, 2002.*]

Wolf Roder is Professor of Geography at the University of Cincinnati. He is the author of Human Adjustment to Kainji Reservoir in Nigeria *and of "Magic, medicine and metaphysics in Nigeria" in the* Skeptical Inquirer.

The Creation Controversy & the Science Classroom

by James W Skehan and Craig E Nelson
Arlington (VA): NSTA Press, 2000.
56 pages.

Reviewed by Brian Alters, McGill University

One of the greatest needs for biology instruction is an understanding of why many students consider a fundamental theory of science to be faulty and what to do about it pedagogically. A deeper understanding of students' underpinning religious beliefs concerning evolution, the age of the earth, and science in general benefits biology instructors (and other science instructors as well) in helping to comprehend students' learning roadblocks, why the roadblocks exist, the history of the roadblocks, and why everyone does not share such roadblocks. Naturally such an understanding is helpful, but also important is how instructors can nevertheless increase student understanding of such a publicly controversial topic as evolution.

Appropriately, the National Science Teachers Association published a 56-page booklet containing two chapters responding to these two needs of understanding and strategies: *The Creation Controversy & the Science Classroom.* The work is divided into two chapters, each addressing one of these needs: "Modern science and the Book of Genesis" by James Skehan and "Effective strategies for teaching evolution and other controversial topics" by Craig Nelson.

In his chapter, Skehan — an NCSE Supporter — starts by taking readers through why people believed in a young earth in the past and why some still do today. He explains that both scientific education and religious education are important in a civilized society. He personally believes that the God of the Bible created the universe and the physical processes driving physical and biological evolution — identifying himself as a theistic evolutionist. In explaining the genesis of Genesis, Skehan succinctly recounts St Augustine's reasoning, the external evidence for the biblical authors, the evidence from the Genesis document itself, varying traditions of scripture scholars, and how creationists differ from those in the mainstream of scriptural studies. The significant difference between creationists and most biblical scholars is the creationist belief that the Bible is to be taken literally and must not be interpreted by techniques used on other literary works.

A transition is then made to creationist attempts to determine the age of the earth from the Bible. Skehan explains how and why biblical scholarship and science have changed over the years, including sections on the age of the earth as calculated from the Bible, and the physical and biological data concerning the age and evolution of the earth.

The chapter ends by summarizing the creationists' ultimate position: if there is a conflict between science and a literal interpretation of the Bible, then science is wrong. Skehan explains how religious and scientific endeavors are two different kinds of knowledge, explaining that those who misrepresent the Bible as science, rather than a theological document, are damaging religion.

The reader quickly comes to understand that the reasons why creationist students believe what they do about evolution often has as much (or more) to do with biblical illiteracy or marginal literalist traditions than with misconceptions in science. Because of this problem, Skehan goes as far as to state:

> The education of every science teacher who is likely to face the creation science mindset should include something about the premises and procedures of modern biblical scholarship (p 16–7).

Probably everyone would wholeheartedly agree that it would benefit science teachers better to understand the reasons for their students' learning roadblocks, but encouraging future teachers to take biblical scholarship training to become public high school science teachers will be suspect by some — including many practicing science teachers. Yet it could be plausibly argued that because the history and philosophy of science has included brushes and entanglements (to say the least) with biblical scholarship, and because the history and philosophy of science should be integrated in science courses, the education of science teachers should therefore include some biblical scholarship. However, Skehan goes further and states that:

> Teachers must be able to help students from varied backgrounds ... realize that there is no necessary conflict between interpretations of data from scientific studies and religious beliefs based on the Bible (p 2).

This is a stimulating statement. Most people would probably have no problem with students' coming to an understanding that no conflict exists between science and the Bible as a by-product of public school education. However, many more people might take issue with preparing public school science teachers to be able to help students to realize that their religious tradition is erroneous (or at least part of their religious tradition is erroneous). It is a subtle distinction that can be an intriguing point of discussion for educators.

This first chapter is a concise, detail-rich history of some of the relevant issues concerning science and biblical scholarship, with a good relevant criticism of creationism woven throughout for instructors wanting better to understand the biblical beliefs that may underpin their students' concluding that the science of evolution is unsound — all in only 18 pages!

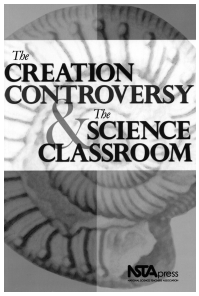
Nelson's chapter on effective strategies for teaching evolution is also to the point, with a great number of useful ideas and strategies packed in a short read. His recommendations are useful not only for teaching evolution to a variety of students but also for teaching many other controversial issues. He believes that most other major scientific theories, which may be less well understood by the public than evolution is, would be rejected even more widely if the public understood these theories well.

The chapter begins with a discussion of key pedagogical strategies with corresponding problems, emphasizing the fundamental role of "active learning". The results of empirical studies supporting the use of these strategies in college-level education are given to show the significant positive effects of active learning compared to using only traditional didactic pedagogy and passive learning practices. Nelson then turns his attention to problems that arise from traditional content and curricula, emphasizing that instructors can make considerable changes here also. Some problems addressed are: (a) in the rush to cover the material, teachers often present just the conclusions, leaving out the importance of science's evidence-based critical thinking; (b) too often teachers appear to present all topics in science as equally well supported (even though evolution is far more supported than many other accepted scientific concepts); and (c) words are often used in science education in a way contradictory to students' common usage.

Not all pedagogical problems arise from using traditional pedagogy and content; many arise from outside traditional pedagogy and content. Nelson addresses some of these problems, such as public controversies that usually rest on disagreements about consequences of the science. Employing a "rusty hand-grenade" as his key metaphor, Nelson effectively illustrates risk analysis in a manner understandable to virtually all students. The intended result is that students can rationally disagree on how strong the evidence must be to justify various decisions based on the trade-offs — as recognized by students. This examination of trade-offs and consequences is then considered in light of teaching evolution. Students who perceive they have much more to risk (for example, eternal salvation) may require a great deal more evidence of the soundness of evolution than those students who feel they have little to risk.

Before Nelson proceeds to more explicit juxtaposing of evolution and types of creation, he effectively cautions his science–teacher readers not to incorporate the religious consequence approaches if they feel uncomfortable. The tools that he gives for bridging false creation/evolution dichotomies are certainly useful in post-secondary education, but some may be problematic to implement in public high school science courses due to their religious nature. However, even if some teachers are uncomfortable with personally implementing such approaches, the material is important for all teachers to understand.

More strategies are given for matters arising from outside tradi-



tional pedagogy and content. The ubiquitous problem of students' wanting teachers just to tell them what to memorize is countered with three separate strategies: (a) teaching the "game" of science — and explaining why evolution is good science, (b) drawing a clear distinction between what science does and what religion does, and c) focusing on humans — because most students are quite interested in the details of the evidence for human evolution, they will be more motivated to do the necessary work for higher-level understanding.

The chapter ends with a table of 21 evolution questions with brief answers from "quick creation" (sometimes including "gradual creation") and basic science, including lines of evidence and applications. The information from the table is to be used in a very understandable "Big Mac" metaphor for helping students to learn the wide variation in strength of support among different statements about evolution. Nelson claims the strategies in the chapter make teaching more inclusive, effective, and fun. I certainly agree.

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The Antiquity of Man: Artifactual, Fossil and Gene Records Explored

by Michael Brass
Baltimore: Publish America, 2002.
220 pages, bibliography.

Reviewed by Tom Morrow

When I learned that someone wrote a book-length rebuttal to Michael Cremo and Richard Thompson's Hindu creationist tract *Forbidden Archaeology: The Hidden History of the Human Race* — a 900-page exposé of "anomalous archaeological artifacts" that suggested modern people lived on earth 4 billion years ago — my first reaction was, "Why would somebody go to the trouble?"

It has been a long time since I read Cremo and Thompson's 1993 book, but I immediately recalled how they devoted hundreds and hundreds of pages to reconstructed drawings of "eolith" stones, lifted from reports published a century or more ago, for relics that no longer existed and could not be re-examined. By the time I reached their chapter that suggested that Big Foot and the Yeti were living hominids whose existence was being suppressed by "establishment scientists", I dismissed it as a typical creationist fantasy.

Just as Christian creationists attempt to harmonize science with the Bible, Michael Cremo and Richard Thompson are Hindu creationists who attempt to harmonize science with their sacred Vedic scriptures such as the *Bhagavata Purana*, which describes how men and women have lived on earth for a vast period of time called the Day of Brahma that encompasses a thousand "yuga" cycles totaling 4.32 billion years.

Michael Brass, an archaeologist from Cape Town, South Africa, wrote a lengthy rebuttal to Cremo and Thompson's book entitled *The Antiquity of Man: Artifactual, Fossil and Gene Records Explored*. But Brass's book is not a tit-for-tat response to Cremo and Thompson's book. Instead, he mostly summarizes the vast archaeological and paleoanthropological evidence for human evolution from a huge variety of scientific sources. His specific criticisms of Cremo and Thompson are sparse yet devastating because he shows how they borrow the same discredited tactics that Christian creationists have used in their literature for ages.

For example, Brass shows how Cremo and Thompson selectively quote paleoanthropologist Russell Tuttle to imply that he believed that the 3.5 million-year–old Laetoli footprints were made by an anatomically modern human, despite the fact that Tuttle's report clearly said they were made by a hominid of indeterminate species. Cremo and Thompson give enormous weight to Solly Zuckerman's and Charles Oxnard's dissenting opinions of the Australopithecine fossils while completely ignoring the dozens of scientific papers that thoroughly document Zuckerman's and Oxnard's errors.

Brass also reveals how Cremo and Thompson misunderstand basic scientific principles. For example, they reject the recent radiocarbon date of the Hans Reck skeleton because they allege that it could have been contaminated by an intrusive burial. But even if that happened, such an error would make the specimen appear incorrectly *older* than its actual age, not younger. Cremo and Thompson also endorse Louis Leakey's discredited opinion that Neanderthals were hybrids that resulted from interbreeding between *Homo sapiens* and *Homo erectus*. But if, as they insist, modern humans lived on earth for hundreds of millions of years without change, these *Homo sapiens* would have been genetically incapable of interbreeding with another species.

I do disagree with Brass's discussion of the biological role of homeobox (*Hox*) genes that guide the construction of the axis and limbs of animals. Brass's presentation primarily relies upon Jeffrey Schwartz's *Sudden Origins: Fossils, Genes and the Emergence of New Species* (New York: John Wiley & Sons, 1999). Schwartz is a paleontologist, not a biologist, and most biologists I have talked to insist that Schwartz's book has serious flaws.

For specialists, a more reliable book about *Hox* genes is Wallace Arthur's book *The Origin of Animal Body Plans: A Study in Evolutionary Developmental Biology* (Cambridge: Cambridge University Press, 1997; see review by Laurie Godfrey on page 35). For the non-specialist, I recommend Carl Zimmer's breezy book *At the Water's Edge* (New York: Touchstone Press, 1999).

But this is a minor disagreement. Michael Brass's book is an excellent resource that thoroughly covers the most current archaeological and paleoanthropological findings in human evolution.

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History of Science Society

Statement on Evolution and Related Matters

The history of science can teach us much about the nature and development of science over time. As the National Academy of Sciences explains in its National Science Education Standards, "In learning science, students need to understand that science reflects its history and is an ongoing, changing enterprise. The standards for the history and nature of science recommend the use of history in school science programs to clarify different aspects of scientific inquiry, the human aspects of science, and the role that science has played in the development of various cultures."

The History of Science Society endorses this view, developed as part of a process that involved over 18 000 scientists and all the major scientific organizations and funding agencies. The history of science helps us understand scientific processes and is important for informing the way that science is used publicly, for example, in the courts and in the development of educational standards in those states and countries that have chosen to develop such standards for their public schools. In such cases it is important to draw on the best available understanding of science and its social context.

Recent discussions about educational standards in public schools have focused on the teaching of evolution and related issues. The history of science shows that such concepts as evolution and geological change are well established and belong in science curricula along with other basic scientific ideas. The history of science has generated a rich literature exploring the development of these concepts as well as the relationship between science and religion; this discussion is available to inform ongoing public discussion.

In view of this historical perspective, the History of Science Society disapproves of recent efforts by state school boards effectively to remove evolution as a subject from the secondary school curriculum, either through textbook disclaimers or censorship. Such efforts will only hinder students from developing a historical appreciation for science as a process of intellectual inquiry and from understanding the place of science in society, both past and present.

The History of Science Society, which explores the nature of science and scientific change, provides a valuable resource of over 2900 members, many of whom are available to serve as consultants in public arenas. Through its publications and other activities, the Society provides scholars, decision makers, educators, and the public with historical perspectives on science policy and on the potentials, achievements, and the limitations of basic and applied science.

Contributors: Jane Maienschein (Chair), Ed Larson, Ron Numbers, Phil Sloan, and Liba Taub.

Understanding Creationism and Pseudoscience

Tout comprendre c'est tout pardonner, runs the French saying: to understand all is to pardon all. Even if you are less interested in pardoning creationists than in refuting them, you still need to understand them. (As Eugenie C Scott urges in her contribution to *Skeptical Odysseys*, which we reprint starting on page 11, we need to understand the emotional appeal of creationism, for providing "a scientific explanation is necessary but not sufficient to change someone's mind".) Nobody interested either in studying or resisting creationism can afford to be ignorant of the substantial body of scholarly and popular literature examining the creationist movement. And, because creationism is arguably the pseudoscience *par excellence*, it is useful also to look at the scholarly and popular literature on pseudoscience, which, thanks to the skeptical movement, is burgeoning. Featured here are books on creationism in particular and pseudoscience in general, as well as two journals devoted to combating pseudoscience. The following books are available through the NCSE web site: <http://www.ncseweb.org/bookstore.asp> — look in the new "In the latest *RNCSE*" section. And remember, every purchase benefits NCSE!

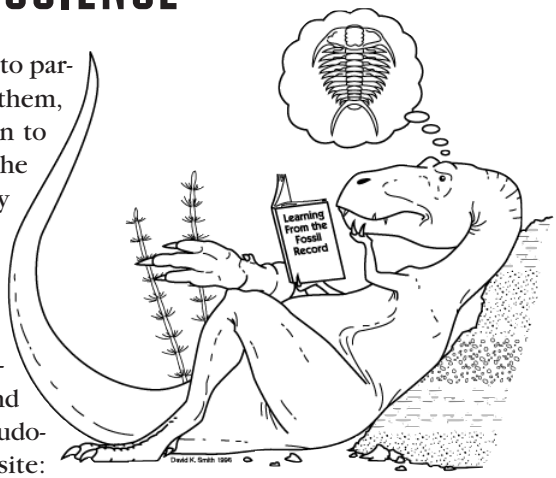


Illustration by Dave Smith, used with permission of the University of California Museum of Paleontology.

Creationism in particular

Species of Origins: America's Search for a Creation Story
by Karl W Giberson and Donald A Yerxa
Intended in part as a sequel to Ronald L Numbers's seminal work, *Species of Origins* impartially surveys the full spectrum of the creationism/evolution debate, from young-earth creationism and "intelligent design" through theistic evolution to atheistic evolution. Writing in *Research News*, Michael Ruse describes it as "a simply invaluable primer on the subject that should be made compulsory reading for all who have ever thought on science-and-religion. ... I can think of no better place to start into the debate about origins — creationism or evolution — than with this book." The authors are professors — Giberson of physics and Yerxa of history — at Eastern Nazarene University.

Anti-Evolution: A Reader's Guide to Writings Before and After Darwin
by Tom McIver
Containing bibliographical data and brief objective descriptions of almost 2000 anti-evolutionist books, pamphlets, and tracts, and with useful biographical data on their authors, *Anti-Evolution* is invaluable for the serious student of creationism. Writing in *Nature*, Euan G Nisbet said, "McIver has provided us with a splendid bestiary of anti-evolution ideas. ... It is a fascinating work ... either for a chuckle or, on those unpleasant occasions, to face up to a nightmare on the rampage." Published in 1988, *Anti-Evolution* was re-issued in paperback, with a new introduction, in 1992. McIver is a long-time member of NCSE.

The Creationists: The Evolution of Scientific Creationism
by Ronald L Numbers
Published in 1992, Ronald L Numbers's monumental study remains the pre-eminent work on the history of creationism, respected by people on both sides of the dispute. "For those interested in the background of the modern revival of creationism, whether evolutionists or creationists", wrote the Institute for Creation Research's Henry M Morris, "this book is a rich mine of information and historical insights." And Roger Lewin writes in the *Washington Post Book World*, "As an exposure of one of the most socially explosive and intellectually damaging movements of recent times, it is unquestionably a volume of major importance."

God's Own Scientists: Creationism in a Secular World
Christopher P Toumey
God's Own Scientists investigates the anti-evolution movement through the eyes of a cultural anthropologist who spent over five years talking with, studying with, and interviewing creationists. "Creationism has two overriding themes", Toumey concludes, "an unquenched hostility to the idea of evolution, based on the belief that evolution is intimately involved with immorality ... and a quasi-religious awe of science ... so that creationism will be made more credible by the sanctification that supposedly flows from the plenary authority of science." A valuable and insightful study. Toumey is also the author of *Conjuring Science: Scientific Symbols and Cultural Meanings in American Life* (New Brunswick [NJ]: Rutgers University Press, 1996).

Where Darwin Meets the Bible: Creationists and Evolutionists in America
by Larry A Witham
A reporter for the *Washington Times*, Witham provides a lively and anecdotal account of the contemporary creationist/evolution controversy, based on his wide reading and personal interviews with many of the principal players on both the

anti-evolution and the evolution sides. Reviewing *Where Darwin Meets the Bible* for *Science*, Kenneth R Miller praises Witham for weaving "the isolated elements of the conflict into a fabric that connects the flow of ideas, events, and politics. Any scientist tempted to believe that the major figures in the anti-evolution movement are half-hearted, insincere, or simply opportunistic in their assault against mainstream science would do well to read this book."

Pseudoscience in General

Fads and Fallacies in the Name of Science
by Martin Gardner
Published originally in 1957 as the revised edition of his *In the Name of Science* (1952), Martin Gardner's first book on pseudoscience is still as relevant — and as readable — as ever. A chapter is devoted to creationism, of course, but Gardner discusses a wide variety of bizarre pseudoscientific beliefs. "In the last analysis", he writes, "the best means of combating the spread of pseudoscience is an enlightened public, able to distinguish the work of a reputable investigator from the work of the incompetent and self-deluded." Through *Fads and Fallacies* and its sequels, Gardner helped, and continues to help, to enlighten the public accordingly.

Skeptical Odysseys: Personal Accounts by the World's Leading Paranormal Inquirers
edited by Paul Kurtz
To celebrate the 25th anniversary of CSICOP — the Committee for Scientific Investigations of Claims of the Paranormal — Paul Kurtz invited 35 prominent skeptics either to provide autobiographical reflections on their skeptical activities or to report on the current state of research on the areas in which they specialize. Contributors include Steve Allen, Martin Gardner, Philip J Klass, Joe Nickell, Michael Shermer, Victor J Stenger, and NCSE's very own Eugenie C Scott. The reviewer for *Publishers Weekly* wrote, "Here are writers who love to stir the stewpot of scientific controversy, adding investigative insights to the intrigue and serving up informative, educational essays that are accessible and entertaining."

Prometheus Bedeviled: Science and the Contradictions of Contemporary Culture
by Norman Levitt
In *Prometheus Bedeviled*, Norman Levitt attempts to "analyze the standing and the prospects of science in a society that is steeped in a democratic ethos, professes to admire science, and expects great things of science, but which, notwithstanding a massive educational system, comprehends science rather poorly", decrying the prospect of "the supplanting of science by a mélange of viewpoints and methods in which populist enthusiasm or even quasi-religious dogma will be anointed with the cultural authority of the 'scientific'". Richard Dawkins describes Levitt as "a new enlightenment hero, a post-postmodern Prometheus bringing fire to the bellies of scholars and students intimidated by obscurantist intellectual bullies and needing encouragement to fight back."

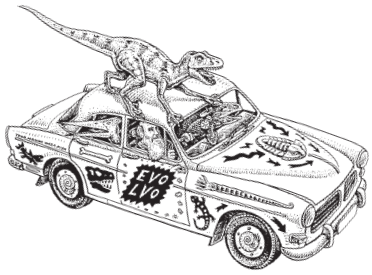
Skeptics and True Believers: The Exhilarating Connection Between Science and Religion
by Chet Raymo
Drawing on his own quest for a rapprochement between science and religion, Chet Raymo, Professor of Physics and Astronomy at Stonehill College and a science columnist for the *Boston Globe*, suggests that religion ought to embrace the findings of science and science ought to acknowledge and nourish the spiritual side of humanity. Praising *Skeptics and True Believers*, Stephen Jay Gould wrote, "These confessions of a wise religious humanist who also loves, practices, understands, and lives by the ideals and findings of science show us how to heal the false and unnecessary rifts in our intellectual cultures, and to bridge the gap between knowledge and morality."

The Borderlands of Science: Where Sense Meets Nonsense
by Michael Shermer
From the publisher: "As author of the best-selling *Why People Believe Weird Things* and *How We Believe*, and Editor-in-Chief of *Skeptic* magazine, Michael Shermer has emerged as the nation's number one scourge of superstition and bad science. Now, in *The Borderlands of Science*, he takes us to the place where real science (such as the big bang theory), borderland science (superstring theory), and just plain nonsense (Big Foot) collide with one another. ... [*The Borderlands of Science*] will help us stay grounded in common sense as we try to evaluate everything from SETI and acupuncture to hypnosis and cloning."

Two Skeptical Journals

Skeptical Inquirer
edited by Kendrick Frazier
Published bimonthly by the Committee for Scientific Investigations of Claims of the Paranormal and now in its 24th volume, *Skeptical Inquirer* ("the magazine for science and reason") "serves the public and news media, providing access to facts regarding the scientific investigation of claims of the paranormal from a skeptical point-of-view [and] enabling readers to separate fact from myth in the flood of occultism and pseudoscientific theories presented in today's culture." The *Washington Post* describes *Skeptical Inquirer* as "...A massive broadside attack on ... the New Irrationalism: Antiscience and Pseudoscience ... A devastating exercise in debunking ..." (Find *Skeptical Inquirer* on the web at <http://www.csicop.org/si>.)

Skeptic
edited by Michael Shermer
Skeptic ("a quarterly publication of the Skeptics Society devoted to the investigation of extraordinary claims, revolutionary ideas, and the promotion of science"), now in its 10th volume, publishes reports on and investigations of "claims by scientists, historians, and controversial figures on a wide variety of theories and conjectures including but not limited to: evolution, creationism, cults, religion, Holocaust revisionism, extreme Afrocentrism, conspiracy theories, near-death and out-of-body experiences, cryonics, life after death, witchcraft and witch crazes, mass hysterias and urban myths, hypnosis and altered states of consciousness ..." and many more. (Find *Skeptic* on the web at <http://www.skeptic.com>.)



NCSE on the Road

A Calendar of Special Events, Presentations, and Lectures

Date May 28, 2003
City Los Angeles CA
Presenter Eugenie C Scott
Title Evolution: Schools, Courts, Politics
Event Center for the Study of Evolution and the Origin of Life, Spring Banquet
Time TBA
Location TBA
Contact J William Schopf, schopf@ess.ucla.edu

Date June 18, 2003
City San Francisco CA
Presenter Eugenie C Scott
Title Writing Science for the Public
Event Pacific Division of the American Association for the Advancement of Science
Time TBA
Location TBA
Contact Eugenie C Scott, scott@ncseweb.org

Date June 21, 2003
City Chico CA
Presenter Eugenie C Scott
Title Is Intelligent Design a Form of Creation Science?
Event Society for the Study of Evolution meeting
Time TBA
Location TBA
Contact Eugenie C Scott, scott@ncseweb.org

NCSE Speakers Available

Name Eugenie C Scott
Title NCSE Executive Director
Contact scott@ncseweb.org

Name Glenn Branch
Title NCSE Deputy Director
Contact branch@ncseweb.org

Name Eric Meikle
Title NCSE Outreach Coordinator
Contact meikle@ncseweb.org

Name Alan Gishlick
Title NCSE Postdoctoral Scholar
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Name Philip T Spieth
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Name Phina Borgeson
Title NCSE Faith Network Project Director
Contact borgeson@ncseweb.org

Name Skip Evans
Title NCSE Network Project Director
Contact evans@ncseweb.org

For more information or to arrange a presentation, connect to <http://www.ncseweb.org/ourstaff.asp> or call NCSE.

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

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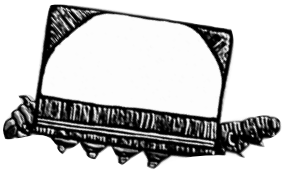
BOOKREVIEWS



Designer Universe: Intelligent Design and the Existence of God

by Jimmy H Davis and
Harry L Poe
Nashville (TN): Broadman and
Holman, 2002. 252 pages.

Reviewed by Margaret Gray Towne, University of Nevada, Las Vegas

This book targets Christians who seek to relate their faith to modern science yet who do not have formal training in science, philosophy, or theology. The authors state outright in the preface that they write from the perspective of faith and "[n]ot only do we believe that the universe was designed, but we also know the Designer" (p xvi). Furthermore, "[t]he Intelligent Design Movement is concerned that people believe in God as the cause of the universe and everything in it" (p xiv). While many books have been written on "intelligent design" recently, not all authors specify who the designer(s) might be. Davis and Poe maintain throughout this book that the God of the Bible is indeed the "Intelligent Designer". This is a key point, as the "intelligent design" thesis is being discussed and debated by school boards, politicians, teachers, parents, and other citizens in various states. Those in support of its being taught in public school science classrooms are usually careful to avoid specifying who the designer is.

The authors admit that their belief in God as the "Intelligent Designer" is based on faith (p xvi), yet they attempt in later chapters to support this thesis from a scientific perspective with demonstrable proofs. At the book's end (p 235), they state that "[t]he Intelligent Design Movement has made clear that it hopes to make design a recognized part of science." However, they repeat that "[s]atisfactory empirical evidence may be present to conclude that a Designer made the universe but that we receive this knowledge by faith" (p 237). If they believe that "design may be as elusive as God" (p 10), how then can it be scientifically established?

It was not clear in the book how the God of the Bible could be specifically and scientifically substantiated as the intelligent designer. On page 111, the authors ask, in reference to another proposal, "How scientific is a proposal that cannot be tested?" This same question could be asked about their thesis. Can the suggestion that the God of the Bible is the intelligent designer be tested? On page 120 they write, "[a]lthough the design movement does not prove the existence of the 'God of Abraham, Isaac, and Jacob,' its findings do provide insight into theological issues." No doubt that is true, but does it provide insight into scientific issues?

The authors give a very interesting, in-depth, historical overview of belief in a creator designer. The contributions of philosophers from ancient Greece through the Protestant Reformation, as well as those of various long-extinct groups such as the ancient Egyptians and Celts, are colorfully described. They note that the idea of a designer comes out of many heritages, not just that of the West; however, not all groups identify the same designer or define "design" in the same way. Davis and Poe seem to suggest that since most of the world's cultures over the miles and millennia believed in design, it must have credibility. This reasoning breaks down when applied to belief in a flat earth and geocentrism, which were also long affirmed yet proven to be untrue.

The authors accept the "intelligent design" thesis that life and the universe are so complex, awesome, unique, beautiful, specific, and even puzzling that they must be the products of an intelligent designer. They detail the complexity of DNA and proteins and their synthesis. They point to biochemical processes such as photosynthesis, nerve impulses, and the sequences of blood clotting as irreducibly complex and requiring an intelligent designer, because they supposedly cannot be explained through known scientific mechanisms. The authors do not consider that the Creator might have freed the universe to evolve atoms, molecules, metabolic pathways, and cells through dependable mechanisms and laws that can be understood. Could the intelligent designer have designed naturalistic evolution and let it fly? Recognizing scientific mechanisms does not preclude a Creator God. Evolutionary belief does not demand atheism. Denying the sporadic intervention of an intelligent designer does not deny a Creator God.

The authors suggest that the fact that all of life shares similar biochemistry (DNA, enzymes and other proteins, similar biochemical pathways, and so on) supports the design hypothesis. However, if a designer were continually at work, might there not be infinite variety, uniqueness, and individual design? Would not the universal relatedness of living things better support descent with modification, genetic and hereditary similarity, common ancestry, natural law, evolution? Homologous structures, which are discussed in the book, seem to imply this relatedness rather than the infinite possibilities of variation that an involved, intelligent designer would presumably be free to express.

A major point that is not clarified throughout the book is exactly what is meant by design. Is it accomplished sporadically, miraculously, minimally, benevolently, consistently, secretly, whimsically, intentionally, predictably? Is it the same as creating? Does it mean "from nothing" or "from something"? Is it equivalent to order, harmony, beauty, awe, intention, complexity, pattern? Could chaos come from design? Does design operate through hurricanes as well as through life-giving rain or sickle-cell anemia, which prevents malaria? Could it be operating through evolutionary mechanisms? Could

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"materialistic processes" have been designed? Must materialism rule out a designer who chose to design laws and chance possibilities? Does design refer to beginnings or origins or is it unfolding or operating, or both? How would we know? This is what is not clear. What *is* design? Is it a concept that explains the unknown? What happens when the unknown becomes known? Might the argument from irreducible complexity be an argument from ignorance? We cannot explain it, so it *must* have been intelligently designed. Is the unexplained necessarily unexplainable?

There are myriad questions that scientists have not *yet* answered, but it is hoped that many will be scientifically explained eventually. This motivates scientists to continue to research and question. Science's ignorance is not a vacuum into which a designer can automatically be dropped; inserting the "design hypothesis" does not resolve these unanswered questions.

Did X lead to Y or did an intervening designer lead to Y? Why did the designer intervene this time? Is design a manipulation of DNA? Does the designer use radiation, or chemicals, or miracle? Are adaptations (p 199) design? There are 4000 species of aphids. Were they all designed? Are there ways to know? What overarching purpose does the designer have? Is there just one designer? How can that be shown? If it is science, evidence is required.

Designer Universe covers many areas in considerable depth and presents the "intelligent design" thesis from a perspective of deep faith and belief in God. Its historical overviews contribute the most. It also informs on science and theology and triggers serious questions — what any stimulating book should do. It remains to be seen whether the "Intelligent Design Movement" will sufficiently demonstrate scientific authenticity one day — an objective that *Designer Universe* fails to meet.

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Design and the Existence of God

by Jimmy H Davis and
Harry L Poe
Nashville (TN): Broadman & Holman, 2002. 252 pages.

Reviewed by Bradley J Cosentino, Jason J Williams, Laura B Guderyahn, and Stephen B Hager, Augustana College

In *Designer Universe*, Davis and Poe long for the second coming — the second coming of "intelligent design" (ID) as an explanation for all natural phenomena in the universe. Until the emergence of David Hume's naturalistic philosophy in the late 18th century, the dominant philosophy in the Western world held that the universe was supernaturally designed rather than formed solely by natural processes. Much to Davis's and Poe's distress, methodological naturalism has dominated scientific practice since the late 19th century. Yet the authors believe that design should remain a vital part of scientific practice even today. In fact, the authors not only believe that a designer is responsible for all natural phenomena, but also say that they know the designer. To argue this, Davis and Poe attempt to re-establish non-scientific, faith-based arguments ("established pathways", as stated on p xv of the preface), which they believe show the consonance of ID and natural science.

Davis and Poe begin the book by taking the reader on a whirlwind tour of the world's past and present religions, explaining their fundamental ideas and identifying a common thread that supposedly unites all of them: the concept of a designer who created the cosmos. Aside from organized religions, the authors then argue, the idea of design can be found within the philosophies of Aquinas, Descartes, and Pascal, among others. *Designer Universe* goes on to summarize basic chemistry, biology and physics in such a way as to argue for design on the basis of the fine-tuning of the universe. In other words, only a designer could have produced the unique natural properties inherent in the universe. This fine-tuning argument is not new and has been used previously by other "intelligent design" creationists (Oord 2002). Unfortunately, Davis and Poe expand on this misguided conclusion by reflecting on the philosophical significance of the natural properties of the cosmos, especially as it relates to humans. They state that since the natural world has so many constants and since humans fit so well within these seemingly improbable constants, this, too, is evidence of an intelligent designer.

Davis and Poe then attempt to use this argument for design as evidence against Darwinian naturalism. However, they fail miserably at this. They scarcely analyze the details of evolutionary biology and barely mention the fundamental arguments of ID proponents, limiting their coverage to William Dembski's SETI-like approach to testing for evidence of design in the universe and Michael Behe's concept of irreducible complexity. Nor do they attempt to touch the larger, more fundamental issue of how or why Dembski's and Behe's claims clash with Darwinian naturalism or evolutionary theory — or even to note that scientific research has refuted these claims (Miller [2002] identifies how the molecular constituents of several biochemical processes function in other capacities, and thus refutes Behe's claim that these processes are irreducibly complex).

It is possible, however, that this disjointed and incoherent argument results from the primacy of faith in the authors' worldview. According to Davis and Poe, naturalistic science — a term they use to describe all of the wondrous objective realities in the world — simply lacks the explanatory power that faith provides. To understand the universe and all its complexity, the authors contend that one must perform science from a perspective of faith — something that most ID proponents actually deny in public. In

This review was the outcome of a summer reading project of the Darwin Club, which is a student organization at Augustana College that seeks to inform the public about evolutionary theory.

effect, it seems as though the authors want something different for the ID movement. They are not mainstream ID supporters at all. For example, Davis and Poe want scientific investigators to begin from the perspective of faith and to confirm their faith with scientific evidence. On the final page of the book, they write, "Satisfactory empirical evidence may be present to conclude that a Designer made the universe but that we receive this knowledge by faith" (p 237). Thus, the conflict between *Designer Universe* and prominent ID proponents such as Dembski and Behe is over which comes first: faith or science. However, the authors never explicitly reveal the rift between their beliefs and the mainstream ID movement, a phenomenon previously identified by Pennock (1999). They cast themselves as part of a unified and coherent ID program rather than as faith-based theologians. We suspect that the authors' faith-based foundation for ID makes the members of the Discovery Institute's Center for Science and Culture (CSC) cringe in their creationist boots. (The CSC has as one of its missions "The Wedge Project", which is based on the acknowledged desire to replace the current naturalistic methodology of science with ID [Still 1999].)

In *Designer Universe*, Davis and Poe have explicitly, though unconvincingly to the informed reader, imposed their Christian faith on ID — a program that prides itself on its supposed empiricism — at the same time discrediting the scientific process that has allowed the discovery of all the awe and wonder they find in nature. The irony here is that Davis and Poe actually believe a scientific process free of naturalism can be possible. They do not understand that a science free of naturalism is inherently unscientific! Despite this, many orthodox Christians ignorant about the ID movement and its public agenda to have ID taught in public schools will undoubtedly find this book full of new and persuasive ideas. But those who are initiated to the debate between evolution and ID know better. Davis and Poe use the same old erroneous arguments that are found in the creationist literature. The unfortunate outcome is that *Designer Universe* only succeeds in furthering the confusion and misinformation found within our society concerning what evolution is really about and the relationship between evolution (and much of science) and faith. Indeed, all that really surfaces after reading *Designer Universe* is the acknowledged desire "to make design a recognized part of science" (p 235), and therefore the political rhetoric of all ID supporters to have creationism (under the auspices of "intelligent design") an integral part of the science classroom in public schools.

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The Ghost in the Universe: God in Light of Modern Science

by Taner Edis
Amherst (NY): Prometheus Books, 2002. 326 pages.

Reviewed by David Eller

The French mathematician and scientist Laplace famously answered the question of why he left out any mention of God from his book on celestial physics with the words, "I have no need of that hypothesis." Edis's book is a reaffirmation and extension of that answer, showing how there is in fact no ghost in the universe at all — no major conceptual or empirical problems that science has not solved or promised to solve without reference to any god(s).

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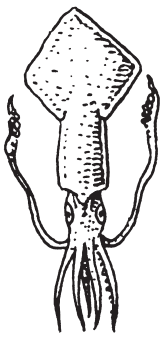
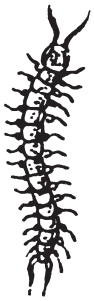
The book is a wide-ranging discussion of issues both scientific and historical, from biological evolution to sacred texts and morality. He starts by asking the provocative question, Does God exist? While he remains respectful of religion, saying "we have a lot to learn from religion", he concludes that there are excellent reasons to disbelieve in God (a position known as positive atheism, as opposed to negative atheism, which merely claims that there are no good reasons to believe). Theistic scientists will find his secularism discomfiting, and avowed atheists will find his openness to religion frustrating, but his argument is worth setting aside one's personal convictions.



The book contains nine chapters, of which two or three will most interest the strictly scientific reader. These chapters cover theological and philosophical notions of God, evolution, physics and cosmology, history and sacred texts, the historicity of Jesus, miracles, mysticism and the mind/brain problem, faith and reason, and morality. All of them are written for the informed generalist or layman, although a little scientific background helps. For the professional scientist, there is still enough insight and detail to make the discussion, especially outside of his or her own specialty, useful and engaging.

The chapters that bear most directly on science are the second and third, with relevant explorations in the seventh (mysticism) and eighth (reason). In the second chapter (evolution), there is a worthwhile examination of "intelligent design", with which all scientists need to be familiar. The third chapter (cosmology) naturally ranges over the Big Bang, quantum physics, and the so-called "anthropic principle" — another back-door theistic notion that scientists need to know about. The seventh (mysticism) reviews the "scientific" argument about mystical experiences and brain states, although without reference to Newburg and d'Aquili's popular work on the sub-

ject. The eighth (reason and faith), which I might have placed earlier in the book, starts with a chilling quote from Martin Luther to the effect that reason is the greatest enemy of faith because it does not aid spiritual things. People who are looking to learn more about the nature of reason and the "postmodern" challenge to science (as little more than an opinion or a "worldview") would be well-served to spend some time there, but the Luther quote says everything that we need to hear about reason and its relation to faith. Reason is, to paraphrase Steven Weinberg, neither for nor against faith but profoundly disinterested in it.



For those who are interested in the more specifically religious subjects, the chapters on scripture, the historical Jesus, and so on are worth a look. Also, these "non-scientific" chapters help to advance Edis's main thesis, which is not stated explicitly until well into the book: that if there is a "ghost in the universe", it is randomness and accident. The mistake theists make, he asserts, is that they misrepresent science as narrowly concerned with "law" and nature as narrowly characterized by "regularity", leaving a gap of creativity and order that can only be filled with intelligence and intention. Edis makes the point — and supports it with illustrations from nature, scripture, and history — that the universe is in fact a unique combination of the regular and the random, the lawful and the accidental. History is the fundamental theme: a world that has evolved to this particular state is "a deeply historical world. The evolution of the universe is constrained by the frozen accidents of the past, but novelties also keep arising from, again, accidents. Ours is not a world to be summed up in a few equations" (p 106). Thus, as Gould has said, if we rewound the "tape of time" and let it run again, it might run very differently.

Edis drives his point home well with his analyses of scripture and religious history. Not only natural laws but also social facts are the result of specific identifiable events and the crystallization and institutionalization of successes, failures, or pivotal decisions. While not advocating a "science of history" — one can no more sum up human history than natural history in a few equations — it does show that, with a few diverging events, the religious face of the world could have been very different, too.

If there is one shortcoming of Edis's religious discussion, it is that he focuses exclusively on the Judaeo–Christian–Muslim complex of religions. He does mention Buddhism in the mysticism chapter, but other religions, including traditional, animistic, "non-theistic" religions, are completely absent. But fair-minded observers of religion cannot allow one religious view to hijack and dominate the "god-talk", nor can we assume that everyone who uses the word "god" even means the same thing by it. In the end, the best argument against God may not be science but all the other gods.

Ultimately, in his main thesis, Edis probably has his finger on the issue that will distinguish the science of the future from the science of the past and that will forever remove the "gaps" into which theists thrust their god(s). While science cannot prove that there are no gods, it can do what Edis, along with Weinberg and Laplace, have suggested it does: demonstrate that there are no "ghosts" in the universe at all — no need for any other hypotheses than the ones naturalistic science offers.

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Ivory Bridges: Connecting Science and Society

By Gerhard Sonnert with the assistance of Gerald Holton
Cambridge (MA): The MIT Press, 2002. 227 pages.

Reviewed by Jon P Alston, Texas A&M University

The authors of this slim work (115 pages of text and 110 pages of appendices and references) challenge the commonly held stereotype of the scientist/researcher as living in an ivory tower isolated from the rest of the society. While there are scientists who follow their interests irrespective of the practical "good" their research might result in, this stereotype is in large part mistaken. Rather, researchers are often very interested in policy-driven research and in conducting pure research in the hopes of solving selected problems; NASA-supported work on space and related issues, cancer research, and the development of the atomic bomb are all conducted with practical, specific, aims in mind, though the answers may not be clear at the time of the research. Scientists also are concerned with the consequences their findings might have on the general society.

Research that hopes to maximize the common good is subsumed by the authors under the concept of *Jeffersonian Science*, which involves

Molecular Complexes Do Double Duty

Scientific evidence that complicated microbiological and biochemical systems may have built-in flexibility continues to mount. Research showing that individual proteins can have more than one function raises serious challenges to both "irreducible complexity" (from Behe) and "complexity-specification" (from Dembski). See, for example:

Burkhard P, Strelkov SV, Stetefeld J. Coiled coils: A highly versatile protein folding motif. *Trends in Cell Biology* 2001 Feb; 11 (2): 82–8.

Petka WA, Harden JL, McGrath KP, Wirtz D, Tirrell DA. Reversible hydrogels from self-assembling artificial proteins. *Science* 1998 Jul 17; 281: 389–92.

Shah DS, Perehinec T, Stevens SM, Aizawa SI, Sockett RE. The flagellar filament of *Rhodobacter sphaeroides*: pH-induced polymorphic transitions and analysis of the *fliC* gene. *Journal of Bacteriology* 2000 Sep; 182 (18): 5218–24.

[*Thanks to Dave Ussery for sending these references along.*]

both basic research and policy-driven science; science in this context, however, has as its aim the ultimate benefit of the society and always has practical motivations. Under such a model, researchers are faced with dealing with the demarcation of politics and science and limitations on research found in any democracy; often politics drive research agendas.

Such concerns are not found in the traditional ivory-tower view of science, *Newtonian Science*, in which the researcher is guided in the selection of research topics by personal curiosity, the discipline, a desire for prestige, or unanswered questions in one's field. Newtonian science is guided by the search for "mastery of the world of sensations" rather than to provide solutions to practical problems. The irony, of course, is that seemingly pure research often has valuable spin-offs that do provide answers, though such payoffs are impossible to predict at the time of the research and may take years to be developed on a practical level.

A third model of scientific endeavor is the *Baconian Model* of scientific research. This model, more common in industry, encourages research that is guided by the expectation that practical knowledge and societal benefits will be the results. Such research may be "pure" rather than goal-oriented (applied) — though the distinction is ambiguous at times — in that there is no real certainty of practical results; we can divide those who seek practical solutions at the outset (engineers) from those who do not (scientists). Baconian science is favored by tax-paying citizens, since it promises to provide direct and more immediate benefits. Unique American responses to the demands to provide scientific benefits were the establishment of land grant universities and agricultural and engineering extension programs supporting both solutions to specific problems (better plants and more productive animals, earthquake-proof buildings) and basic research (genetics, stronger construction materials).

The authors show that scientist–researchers, who are also scientist–citizens, administrators, and members of professional organizations, have become increasingly involved in the political arena and in educational efforts to support and legitimize their work and values. The importance of the federal government in funding science is alone a reason for scientists to become part of the decision-making process.

In addition, scientists and researchers are also citizens and may wish to promote their causes and values. The authors give examples of numerous attempts of political activism by scientists to influence affairs, often by establishing organizations to present their cases or delivering manifestos. The current wave of such activism on the part of scientists (intellectuals would be a more comprehensive term in this context) has coalesced around the advances in biotechnology, genetics, information technology and privacy, and global warming. In each issue, participants have lobbied the federal government and presented their cases to the general public.

The authors ignore the conflict such activism can generate, as can be found in the issues of the environment, abortion, and the creationism–evolution controversies. The public sees scientists with proper credentials disagreeing with one another, much as do expert witnesses in a trial, where both sides of an issue are supported by scientific claims. This can result in the belief among the public that scientists can support both sides of an issue and therefore should not be automatically believed, that there are two sides to each issue, and that science cannot provide clear answers to important issues.

Appendix D provides an extensive list of scientists' voluntary public interest associations (including NCSE) that promote their causes to the general public and federal committees, as experts and authorities. The list is surprising in its length, and shows that citizen-scientists, their disciplines, and scientist-administrators are vocal and active in the public arena.

The authors conclude that the ivory tower must be linked to the public and government departments. In a democracy, and where government officials (not always scientists themselves) make vital decisions concerning the direction of scientific endeavors, there is no choice but to make one's case as clearly and as loudly as possible.

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And God Created Darwin: The Death of Darwinian Evolution

by Duane Arthur Schmidt
Fairfax (VA): Allegiance Press,
2001. 207 pages.

Reviewed by Glenn Morton

This is an ignorant book — written by the ignorant, for the ignorant — and attested to by a professor of law. This is the first book by Duane Schmidt, a retired dentist. His avowed purpose is to change the minds of the theistic evolutionists. This book, which is recommended by Phillip Johnson, will not achieve its purpose, because it has more factual errors per page than any creationist book I have ever read, save one.

The book is divided into 13 chapters with such titles as Darwinians' Deceits, Darwinians' Deceptions, Darwinians' Deflections, Red-Faced Scientists, and Mickey Mouse Science, among others. These titles gives the correct gist of this poorly written book. The main thesis, repeated over and over, is that every piece of evidence evolutionists have is totally fictional. *Eslabon imaginario* is a phrase which occurs over and over, taken from a museum exhibit in the Galápagos Islands. Schmidt's claim is that radiometric dating, the fossil record, beneficial mutations, natural selection, vestigial organs, and homology are all myths — fictions made up by people opposed to God.

Since some readers of this review might run into some of

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these arguments, it is useful to point out some of the factual errors and claims. They run the gamut, from simple errors in fact to downright distortions and misrepresentations.

Here are some of the simple errors. Schmidt will surprise many people by the claim that Stanley Miller performed his famous experiment in the 1960s (p 28). It was in 1953. He alleges (p 114–5) that anthropologists believe *Homo erectus pekinensis* ("Peking man") is an ape. He claims (p 125) that a Hualalai eruption on Hawaii was from Kilauea. He maintains (p 133) that there is only one specimen of *Archaeopteryx*: there are 7 plus one feather. He seems unaware (p 135) that Scopes was convicted in the famous "Monkey Trial" because he wonders whether more creationist information would have changed the outcome. He claims (p 12) that scientists have mapped 3.2 billion genomes. Given that there are only about 10 million species on the planet, the problem with the claim becomes obvious.

Unfortunately, the misinterpretations and distortions are even more outrageous that the simple errors of fact, though no less numerous. For example, there is the old saw that geologists date the age of rocks according to the wishes of evolutionary biologists (p 47, 121), giving the age the biologists need. Schmidt does not bother even to criticize radiometric dating.

In what is certainly an example of why evolution should be taught better in schools, Schmidt ignorantly asserts that evolutionists require that a daughter species kills off the parent species (p 44–6) — not so, of course. He further states (p 93) that no beneficial mutations occur whatsoever — except in the mind of the evolutionist. He asserts (p 94) that it takes many billions of minute changes for the evolution of a species. He obviously is unfamiliar with the work on monkey flowers (genus *Mimulus*) that shows that only 8 mutations control the majority of morphological change (*Nature* 1995; 376: 762). He declares that there is no intermediate between single-celled and multicellular life forms. He obviously has not studied the *Volvox*, whose species show such a sequence.

He alleges (p 142–3) that microbes require as much genetic information as exists in the New York City library. The average book has about 1 million bytes of information; bacteria like *M genitalium* have about half that much information in the genome — around 600 000 bytes of information (*see "Trading on genomes: Recent creationists use genomic data from mycoplasmas",* RNCSE *2002 Sep–Oct 22 [5]: 30–5*). But these errors are only half the story.

Schmidt inadvertently acknowledges his ignorance when he complains that scientists use "semantic browbeating" as a way to deceive people into believing science (p 60). He defines this as any technical jargon (which he calls "a syllabic morass") that is not understandable to "the man in the car pool or soccer moms". And amazingly, on page 61, he charges that scientists use "as many syllables as possible" so that no one can understand what they mean. This clearly is an admission that the author is too lazy to do the hard work of learning the subjects about which he is writing.

One of the most ignorant statements in the book is the assertion that evolutionists use biological data to support evolution (p 64). What on earth is one to use for support of evolution if not biological data? And in a display of unimaginativeness, Schmidt fills the book with hundreds of unanswered questions critical of evolution. They are unanswered simply because Schmidt chooses not to answer them, but he implies that evolutionists *have* no answers. This is a typical young-earth tactic. Ask questions, give no answers, and hope your reader knows no more than you.

Schmidt makes an *ad hominem* attack on Darwin for having married his cousin (p 192). He asks why the great biologist did not know that inbreeding was bad — not to mention being outlawed by the Bible. He suggests that the illnesses suffered by Darwin's children (including some of their deaths) was a direct result of this inbreeding. Schmidt conveniently ignores the fact that Abraham married Sarah who was his half-sister, an even closer relation than in Darwin's marriage (Genesis 20:12).

The most amazing thing about this error-ridden book is that Phillip Johnson endorsed it. It clearly raises the issue of whether Johnson is interested in truth, or only in winning the case for his client, like a good lawyer. I see no benefit Johnson could possibly get from endorsing this error-laden book.

In closing, this book is not worth the money, even as a prime example of the worst sort of anti-evolution distortion.

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Moral Darwinism: How We became Hedonists

by Benjamin Wiker
Downers Grove (IL): InterVarsity Press, 2002. 328 pages.

Reviewed by Van A Harvey, Stanford University

As Robert T Pennock showed in his book *Tower of Babel* (Cambridge [MA]: MIT Press, 1999), creationism can no longer be regarded merely as a fundamentalist attempt to preserve the literal meaning of the Bible; rather, under the new rubric of "intelligent design" (ID), the movement now includes within its ranks some highly sophisticated writers who reject evolution for many diverse reasons. *Moral Darwinism* does so, for example, because the author believes that evolution rests on materialistic and atheistic assumptions subversive of morality and religion. Wiker's aim is not limited to showing Christians that Darwinism is utterly incompatible with Christianity; he also wants to convince intelligent readers that Darwinism is not a science based on evidential grounds, but an atheistic ideology bending all of its findings to support a secularized and materialistic worldview that was first proposed by the ancient Greek philosopher Epicurus. This worldview is "rooted in the desire to keep the universe closed … so that the divine may not re-enter" (p 294).

Moreover, he argues that Darwinism not merely is a materialistic theory about nature but neces-

sarily entails a hedonistic ethic — the implications of which can be seen in Social Darwinism, the eugenics movement, the widespread tolerance of homosexuality, euthanasia, suicide, and, at the margins, bestiality. These immoral consequences, Wiker argues, constitute the reason why we are now engaged in the so-called culture wars and why the contemporary moral debates over abortion, euthanasia, and homosexuality are so hopelessly irreconcilable. "Peaceful coexistence" between evolutionists and anti-evolutionists is "impossible in our culture" (p 24).

Now it has always been one of the strategies of anti-evolutionists to argue that, because evolution is "just a theory", it is only fair that ID be given equal time in the schools as an alternative theory. Wiker's book may be seen as an attempt to ratchet up this argument still further: first, by attempting to show that Darwinism is not a legitimate scientific theory but simply a modern version of the materialistic faith proposed by Epicurus; and second, by asserting not just that ID is not just an alternative hypothesis worthy of consideration but that

> from scientific evidence open to all, we can infer that nature has an intelligent designer. Further, we can extend these arguments philosophically, demonstrating that the intelligent designer is God, and thereby have *knowledge* that God exists … through a study of the natural order (p 77; italics in original).

The greatest part of the book is devoted to the first of these goals while the second is merely asserted.

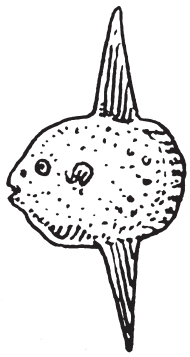
In 8 of the 9 chapters, Wiker takes us though his highly selective version of Western thought. He attempts to show first how "it all started with Epicurus". Then he turns to Lucretius — "the first Darwinian" — and how his philosophy is incompatible with Christianity. After the fall and the re-emergence of Epicurean materialism in the Renaissance, it becomes triumphant in Newtonian science, which banished all supernatural causation. This materialism, in turn, is used by Hobbes, Spinoza, and DF Strauss to undermine the authority of Scripture, preparing the way for the final embrace of Epicurean materialism by Darwin. The final chapter on "how we became hedonists" attributes all that Wiker finds reprehensible in Western society — Social Darwinism, the eugenics movement, birth control, Planned Parenthood, and the acceptance of perverse sexual behavior as exemplified in the Kinsey Report — on this Epicurean materialism.

The conclusion Wiker draws from this history is that (1) since modern science itself no longer embraces the materialistic universe of Newton and Darwin, and (2) since this materialism itself was built on a faith, then (3) science should once again reassess the notion that nature is a closed system. ID, in short, is a live alternative once again.

It would take a review as long as Wiker's book to show the selective and tendentious nature of his historical interpretation, the force of which is to argue that it is the acceptance of materialism that is the primary reason that scientists and historians cannot appeal to supernatural causation to explain natural processes and events.

From Wiker's treatment of Darwin, for example, the reader would never learn that Darwin started out as a creationist and only gradually came to discard Paley's view that organisms were perfectly adapted to the environments, that the geological evidence was incompatible with a universal flood, that the boundary between species was more fluid than supposed, and that natural selection was a more useful hypothesis than the directed variation proposed by Lyell and Herschel. Because Darwin often operated "by faith" — that is, he had no way to explain heredity and no precise explanation for some of the biologic processes that underlay his evolutionary model — Wiker therefore concludes that it was Darwin's implicit materialism that accounts for his rejection of teleology and the Aristotelian notion of essential species.

Another problem with this book is Wiker's use of the umbrella-like term "materialism" to explain and dismiss the biblical criticism of Spinoza and, especially, DF Strauss. In the case of Strauss, it was not Epicurean materialism that led him to rule out miracles as a principle of historical interpretation but his Hegelian idealism. The point of Strauss's book was to show not only that both supernatural and rationalistic interpretations of the miracle stories in the New Testament were untenable, but also that Hegel's acceptance of Christianity was inconsistent with his own view that the Universal could only be seen in the entire unfolding of the Absolute Spirit in history. It could not be manifested in a single individual, Jesus Christ.



In these examples, as in others, it is clear that Wiker's real objection to modern thought is twofold. The first is that it affirms a "closed universe" — which is to say that it does not use or permit the appeal to miracles and divine intervention as a principle of public explanation. The second is that Wiker contends that any such naturalism leads to immorality.

So far as the first claim is concerned, Wiker does not consider the possibility that even if Darwin, Spinoza, Locke, and Strauss *were* materialists as he claims, there are good methodological reasons why scientists and historians do not appeal to supernatural causes and "intelligent design" to explain events and processes. In the case of historical inquiry, for example, it simply is not possible to know whether a given event is a miracle; and in the case of natural science, one has no way of knowing antecedently what a divine intelligence would intend as regards nature.

The second claim — naturalism leads to immorality — will be puzzling to many readers until they understand that throughout his book Wiker appeals to what he calls "the great law of uniformity". This "great law", it turns out, is Wiker's conviction that every morality assumes a cosmology, and every cosmology assumes a morality. The consequence of this "great law" then is that if science treats nature as "amoral", then it must correspondingly regard human behavior as amoral.

An adequate discussion of this alleged "great law" would involve still another discussion beyond the

limits of this review. Suffice it to say that, for Wiker, this "law" apparently means that if one holds that nature is "amoral", it would be inconsistent for one to argue for a morality — say, altruism — that made no claims to find its justification in nature. Wiker could not accept the notion that one could consistently look upon science as a pragmatic way of dealing with the world or providing the best explanation for certain processes while at the same time advocating an ethic that was not exemplified in nature. He thinks that one could not, for example, accept the principle of natural selection and at the same time oppose eugenics. I find this utterly unconvincing.

One final but not unimportant observation. One of the professed aims of Wiker's book is to show that Epicureanism is incompatible with Christianity. But just as Wiker uses the term "materialism" to mean the exclusion of any appeal to supernatural intervention in the world, he limits the term "Christian" to those who accept supernatural interventions and, above all, a natural law theory that requires essentialism, teleology, and an ethic built upon these concepts. In a fleeting but revealing aside, Wiker concedes that his argument is in defense of only one kind of Christianity. He writes that "in order to avoid the tiresome repetition of this distinction … when I say 'Christianity' I will simply mean the kind of Christianity compatible with 'intelligent design'" (p 76). In short, we have no discussion in this book of those many Protestant and Catholic theologians who have argued that we can have no unaided rational knowledge of an intelligent designer and who, consequently, reject the notion that ID can be proposed as an alternative scientific theory. Nor do we have any discussion of those philosophers and theologians who have rejected natural law theory or who have argued that no person can find natural law philosophically convincing unless he or she has already embraced a certain form of theism.

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Trilobite!: Eyewitness to Evolution

by Richard Fortey
New York: Alfred A Knopf, 2000.
287 + xiv pages, 16 plates.

Reviewed by Kevin Padian, NCSE President

Perhaps the title "Trilobite!" does not have quite the threatening ring of "Jaws!" or "Carnosaur!" (with or without the exclamation point), but the subtitle really gets to the meat of the book. The trilobites *were* eyewitnesses to evolution in many different ways. Richard Fortey, trilobite specialist at the Natural History Museum in London and a fine writer, is an ideal guide, not just for his expertise in the animals, but for his literate approach to the history of knowledge about trilobites and for his ability to use them to show how scientists approach evolutionary problems with fossils.

Fortey is the author of several excellent books, including *Life*, *Fossils, the Key to the Past*, and *The Hidden Landscape*. Far more than a taxonomic specialist, he has spent his career studying the importance of trilobites to major problems in evolution, including their relationships, their geographic spread and what this might say about correlating rocks from ancient ocean bottoms, and their morphological diversity and functions. Given the scope of his other books, it is not surprising that Fortey chose to introduce readers to his beloved fossils using a problem-centered approach (rather than a dry, taxonomic, textbook-like one). An especially pleasant added value is his penchant for literature, local history, and the development of the field with all its personalities, which allows the reader a vivid and close look at the science.

"Eyewitness" is an especially apt theme for the book. Fortey begins by taking us to a spot on the North Cornwall coast called Beeny Cliff. This is where Thomas Hardy famously situated a scene in his early novel *A Pair of Blue Eyes* that became the archetypal — and literal — cliff-hanger of Victorian prose. In the novel, Knight, one of the protagonists, slips and tumbles over the edge of the cliff. Clinging to his life, desperately waiting for aid, Knight comes face to face with a trilobite embedded in the rock, which stares at him with stony eyes dead for millions of years. Instead of seeing his life flashing before him, Knight, an amateur scientist, sees the *history* of life — from primordial slime to iguanodons and mammoths. It has been known for some years that Hardy cribbed the paleontological knowledge in this passage from one of Gideon Mantell's popular books of the time. Fortey reveals another twist to the cliff-hanger: there are no trilobites in that particular geologic section.

But the eyes of the trilobite that stared at Hardy's Knight are amazingly complex and varied structures, originally formed of calcite. Trilobites retained this ocular legacy through their evolutionary history, but found ways to modify the crystal structure and the number and size of the lenses. Recent technology has enabled scientists to model and simulate the structure of these eyes in order to understand just what trilobites saw and how the eyes evolved. They certainly witnessed a great deal of geologic history.

Trilobites are distributed all over the world, from the Cambrian to nearly the end of the Permian, roughly speaking the first 300 million years of the good fossil record that we call the Paleozoic Era. From their earliest appearance they are quite diverse, and they are notorious for their rapid rates of origination and extinction of species. This is borne out by Fortey's remark that even in the Early Cambrian, trilobite faunas are different from one another in different parts of the globe. As continental shelves separated and collided and moved all over the world, the trilobites kept pace. Like few other groups, they point geologists to rock strata that have similar faunas that reflect deposition at about the same time. This has helped tremendously in correlating and connecting ancient pieces of real estate into a cohesive history of geologic strata.

Fortey's book also covers the people who have been witness to the developing understanding of

trilobites, which were first interpreted as odd flatfishes. He paints fine portraits of geologists and paleontologists who have braved rain, cold, and provincial cooking to search out these petrified beasts in the remotest places. Fortey recounts how knowledge of the trilobites expanded through time as better-preserved specimens revealed a fantastic diversity of eyes, legs, segments, and spines. And he explains how recent advances in developmental biology have revealed the probability that *Hox* genes underlay these variations, just as they do in living arthropods. One of Fortey's most interesting portraits, to me, was his account of the Cambrian "explosion" of trilobites and other invertebrates. Fortey cuts through a lot of the silliness about "phyla" and timing of diversification that seems to flummox creationists like Jonathan Wells and Phillip Johnson — neither of whom is conversant with the evidence.

Readers should not expect to find an omnibus reference book on trilobites. Fortey has a lot to teach about trilobite structure, diversity, and evolution, but his book is far less pedestrian and far more engaging than a more text-like treatment would have been. Rather, he has used trilobites as a vehicle to explain a great many aspects of evolution, geologic history, and how we know what we know about these ancient animals and the problems that they illuminate. Besides, his prose is genial and knowledgeable and his diction is superb. We in the field of evolution are lucky to have a great many fine writers, and Richard Fortey is one of the best.

A word of caution: Trilobites are among the most popular and available invertebrate fossils — in particularly a number of species from Morocco, some of which Fortey figures in his book with elaborate spines, horns, tails, and legs. But *caveat emptor*: commercial purveyors often "restore" the finer and more lucrative details, and your local fossil emporium might not know this (or tell you).

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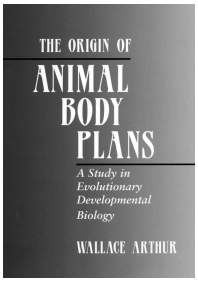

The Origin of Animal Body Plans: A Study in Evolutionary Developmental Biology

by Wallace Arthur
New York: Cambridge University Press, 1997 (paperback, 2000).
352 pages.

Reviewed by Laurie R Godfrey, University of Massachusetts, Amherst

Neo-Darwinism is a product of research conducted in the mid-20th century that culminated in a "new" or "modern" synthesis of Mendelian population genetics and Darwinian naturalism. Throughout its formation, the Modern Synthesis placed an emphasis on two components of evolutionary change: the destructive force of natural selection and the creative force of mutation. According to the Modern Synthesis, the environment provides the context in which selection operates on variation produced by mutation, and the way selection behaves depends on that external context. The focus of evolutionary theory in the mid-20th century was on genes and environments; development played a minor role. Because mutations were perceived as random and the variants thus produced were perceived as differing in minor ways, the question of how variation is produced was generally considered neither interesting nor important. Merely through its power to disallow certain variants while permitting others to survive, the destructive force of natural selection could control the direction of evolutionary change. According to this perspective, time is empowering. It is the destructive force of natural selection that provides direction to evolution, while the creative force of mutation is nondirectional.

Evolutionary theory has changed dramatically in the late 20th and early 21st centuries with evolutionary developmental biology as its centerpiece, and Wallace Arthur is at the forefront of that change. Evolutionary developmental biology examines the role of development in the production of variation — the ways in which development constrains the production of form, how selection can act independently of the external environment ("internal selection"), and how genes interact during development. It promises to build a bridge between mechanisms of population genetics and evolutionary ecology, and comparative anatomy and paleontology — a new "new synthesis" of established disciplines. It promises to address the nonrandom nature of the variation upon which natural selection acts, and why certain developmental pathways are more likely than others.

Furthermore, rather than shying away from the biggest, most vexing questions in evolutionary biology — rather than addressing them only partially by invoking small changes over huge periods of time — evolutionary developmental biology embraces them head-on. Some of those big questions revolve around the origin of the 35+ animal phyla (each fundamentally distinct in body form). Others revolve around their evolutionary relationships. Yet others revolve around what Niles Eldredge has called the "herky-jerky" nature of variation in the fossil record — the *geologically* sudden appearance of certain taxa. Why have no phylum-level *animal* body plans arisen during the last 500 million years of geological time (that is, since the Cambrian), while the same is not true of plants? Why does an explosion of animal body plans occur in the paleontological record during a relatively limited period of time? Are neo-Darwinian explanations (that is, as embodied in the old "New Synthesis") sufficient to account for the origins of distinct body plans in time and space? These questions, and others, are the subject matter of Wallace Arthur's book *The Origin of Animal Body Plans*.

This is an excellent, data- and theory-rich, thought-provoking book.

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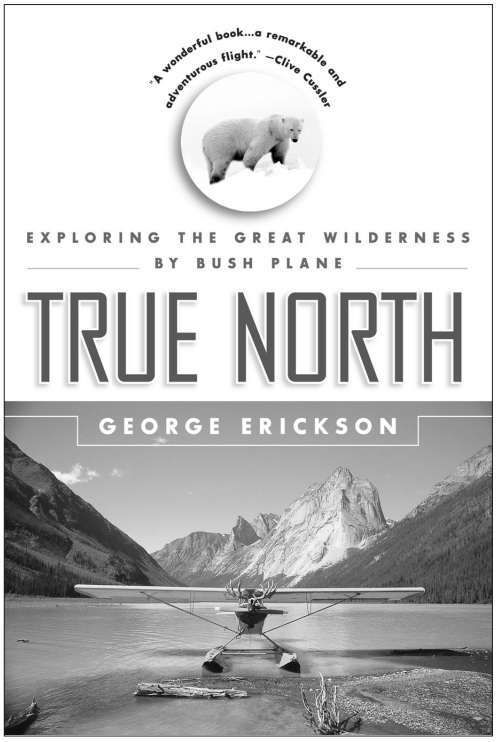

John Cole, past president of NCSE, past editor of *NCSE Reports*: "An excellent book by a best-selling author who donates his profits to groups like the NCSE!"

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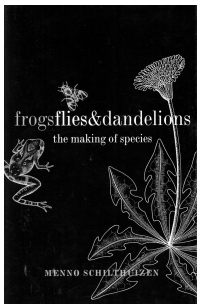
True North can also be purchased in stores or on Amazon, but specify the author.



Frogs, Flies, and Dandelions: The Making of Species

by Menno Schilthuizen
Oxford: Oxford University Press, 2001. 245 pages.

Reviewed by John Wilkins

It makes the excitement of modern evolutionary theory accessible to the general public. The premise of this book is that, if we are to understand the evolutionary origins of animal phyla and the relationships among them, we must better understand the developmental basis for the production of variation. We must consider not merely those external environmental factors that might influence the success of adaptive radiations, but also those aspects of the production of form that might make adaptive radiations possible in the first place.This book reviews the fossil and molecular evidence for the origin and evolutionary divergence of animal phyla, as well as major concepts of the discipline of evolutionary developmental biology (*Hox* genes, internal selection, developmental constraints, and so on). The genome is dynamic, subject to exon shuffling, gene duplication, gene conversion, and unequal exchange between chromosomes. Wallace Arthur describes these processes and shows how they may be critical to origin of body plans. He argues that mutation does play a directing role in evolution.

Wallace Arthur is not an anti-Darwinian, and he is certainly not an anti-evolutionist. He does not invoke higher-order mechanisms to explain evolutionary change, and he is comfortable in a world in which selection operates in local environments on variation produced by mutation. But he, like so many contemporary evolutionary biologists, believes that the Modern Synthesis of the mid-20th century paid insufficient attention to the mutational and ontogenetic basis of the production of variation on which selection operates. Neo-Darwinism, to Arthur, is not "wrong" but it is incomplete and "horribly lopsided". This book helps to remedy that situation.

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It is a commonplace these days to note that Darwin, in his *Origin of Species*, actually failed to account for the origin of species. Instead, it is said, he accounted for the origins of adaptations. On the difficult and, even back then, contentious, subject of speciation, he made only a few and unconvincing comments.

The current orthodoxy in evolutionary biology is that species are formed through a process called *allopatric speciation*, proposed in Darwin's day by one Moritz Wagner. In allopatric speciation, populations of a species become separated from the main range, and undergo more or less random changes until they are no longer properly interfertile with the "parent species", and a new species is formed. Adaptations are the subsequent effect of being isolated by geography, not the reason for speciation. Those who, like poor Darwin, think that species are formed through natural (or sexual) selection in one location — through *sympatric speciation* — are proposing an outdated and debunked view.

The arguments are presented in this book with as much attention to detail — and to both the biology *and* the personalities — as in any book I have seen. Schilthuizen is that extreme rarity — a biologist who writes entertainingly and clearly for lay audiences. He also has the ability to lay out his opponents' views fairly. And he has opponents — he is firmly of the view that the sympatric account of the origins of species is the preferable one. This immediately puts him at odds with the so-called father of the modern evolutionary synthesis, Ernst Mayr.

Since the 1940s, Mayr, who is still alive and publishing at the time of this writing, has championed the allopatric account. For him, as important as selection is, genetic isolation of populations is a necessary prerequisite for new species to form and start adapting. His view is the foundation for the allopatric orthodoxy, and the view of species that underlies it — the so-called Biological Species Concept — is the ruling view of what species are.

Schilthuizen presents the case studies that are finding their way into the literature — the cichlids of Lake Tanganyika which have diversified from one species into hundreds, as well as the apple maggot flies that speciated from hawthorn flies in California, and so on. But the most entertaining examples are the little-known Rhinogradentia, mammals, now unfortunately extinct, that lived on the Pacific Hi-Iay islands until the 1950s and an unfortunate nuclear disaster. They are unfortunate in another sense — they only ever lived in the imagination of Gerold Steiner. But Schilthuizen manages to use these creatures, whose nasal adaptations take the place of feet, tentacles, and musical instruments, to introduce the issues of species concepts, speciation, and the way biologists work, particularly in the field.

What follows is a full insight into the way science works in a situation in which there is a deep dispute at the core of a discipline. Schilthuizen is able to give the reasons that specialists who played and still play central roles in the argument over sympatry and allopatry took the positions they did, or why they changed their minds. He has interviewed many of his colleagues and brings to the fore research and publications known only to the inner cognoscenti. For this alone the book is worth reading.

The speciation debate has been overwhelmed by a major shortcoming that is all too common in biology: rather than suggest that *most* speciation is allopatric or sympatric (or one of the other

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alternatives: parapatric, stasipatric, polyploid, and a host of increasingly abstruse names) and then seek to find how relatively common they are, theorists tend to claim that *all* speciation must be that way. But the arguments are largely based on prior belief and theory rather than on empirical evidence. Schilthuizen avoids this temptation. Yes, he is aiming to show that sympatric speciation is valid, and even perhaps that it is more common that the allopatric version, but he does not say that *all* speciation is sympatric, even if he does think that most is. Again, this is a major virtue of the book.

It is rare to get a book on a technical issue that can be read and enjoyed by nonspecialists, but this is one such book. It could be read by high school, college, and graduate students with profit, and the more one knows about the topic, the more thought-provoking it is. And once again, poor old Darwin is shown not to be so silly after all. I recommend this book.

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Charles Darwin: The Naturalist Who Started a Scientific Revolution

by Cyril Aydon
New York: Carroll & Graf, 2002.
326 pages.

Reviewed by Richard Milner

Does the world really need yet another re-telling of the life of Charles Darwin? Scores of biographies, thousands of articles, and 14 000 surviving letters — part of a thriving Darwin Industry — have chronicled his lifelong voyage of discovery, during which he redrew the map of humankind's place in nature. Still, no matter how well and how often that ground is raked over, my answer is yes. At a time when the founder of evolutionary biology is still vilified, denied, even demonized by know-nothings, Cyril Aydon's accurate, well-crafted retelling of the tale is certainly welcome.

Aydon notes that the British have always held a strangely ambivalent view of Darwin. During his lifetime, he was regularly denounced from the pulpit, yet they held his funeral in Westminster Abbey, where he was entombed with England's greatest heroes. (Indeed, Darwin's remains lie a few paces from those of Sir Isaac Newton.)

Appropriating an image from the great essayist Montaigne, Aydon acknowledges that his new Darwin biography is a bouquet made up of flowers gathered by other men: "Only the ribbon that binds them together is my own." Nevertheless, a biographer reveals his level of skill by his choice of blooms and ribbons. Aydon apparently had an exhilarating journey through "Darwinland", visiting Down House and the more significant archives. He hits all the expected marks, yet is curiously lacking in new discoveries or insights.

He makes much of the fact that Darwin was "one of the luckiest men who ever lived" because he came from a wealthy family (and married into another) and so was free to be creative and follow his heart. True, many people do not realize that Darwin was rich — the equivalent of a millionaire today. So what? So were a thousand aimless and dissolute scions of the English gentry and nobility. His friendly rival Alfred Russel Wallace, born into genteel poverty, supported his own expeditions by selling tropical beetles to the British Museum for a few pence each, yet he, too, discovered the theory of evolution by natural selection.

Not that Aydon commits any grievous gaffes in relating his oft-told tale. All the familiar landmarks are here — Charles' father's initial refusal to let the young man go on the voyage, the prickly relationship with Captain FitzRoy, the Christianized Indian Jemmy Button, the wonders of the rainforest and the Galápagos, the outwardly conservative family man revolutionizing Western thought from his bucolic estate, Thomas Huxley's battle with Bishop Wilberforce, and the remarkable Alfred Russel Wallace nipping at Darwin's heels and forcing him, at last, to complete and publish his great work. It is an accurate recounting, bolstered by numerous quotes from letters, diaries, and notebooks, but it has all been done many times before.

Such extensive use of primary sources gives the reader a feel for the language, the people, and the history. However, Aydon inexplicably adopts the indifferent scholarship of 50 years ago in not sourcing a single quote. Over the past few decades, Darwinian scholarship has been notable for its meticulous documentation and attribution — a gold standard established by the Darwin Correspondence Project, which has been arranging and publishing all the letters. Aydon openly admires but does not emulate the major Darwin biographies, like those of James Moore and Adrian Desmond, and Janet Browne's two volumes, which always give complete sources. Quotations can be identified without interrupting the narrative flow by identifying each quote with the first few words of each passage in an appendix. To slough off that responsibility is a major flaw, showing disregard both for scholars and "general readers" who may have no clue as to the sources.

Aydon's publisher describes him as a "business consultant" turned writer. His expertise in commerce has led him to preface the book with an interesting note about monetary values in 19th-century England. "Accounts of transactions expressed in the money of earlier times have lost all meaning for the modern reader ... and must be translated", he writes. Any sum "should be multiplied by fifty to obtain its equivalent in today's money." In considering property values, "the price of property has risen much faster than prices generally. While it is reasonable to treat the £30 000 that Robert Darwin lent his brother-in law Josiah Wedgwood to buy his country estate ... as being equivalent to £1 500 000 in today's money, that property would actually be worth many times that figure today." Just as Ralph Colp brought his medical expertise to his Darwin, Jim Moore his theological knowledge, and Randal Keynes his

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insider's knowledge of the family, I think that Aydon would have done well if he had utilized his background in business to explore Darwin's financial situation and personal investment strategies.

One also wishes that Aydon had explored some of the newer material about Darwin's stint as a Justice of the Peace, his propensity to write monographs on his own infant's primate behavior, the import of botanical work in his greenhouse and garden, his secret battles with "spiritualist" con men, or his mysterious illness (which seems to have been a combination of anxiety neurosis and a chronic form of Chagas' disease — a blood parasite acquired through the bite of an Argentinian insect). He also spends a couple of pages on a discredited Freudian interpretation of Darwin's alleged "rebellion" against a tyrannical father, which has long since been abandoned by Darwinian scholars.

Darwin's story is told with love in this book, and the author's heartfelt desire to broadcast it anew to the world is commendable. Although those in search of fresh analysis and unfamiliar scraps of information will need to look elsewhere, the familiar tale so plainly retold here will doubtless be new to many. If it succeeds in bringing Darwin's story to readers who have never encountered it, this book may serve as a solid and trustworthy introduction to more sophisticated Darwiniana.

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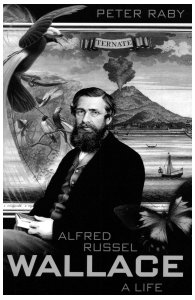
Alfred Russel Wallace: A Life

by Peter Raby
Princeton (NJ): Princeton University Press, 2001. 368 pages.

Reviewed by John Wilkins



When the tale of the discovery of evolution is told in popular books, Darwin's co-discoverer, Alfred Russel Wallace, is mentioned only for having come up with the idea of natural selection and scaring Darwin into publishing "my theory", as he called it, by sending him a letter outlining it and seeking his advice on how to publish. After that, a discreet silence is kept, for Wallace went strange later in life. He turned to spiritualism and séances, and so he is usually ignored as an embarrassment to evolutionary theory and science.

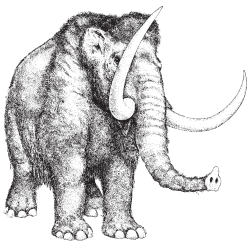
The truth is, however, much more interesting and complex — and ultimately much more satisfying — and Raby's book, following his earlier and equally well-written and researched *Victorian Travellers* on the explorers of the early 19th century, drags the reader into Wallace's world and personality, slowly at first and then head-long. In the end you come away feeling you have met a complex and yet strangely idealistic and naïve fellow who rose to the heights of science in reputation but not position; who single-handedly revolutionized and perhaps even invented the sciences of ecology and biogeography, but who fell for the tricks and sleight of hand of mediums and other charlatans; and who was so single-minded and self-assured that he would get entangled in a legal battle with a flat-earth kook and lose money and prestige.

Wallace's endurance was amazing. Trained as a surveyor, he spent four years in the Amazon Basin, collecting species that had never been seen before, only to lose his specimens and notebooks in a fire on board the ship back to England. Explorers were paid for their labors through the sale of their specimens to museums and collectors, and so he earned almost nothing for the time spent there, and lost his brother to disease in the process. Convincing the Geographical Society to fund an expedition to the Malay Archipelago — what is now Indonesia and Malaysia — Wallace discovered what is known today as the Wallace Line, a 50-mile gap that separates the Eurasian flora and fauna from that of the Austronesian. Birds, animals, and plants all endemic to the Australian and New Guinean region stop at the straits between Lombok and Bali and due north. This is evidence that life developed in different ways in different regions across the planet, and Wallace was quick to draw the obvious conclusion, although he was rather hesitant to spell it out publicly — life evolved. He published, in 1855, three years before he and Darwin shared credit for the discovery of natural selection, an essay in which he presented a "law" (actually, a hypothesis) that new species emerge immediately adjacent to their nearest relatives. Although that essay was drawn to Darwin's attention by his friends, he failed to see that Wallace was hot on his heels, even though they exchanged some letters. When Wallace was recuperating from a malaria attack on Ternate island, he flashed upon the idea of selection as the cause of new adaptations and species. Writing up his inspiration, he sent a letter to Darwin. Wracked by the conflict between the desire to be recognized for his two decades of work and the need to act honorably, Darwin sent Wallace's letter to his friends Sir Charles Lyell and John Hooker, who presented it and some of Darwin's older writings to the Linnaean Society, and the rest is history.

Except it is not. What happened next is often forgotten or glossed over, and it is the more interesting part of Wallace's life for me. When Wallace returned from the Malay Archipelago in 1862 after 8 years there, he found he had some standing in the gentlemanly society of natural historians in London, but since he was from humble origins, he found it impossible to get a paid position. Despite publishing several books, a couple of which are regarded as masterpieces of their genre, he was not very wise about money, and struggled to do science and maintain his family. He also had a problem with the human brain.

According to Wallace, evolution was not merely comprised of selection, it was *entirely* selection.

He was more selectionist than Darwin. Wallace expected that *every* aspect of an organism was not only due to selection in the first place, but in need of selection to be maintained, and this meant no more or less than "survival of the fittest" — the phrase of Herbert Spencer's he urged on Darwin to replace "natural selection", which he thought carried connotations of a guiding intelligence. Although he was, like any good English explorer, a chauvinist in cultural matters, Wallace was convinced that all humans shared pretty much the same cognitive abilities, artistic sensitivities, and so on — a view he was fairly distinctive in holding at that time. Since a gorilla has enough mental capacity to survive quite happily, Wallace had a conundrum: what caused humans to have the large brain they did? They did not need to be able to do calculus or compose sonatas to survive, so it could not be down to natural selection. If not selection, then what? Wallace turned to the then-popular diversion of spiritualism: Spirit was the cause of the large brain and human skills; not the Holy Spirit (Wallace was not a Christian), but the *realm* of Spirit, which he thought was quite natural and could in principle be investigated scientifically.



So began — almost immediately after the *Origin* was published — a lifelong flirtation with the spiritual realm, which earned him at first cautious criticism and eventually open derision by his agnostic or atheist colleagues, and this most likely contributed to his continuing difficulty to find a museum or university position. Darwin called this the murder of his and Wallace's child. In part this was because Wallace could not accept that there might be other forms of selection. He rejected Darwin's notion of sexual selection, the idea that mate choice could generate often extreme adaptations like the tails of his beloved birds of paradise; and what could be more absurd to a naturalist than that overgrown brain of humans? Darwin had no such problems as Wallace, because for him, selection was not all about survival; it was about having more progeny in the long run than alternative forms. He also allowed for what came later to be known as cultural selection, and Wallace could not have this either. Ironically, reading Wallace's original essays on the subject, particularly those in his *Darwinism* (1889), it is curious how substituting "Culture" for "Spirit" makes it into something quite feasible, if not obviously true, as an account of the way human cognition evolved.

A couple of scholars (Brackman 1980; Brooks 1984) have advanced a conspiracy theory that has been taken up by both pro-evolution Wallace-worshippers and anti-evolution Darwin-haters, that Darwin held off passing on Wallace's letter so he could plagiarize some of it in his own work. Raby makes short shrift of this conspiracy theory, as does Michael Shermer's recent biography of Wallace (Shermer 2002), but I am guessing that this will not satisfy the enthusiasts. Darwin lived a shorter life than Wallace, although arguably a more productive one given the differences in their financial circumstances, but Wallace outlived Darwin by 30 years, and never in all that time did he give a hint that he was disappointed that Darwin got all the press.

Wallace's humility may also have contributed to his modern anonymity; he always spoke of "Darwinism", and even when he became a popular lecture-circuit personality in his dotage (yes, even then this was a good way to make money, especially in the United States, as Wallace discovered), he still was known more for his collaboration with Darwin than his own work. The conspiracy theorists, says Raby, have done one service to poor Alfred — they have raised his profile. There have been a number of his works recently reissued and his letters are in preparation.

Wallace is something of an object lesson, as well as a hero in science. Scientific mythology is built to some extent on heroes; it is good to find a worthy person whose naïveté and single-mindedness remind us that in the end, scientists are real people, and even the good guys can deviate from the script. Raby's text is an excellent way to get a feel for many of the social and scientific currents of the Victorian era, and is to be commended to all.

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Genesis: A Royal Epic

by Loren Fisher
Philadelphia: Xlibris, 2000.
284 pages.

Reviewed by Stephen C Meyers

Genesis, A Royal Epic is a welcome new translation of Genesis. The introduction, notes, and appendices alone make it a worthwhile book. In the preface (p 11), Loren Fisher reveals his major presupposition: that Genesis is a royal epic written during the Davidic monarchy (10th century BCE). I regard this presupposition as also the major problem of this book. Scholarship is divided, but more are moving away from Fisher's position because of the weight of the archeological evidence. The most widely accepted treatment of recent scholarship is the book *The Bible Unearthed* by Israel Finkelstein and Neil Asher Silberman (2001). They posit a 7th-century BCE setting for the book of Genesis. Fisher takes up part of this debate in Appendix I.

Finkelstein and Silberman (2001) concluded from their archeological surveys that there was no vast empire during the reigns of David and Solomon. The supposed legendary Solomonic gates probably date from 100

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years later. The background of Genesis is best reflected in the 7th century BCE when Josiah came to power, according to Finkelstein and Silberman. For example, there is the mention in the Joseph story of camel caravans carrying gum, balm, and myrrh, which best reflects the Arab trade under the Assyrian empire. There are many anachronisms in Genesis, such as the mention of the Philistines, who did not come to Canaan until after 1200 BCE. Even though Fisher disagrees with what is becoming the majority view in the field, this does not affect the quality of his translation.

Fisher's suggestion that the stories of Genesis were initially told at the tombs of the ancestors of the Israelites is intriguing. He compares this liturgical origin of these stories to other ancient liturgies, some of which were 7-day rituals. Genealogies may have also developed at these funeral rituals. In Fisher's view, the 7-day creation story derives from these ancient rituals.

There are numerous notes to the translation of Genesis that are very helpful. I only wish that there were a few more notes to explain why he translated certain words, such as "storm" in Genesis 1:2 and "flood" in Genesis 2:6, as he did. Fisher takes a very literal approach to his translation. For example, he translates "elohim" (God) as plural "gods" in Genesis 5:22, 5:24, and 6:9. I like how he transliterates the names of God instead of translating them so there is no confusion of names.

I also like Fisher's use of the word "formed" instead of "created" in Genesis 1, because of the theological baggage associated with the word "created", implying creation *ex nihilo* or "out of nothing". Fisher explains that there are two basic types of creation stories in the ancient world: theogony, the origins of things by the procreation of the gods, and cosmogony, in which chaos is fashioned into cosmos. Frequently in cosmogonic creation stories, there is a battle between chaos and order. This battle is not present in Genesis, but traces of it can be found in the Psalms, Hebrew prophets, and Job (p 272).

In Genesis 3, Fisher states, there is no fall into sin; rather, there is a decision to give up life for knowledge. Death is seen as natural. In contrast to Fisher's views, it was much later on that theologians read a "fall" into this chapter and the consequent view of death as an unnatural result of the Fall of Adam and Eve into sin.

In Appendix II, Fisher deals with the creation/evolution debate. He writes, "It is important to know that the creationists know very little about Genesis, and we need to make this known" (p 267). His two major contentions are that "creation science" is not science and that "creation science" is not based on Genesis. This latter point is Fisher's unique contribution to the debate.

Overall, *Genesis, A Royal Epic* is a good literal translation of Genesis that will upset creationists. I recommend this book as a worthy reference for your library.

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Quest For Truth: Scientific Progress and Religious Beliefs

by Mano Singham
Bloomington (IN): Phi Delta Kappa Educational Foundation, 2000. 184 pages.

Reviewed by Lawrence S Lerner, California State University, Long Beach

This is an interesting but perplexing book. The author, a fundamental-particle physicist at Case Western Reserve University, has been active in the effort to keep "intelligent design creationism" out of the Ohio science education standards. But creationism is only one of the factors — perhaps a minor one — that have motivated him to write this small book. Singham devotes most of the introduction to an outline of the conflict between science and three forms of creationism, which he felicitously dubs *strong* (6-days-plus-flood), *weak* (day–age), and *superweak* ("intelligent design") creationism. He then expands this discussion into a series of broader questions concerning the relationships and conflicts among what he dubs "elite science", "popular science", "elite religion", and "popular religion". But these questions lead the author to the use of such difficult terms as *truth* and *objective reality*. On reading beyond the introduction, it becomes clear that a discussion of the meaning of these terms lies at the center of his interest; the conflict between science and creationism seems to serve mainly as a segue into these broader and deeper matters. The author holds that his long digression is essential to further discussion of the science–religion conflict (and of creationism in particular). But aside from using creationist assertions as examples for some of his arguments, he never really provides a thorough discussion of this subject.

The middle and largest part of the book — 100 pages or so — is the most interesting and useful. The author attempts, with some success, to acquaint the nonspecialist reader with mainstream philosophical views of the nature of science. As one would expect, the discussion centers on the works of philosophers of science Karl Popper, Thomas Kuhn, Imre Lakatos, Paul Feyerabend, and Richard Rorty; by far the heaviest emphasis is placed on Kuhn's analysis of scientific revolutions (Kuhn 1996). Inevitably, as the author warns the reader, the discussion cannot be complete — only so much can be conveyed in a relatively brief summary.

"Truth", the key word in the

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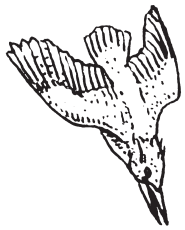
title, is a slippery term. In theology, it has at least one clear meaning: What is revealed in sacred scriptures is by definition true, and the ological argument can proceed on this sound foundation — at least among those theologians who share faith in that particular revelation. Science, however, does not have such a starting point. Popper stressed the now widely accepted view that science can never achieve truth but it *can* make and then test assertions that are *falsifiable.* If a theory survives numerous and varied attempts at falsification, one can have a degree of confidence in the reliability of that theory over a broad range of phenomena. Moreover, if a statement is inherently not falsifiable (for example, "God is just"), it cannot be a scientific statement.

If a scientific theory cannot be "true", can it at least be "correct"? Certainly, in the sense that it accounts for a range of phenomena with good accuracy and can be used to predict the outcome of previously unknown events. Scientists, in contrast to philosophers of science, do not worry too much about this point. Given a particular problem, it is usually pretty obvious to the skilled investigator which theory will yield a satisfactory solution.



How are the sciences related? Singham argues that most scientists are reductionists. Perhaps he is led to this view in part by the hyperbolic titles that famous particle physicists give to their writings aimed at a broader public — and particle physicists do love to use such names as "The Theory of Everything" to describe their work, sometimes only partly facetiously (Lederman and Teresi 1993; Weinberg 1994). If Singham were to consider the views of scientists other than his fellow particle physicists, he might well take a different position regarding the philosophical stance of most scientists. Moreover, the reductionist position he frames is idiosyncratic; he argues that physics deals with the smallest objects (subatomic entities), chemistry with larger molecules, and biology with large chemical systems. He therefore sets up a reductionist hierarchy that is strictly one of scale. He continues,

> the smaller the size scale of the discipline, the closer to truth that discipline is judged to be. Thus, a complete understanding of particle physics would explain how protons, neutrons, and other nuclear particles are formed and how they interact to form nuclei. Since these form the constituents of nuclear physics, all of nuclear physics also would be explained. Similarly, once we know how atomic nuclei form and interact with other atomic components, we would have explained atomic physics and chemistry. … And once we have completely explained chemistry, then we also will have explained biology, then upward through the latter to society and the universe.

This is, I think, a straw-man description of reductionist epistemology too naïve to convince most scientists. It founders immediately on the rocks of emergent properties. There can be no doubt, for instance, that biological systems obey the rules of chemistry without exception. But the rules of chemistry could never have predicted a priori that genetic information is carried by DNA, or that the bases A, C, G, and T comprise the alphabet that conveys that information as it does. Similarly, a thorough knowledge of a deer as a biological organism will not furnish a basis for explanation of the complex herd behavior of the species to which it belongs.

Later, Singham digresses into a cogent and, I think, widely accepted criticism of the way science is taught at all levels below graduate school. He adopts the so-called constructivist view of education — the instructor should not simply assume that his students' preconceptions are wrong and then proceed to lecture them on the correct stuff, but should let them build on their own knowledge systems and arrive at the consensus of modern science through a process of adding new experience to what they already know. While I am sympathetic with this approach as a pedagogic technique, I do not see it as a basis for a philosophy of science. Moreover, I am not at all clear as to what the discussion of constructivist pedagogy contributes to the main argument of the book, except that it leads by inference to the view that pseudoscience has intrinsic intellectual value.

Singham finally comes to what I take to be his solution to the problems of public misconceptions of science and the conflict between science and religion. This solution lies in acceptance of the ideas that (a) *all* knowledge is valid and (b) science does not seek *truth* but *control over the environment.* In adopting this position, Singham comes close to abandoning the distinction between science and pseudoscience. As a corollary, he argues that the important court decisions that distinguish between creationism and science are not intellectually honest. Most scientists would maintain that, complex philosophical structures aside, it is not too difficult to distinguish between science and pseudoscience on the basis of straightforward criteria. In the same way, several courts have not found much difficulty in distinguishing between real science and religiously based programs disguised as science.

Singham further reconciles the Kuhnian concept of incommensurable paradigms (for example, Newtonian physics vis-à-vis quantum mechanics) by making an analogy with biological evolution. Just as species branch from preexisting species — the metaphor is that of a proliferating shrub — new theories branch from preexisting ones. In both cases, the process is contingent; if the preexisting branching structure had been different, the new branching would have been, too. Singham argues further that this metaphor avoids the misconception that knowledge — at least, scientific knowledge — is finite and we will someday know everything there is to know about the universe. Rather, Singham's shrub branches out unendingly into the spaces available between and above the existing branches.

This metaphor is a pretty one and may satisfy many readers. My own view is that it is not very useful except for convincing those who are too much influenced by the idea of a Theory of Everything.

It is, I think unfortunately, never

terribly clear how all this will solve the problem of widespread public belief in creationism and other pseudosciences. Nevertheless, the book is a good read and a good way for the educated but nonspecialized reader to approach both the current problems of the philosophy of science and its position in the scientific world.

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The Tangled Wing: Biological Constraints on the Human Spirit

by Melvin Konner
New York: Henry Holt and Company, 2002 (second edition, revised and updated). 540 pages.

Reviewed by Charles F Urbanowicz, California State University, Chico

This is a wonderful book to read but a difficult book to review. With 488 pages of text and 22 pages of notes and references (beginning with an essay entitled "Caveat: The dangers of behavioral biology"), *The Tangled Wing* is another example of "the big book season"! Other recent big books include the late Stephen Jay Gould's *The Structure of Evolutionary Theory* (2002) and Stephen Wolfram's *A New Kind of Science* (2002). Konner's book is half the size of these, but he has a lot to say and he writes well.

Utilizing information from anthropology, biology, philosophy, and psychology, Konner is trying to provide the "Foundations of a science of human nature" (the title of the first part of this volume); other parts are "Of human frailty", "The modification of behavior", "Human nature and the human future", and, finally, "The tangled wing", referring to the lunar lander that Neil Armstrong took to the moon in 1969.

Konner begins each chapter with appropriate quotes, from Darwin, Huxley, Mary Anne Evans, and Albert Einstein (just to mention a few) as he masterfully makes the case for the importance of biology in our lives. Every chapter is an intricately-written and well-documented essay, and to highlight a specific chapter in this review could imply that others are less valuable, and this is not the case!

However, it *is* possible to summarize *The Tangled Wing* in Konner's own words. He writes that "Human nature exists" and that

> [f]ewer than one in ten Americans accept evolution as a process that goes on without divine intervention. This book not only endorses the last view, it also claims that every aspect of the human spirit — mind, thought, feeling, love, dreams, hope, admiration, decency, faith, and in general everything that the religious person takes as evidence for the soul — came from that same natural process, without need of divine assistance (p xiii).

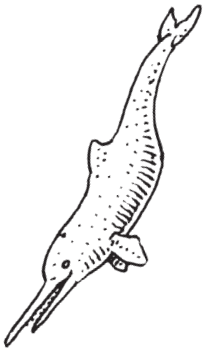
It should be noted, however, that although Konner began "Foundations of a science of human nature" by invoking the first edition of Darwin's *Origin*, "Thus, from the war of nature ..." (p 1), Konner fails to point out that, beginning with the second edition (1860), Darwin himself included the term "Creator", alluding to "divine assistance", for which Konner finds no need. Darwin wrote:

> Thus, from the war of nature, from famine and death, the most exalted object of which we are capable of conceiving, namely the production of higher animals directly follows. *There is a grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one;* and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved (Darwin 1872: 669–70, emphasis added).

Konner is not alone in failing to point out that Darwin cut, rewrote, and edited sentences for all editions of *Origin* published in his lifetime, and every edition of *Origin* is different! This is an extremely important for an appreciation of Darwin's intellectual development *and* his contributions to the study of the evolution of "human nature".

Konner ends *The Tangled Wing* as follows:

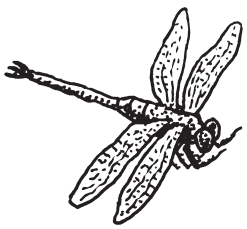
> We must choose, and choose soon, either for or against the further evolution of the human spirit. It is for us, in the generation that turned the corner of the millennium, to apply whatever knowledge we have, in all humility but with all due speed, and to try to learn more as quickly as possible. It is for us, much more than for any previous generation, to become serious about the human future and to make choices that will be weighed not in a decade or a century but in the balances of geological time. It is for us, with all our stumbling, and in the midst of our dreadful confusion, to try to disengage the tangled wing (p 488).



Konner has references for each chapter and current "Recommended Readings" (p 113), but the publisher has opted to make detailed notes available only on the book's web site (<http://www.henryholt.com/tangledwing/>). I wonder how many people are going to read *The Tangled Wing* next to their computers to be able to check on notes or print out the files. With separate reference sources, will they be available to each reader, and will the web site be available when the reader wishes it? (Is this a developing trend or an attempt by publishers to save money?) It is comforting that Konner does write that "to those inconvenienced [by this system of notes on the web], please accept my apologies" (p 497), but I believe

that because of this separation that the current *Tangled Wing* will be of more value to the well-read non-scientist. These readers may be satisfied with Konner's very reasonable and compelling argument and feel no need for additional research. The science professional or university student who might use this as a jumping-off text for further research will have to go through that extra step of checking on the specific references and may not do it.

Konner's first edition of 1982 (with 436 pages of text and 84 reference pages) did include information for all citations, and it is unfortunate that the 2002 volume did not. If another *Tangled Wing* is anticipated, the publisher should see that all notes are included (since other important monumental tomes include them). In this regard Ehrlich's *Human Natures: Genes, Cultures, and the Human Prospect* (2000) may be more useful to readers who want immediate access to supporting materials. With 331 pages of text, 1901 numbered footnotes, and 2574 references, Ehrlich makes it easier than Konner to use his book as a foundation for research.



These shortcomings aside, I encourage readers to obtain the book and read it, study it, and think about it carefully. Konner has numerous excellent thoughts, and he has the writing skill to convey his ideas and information eloquently. Konner (who has both a PhD in anthropology and an MD) deftly weaves in comments on his own ethnographic fieldwork among the African !Kung; his "Acknowledgements" essay points out the support of many individuals, including his wife, the ethnographer Marjorie Shostak.

The Tangled Wing: Biological Constraints on the Human Spirit is thought-provoking, and while Konner may not present us with a final answer concerning "divine assistance" and "human nature" (if ever there will be one), he makes us think! Readers will have to weigh the evidence (and compare it with their own body of knowledge and personal philosophy) and decide accordingly.

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The Landscape of History: How Historians View the Past

by John Gaddis
Oxford: Oxford University Press, 2002. 192 pages.

Reviewed by Arthur M Shapiro, University of California, Davis

Anti-evolutionists regularly argue that historical sciences, such as evolutionary biology or paleontology, are not sciences at all: science, they say, is defined as something you can do in a laboratory. What evolutionary biologists do, they argue, is more like what historians do: interpretive, subjective, and incapable of Popperian falsifiability. In *The Landscape of History*, a distinguished historian enthusiastically embraces the comparison. John Lewis Gaddis, best known as a historian of the Cold War, argues not only for the intellectual isomorphism of historiography and historical sciences, but also for the rigor of their methodology and their superiority to the trendy quantitative methods widely employed in the social sciences. He sees these quantitative methods as simplistic reductionisms that are deeply wrongheaded in the studies of human social phenomena and inferior to complex narratives for generating useful insights.

A few decades ago, narrative methods were dominant in most of the social sciences. Gaddis believes that they have since succumbed to "physics envy". He argues that social processes are inherently historical and thus a nonlinear interplay of chance and necessity — just as evolutionary processes are. He is not sufficiently informed to invoke the "shifting balance" theory of Sewall Wright, but he basically reinvents it verbally. He allows for the usefulness of reductionism in one context — what he calls "counterfactual thinking", consisting of *gedanken* experiments in which one asks, for example: "Holding everything else constant, what if we had exploded the first nuclear device offshore as a demonstration, rather than dropping it on Hiroshima?" These exercises are merely intended to sharpen our thinking, not to generate predictive models.

Gaddis is surely correct in his comparison of history to the historical sciences, but it is unclear if this will increase or decrease the prestige of either. History is historically one of the humanities, but on many campus (including my own), it is now treated as a social *science*. As such, it is the only one with its very own Muse. As an attempt at an operational definition of historical method, *The Landscape of History* fails; such a definition is probably impossible. Some of Gaddis's best insights also occur (more eloquently stated) in Jacob Bronowski's little book *The Common Sense of Science* — which is unlikely to be read by historians (see, in particular, Bronowski's comments on the premature application of reductionistic and quantitative method and the need to resist "physics envy").

Gaddis roams rather widely — the book is really a series of more-or-less self-contained lectures — and he has an annoying tendency to salt his paragraphs with unnecessary references to pop culture and to both the intellectual and physical geography of Oxford. Nonetheless, I read *The Landscape of History* in one sitting and found it enjoyable, if not fully satisfying.

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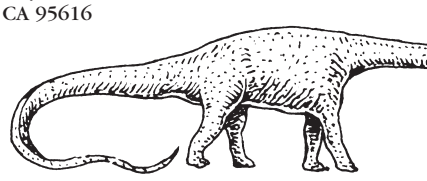

The Primate Fossil Record

Edited by Walter C Hartwig
Cambridge: Cambridge University Press, 2002. 530 pages.

Reviewed by W Eric Meikle, NCSE Outreach Coordinator

This is an admirable effort to provide a concentrated and uniform treatment of the fossil record of that mammalian order of primary interest to our ever-anthropocentric selves. New fossil discoveries related closely to human origins and ancestry tend to be well-publicized and receive wide popular attention. Every year at least one or two new hominin specimens, if not species, make headlines. The pace of such significant fossil discoveries has quickened throughout the last century, and especially in the last three decades.

Those who are not primate paleontologists, however, probably are not aware how closely this pattern of increasing knowledge about our Pliocene and Pleistocene hominin relatives is paralleled by an increasingly rich fossil record for the entire Primate order, covering more than 50 million years. Essentially all fossil primate groups are much better known today than they were in 1960, or even in 1980. However, no comprehensive reference work on this topic has been published in recent years. This book fills that gap, and will serve as a starting point for professionals and advanced students for years to come. While technical, expensive, and not intended for beginners, it does contain numerous illustrations and extensive references to the primary scientific literature, as well as discussions of interpretations and implications of this wealth of primate fossils.

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The Edge on Evolution

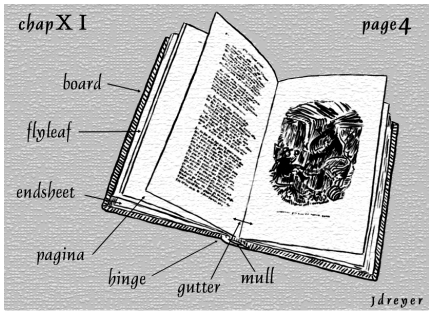
"Today's visions of the science of tomorrow" was a fascinating op-ed in *The New York Times* (2003 Jan 4) that contained responses by a variety of scientists, writers, and futurists to the question "What are the pressing scientific issues for the nation and the world, and what is your advice on how I [President Bush, imagined to be interviewing prospective White House science advisers] can begin to deal with them?"

The responses were excerpted from a larger set solicited by the literary impresario John Brockman. Although only one of the responses in the larger set specifically cited evolution education as a pressing scientific issue, many of the issues that were cited — in genomics, neurophysiology, and evolutionary psychology, for example — obviously presuppose the need for maintaining and improving the public schools' coverage of evolution.

The respondent who cited evolution education as a pressing scientific issue was Robert Aunger, who teaches anthropology at University College, London; he is also the author of *The Electric Meme: A New Theory of How We Think* (New York: The Free Press, 2002). Aunger wrote:

> While the findings of anthropologists indicate that we should be tolerant of cultural variation, taking anthropology seriously as a science also indicates that we should not mistake exotic beliefs for science. The fact that people have diverse systems of belief does not give them all equal claims on truth. "Intelligent design" theorists, for example, argue that because the natural world is complex, a supernatural agent must have designed it. There are two problems with this argument. First, scientific theories for the emergence of complexity exist, such as Darwinian evolution and complexity theory. Second, even if such theories did not exist, the conclusion that only supernatural causes can explain such complexity does not follow, since a scientific explanation for complexity could arise tomorrow. Our final lesson: The teachings of "intelligent design" theorists therefore belong in programs of religious, not scientific, instruction.

For the complete responses, see the Edge web site at <http://www.edge.org/documents/archive/edge110.html>.



God Said It and — Bang! It Happened: The Believable Explanation of Creation

by Bruce Bickel and Stan Jantz
Nashville (TN): Tommy Nelson, 2001. 105 pages.

Reviewed by Margaret Kallman

Finally science and religion are reconciled! According to its authors, this 100-page jaunty and amusing book for teens tells the entire history of the universe, from the Big Bang through the evolution of life to modern humans. It purports to show how this history is completely and accurately compressed into Genesis 1:1–27. The reviewer who takes on this book must appreciate physics, astronomy, and biology, particularly evolution. Oddly, the beginning of life — chemistry — is not discussed.

This is "intelligent design", old-earth creationism: "God created the universe several billion years ago." After creation began, Day 5 lasted "millions of years" because God went into "mass production" of plants, followed by "squishy" invertebrates, then shellfish, vertebrate fish, the Cambrian Explosion, and so on. "After one species would die out, He'd create another" (p 64). "To this day scientists scratch their heads over the Cambrian Explosion. They can't explain it. On the other hand, people who believe that God was the First Cause and Intelligent Designer … know exactly what happened" (p 78).

Scientists, especially Darwinist evolutionists, take a beating in this book.

> Now, the funny thing is that Darwinist evolutionists agree on the order of the Bible record. They agree with the Bible that fish (Day 5) came before birds (Day 5), which came before mammals (Day 6), which came before humans [*sic*] (Day 6). What they don't agree on is how all these creatures got here. Because [they] refuse to admit that an Intelligent Designer created [all], they have no choice but to say that all creatures are linked together, and everything came from an impersonal beginning. Without God … all you have going for you is the link (p 78–9).

The Darwinist evolutionists have been searching for nearly 150 years for the missing link. "But guess what? They've got nothing. Zip. Nada. There is no missing link and there never will be" (p 79).

How do scientists cope with frustration from this futile search? "If you can't find it, why not fake it? Scientists have been so anxious to find the missing link that at times their science has not been very good. In fact, at times it's been downright dishonest" (p 79). The Piltdown fossils of 1912 were hailed as that link, so "everyone pretty much accepted the 'fact' that there was a link between apes and man. There was only one problem. The link was a fake, and the British scientists knew it … The sad part is that for more than forty years, students just like you were told that according to the 'evidence,' we came from monkeys. Even worse, school textbooks continued to tell the story of Piltdown man for years after the rascal was exposed" (p 80).

Nonetheless, "evolution happens!" That is, microevolution — "minor variations that occur in populations of people or animals over time" from causes such as "better nutrition and better working condition (p 77). "Natural selection … also happens …" The retired law professor Phillip Johnson is quoted as a *scientific* expert: natural selection "maintain[s] the genetic fitness of a population" by preventing genetically defective or inferior creatures from surviving and reproducing.

As for the schema of the Genesis section as related in the book, there are other problems here besides the denial of intermediate life forms in the fossil record. The actual "order of the Bible record" is as follows: On Day 3, dry land and seas are separated and plants grow on the land; on Day 4, the 2 great lights — sun and moon — are created; on Day 5, sea animals and birds are created; on Day 6, land animals and humans are created.

Plants created before the sun? "Don't make the mistake of thinking that God created the sun, moon and stars during Day 4 (although a quick reading of the Day 4 verses might give you that impression). [They] were already created during Day 1 … It is just that the earth's atmosphere became clear in Day 4, so the light from the sun, moon, and stars could be seen from Earth for the first time" (p 59)

Birds created before land animals? At various points the authors give times for the first appearance of animals, in the following chronology: land animals appeared 400 million years ago, then insects 360 million years ago, flying reptiles 200 million years ago, and birds 163 million years ago. Despite this sequence, they also insist on the Genesis order where birds appeared on Day 5, then land animals appear eons later on Day 6.

Of course, the authors never mention Genesis 2:5–24, because in *this* creation story the order of creation is, first, heaven and earth, then water, a man, plants, land animals and birds, and lastly, a woman.

About half the pages of this book are devoted solely to theology for 13 year-olds, proselytizing Christianity ("your favorite beach or ski slope … is a dump compared to heaven" [p 91]). There's advice on dealing with skeptical friends: shift the burden of proof — make the skeptic prove the *non*-existence of God.

A bibliography is provided of 38 books by 28 authors, including the usual "intelligent design" promoters: Phillip E Johnson, Michael J Behe, and William A Dembski.

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WEB LOCATIONS VISITED IN THIS ISSUE

NEWS

TOPIC Cobb County Clarifies: Teach Only Science in Science Classes
OWNER Cobb County, Georgia, School District
LOCATION <http://www.cobbk12.org/~boardpolicies/I_Policies/idbd_r.htm>
LAST VISIT January 15, 2003

TOPIC Darwin Day Around the Nation
OWNER The Darwin Day Program
LOCATION <http://www.darwinday.org>
LAST VISIT Jaunary 5, 2003

TOPIC Holy Toledo! Defenders' Club Forms in Ohio
OWNER Toledo *Blade*
LOCATION <http://www.toledoblade.com/apps/pbcs.dll/article?Date=20030118&Category=NEWS10& ArtNo=101180055&Ref=AR>
LAST VISIT January 15, 2003

TOPIC The Edge on Evolution
OWNER The Edge
LOCATION <http://www.edge.org/documents/archive/edge110.html>
LAST VISIT December 12, 2002

NCSE NEWS

TOPIC News from the Membership: Francisco Ayala Interviewed
OWNER Orange County, California, *Register*
LOCATION <http://www2.ocregister.com/ocrweb/ocr/article.do?id=16327&section=NEWS&year=2002&month=12&day=17>
LAST VISIT January 15, 2003

FEATURES

TOPIC "Intelligent Design" Visits San Francisco: The Concurrent Sessions
OWNER The IDEA Center
LOCATION <http://www.ideacenter.org>
LAST VISIT January 15, 2003

RESOURCES

TOPIC Darwin Day Collection Volume I
OWNER The Darwin Day Program
LOCATION <http://www.darwinday.org/tbp/collection-one.html>
LAST VISIT January 5, 2003

TOPIC Creationism and Pseudoscience
OWNER *Skeptical Inquirer* Magazine
LOCATION <http://www.csicop.org/si>
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TOPIC Creationism and Pseudoscience
OWNER *Skeptic* Magazine
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