



REPORTS OF THE

NATIONAL CENTER FOR SCIENCE EDUCATION

DEFENDING THE TEACHING OF EVOLUTION IN THE PUBLIC SCHOOLS

Volume 30, Number 3

MAY-JUN, 2010

CONTINUES NCSE REPORTS & CREATION/EVOLUTION



What
Americans
Know and
Believe About
Evolution

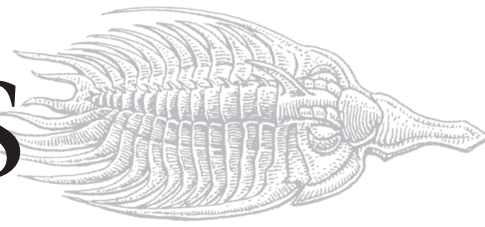
Evolution
Education in
Muslim States

People & Places
of Evolution:
George
McCready
Price

Mary Anning:
Fossil Hunter

Fiction and
Books on
Evolution for
Young Readers

CONTENTS



NEWS

- 4** Updates
News from California, Florida, Kentucky, Mississippi, New Jersey, Tennessee, Texas, the nation, and Australia.
- 6** From Evolution to Global Warming in South Dakota
A legislative proposal borrows a tactic from the anti-evolution movement to attack what is taught about climate change.
- 8** The Case of Mark Tangarone
Steve Newton
A course proposal in the Darwin bicentennial year was turned down by a school district because “topics need to be altered this year to eliminate teaching of Darwin’s work and the theory of evolution.”
- 9** Uproar over Evolution in Israel
Glenn Branch
The chief scientist in Israel’s Ministry of Education questions reliability of evolution and climate change. Sound familiar?

NCSE NEWS

- 11** News from the Membership
What our members are doing to support evolution and oppose pseudoscience wherever the need arises.
- 12** Farewell, Susan
NCSE says goodbye to Susan Spath.

ARTICLE

- 16** Americans’ Scientific Knowledge and Beliefs about Human Evolution in the Year of Darwin
George F Bishop, Randal K Thomas, and Jason A Wood
Americans’ knowledge about evolution often conflict with their beliefs. It is not uncommon for people to hold contradictory views.

FEATURES

- 23** Mary Anning: Fossil Hunter
Shelley Emling
Made famous in the tongue-twister “She sells seashells by the seashore,” this ordinary woman made a huge impact on paleontology in her very short life.
- 25** Teaching Evolution in Muslim States: Iran and Saudi Arabia Compared
Elise K Burton
Both governments and their schools are under strict religious oversight, but the differences in how they teach science, and especially evolution, may surprise you.

SPECIAL FEATURE

PEOPLE & PLACES

- 30** George McCready Price
Randy Moore
The father of the “Flood geology” that underlay the emergence of “scientific creationism” in the 1960s.

MEMBERS’ PAGES

- 19** Address to the National Academy of Sciences
Eugenie C Scott
Remarks to the NAS on receiving the Public Welfare Medal.
- 20** Moore, Moore, Moore, and More
This issue’s book section features the works of authors named Moore — many of whom you have met on these pages.
- 22** NCSE *On the Road*
Check the calendar here for NCSE speakers.

BOOK REVIEWS

- 32** *The Natural Selection*
by Ona Russell
Reviewed by Susan Branch
- 33** *One Beetle Too Many: The Extraordinary Adventures of Charles Darwin*
by Kathryn Lasky
Reviewed by Kate Miller
- 34** *Evolution, Me, and Other Freaks of Nature*
by Robin Brande
Reviewed by Laurel Saiz
- 35** *Optical Illusions*
by Jay Hosler
Reviewed by T Ryan Gregory
- 36** *The True Adventures of Charley Darwin*
by Deborah Heiligman
Charles and Emma: The Darwins’ Leap of Faith
by Carolyn Meyer
Reviewed by Anne H Weaver
- 37** *The Greatest Show on Earth: The Evidence for Evolution*
by Richard Dawkins
Reviewed by Douglas Theobald
- 38** *The Scopes Trial: The Battle Over Teaching Evolution*
by Stephanie Fitzgerald
Reviewed by Carrie Sager

VOLUME 30, NR 3, MAY-JUN 2010
ISSN 1064-2358

©2010 by the National Center for Science Education, Inc, a not-for-profit 501(c)(3) organization under US law. *Reports of the National Center for Science Education* is published by NCSE to promote the understanding of evolutionary science.

EDITOR

Andrew J Petto
Department of Biological Sciences
University of Wisconsin, Milwaukee
PO Box 413
Milwaukee WI 53201-0413
(414) 229-6784 fax: (414) 229-3926
e-mail: editor@ncse.com

EDITORIAL ASSISTANT

LaKisha Barrett

BOOK REVIEWS EDITOR

Glenn Branch

EDITORIAL BOARD

Contributing Editor
John R Cole

Associate Editors

Education

Brian Alters, McGill U

Cell and Molecular Biology

Michael Buratovich, Spring Arbor U

Educational Technology

Leslie Chan, U Toronto

Physics and Astronomy

Taner Edis, Truman State U

Geosciences

John W Geissman, U New Mexico

Mathematics and Statistics

Rob Kusner, UMass - Amherst

Paleontology and Evolutionary Theory

Kevin Padian, U California - Berkeley

Philosophy of Science

Barbara Forrest, Southeastern Louisiana U

Glenn Branch, *Production & Circulation*

Debra Turner, *Design*

Eugenie C Scott, *Publisher*

National Center for Science Education

PO Box 9477

Berkeley CA 94709-0477

(510) 601-7203

fax: (510) 601-7204

e-mail: ncse@ncse.com

http://www.ncse.com

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

Address editorial correspondence to the editor. Style guidelines can be found at <<http://ncse.com/media/authors-information>>. Write to the publisher regarding address changes, missing issues, purchases of back issues, reprint rights, and related issues.

Cover: The coast of Lyme Regis, where Mary Anning searched for fossils (see p 23). Photo by Shelley Emling.

Other artwork ©Ray Troll, 1997
For more information on Ray's work explore his website at <www.trollart.com>.

One of the questions that always yields surprising answers is, "What do people know about evolution?" In this issue George Bishop and his colleagues explore results from a recent poll that may seem to have emanated from the White Queen of *Through the Looking Glass*: If not impossible things, it seems that many respondents were quite capable of believing *contradictory* things about the history and diversity of life.

Of course, some of what we know about evolution is derived from what we learn in school, and that (any educator will tell you) is due only in part to the content of the curriculum. But still, the content of the curriculum is an important foundation — which is why NCSE and its allies spend so much time focusing on what is in science education standards, curricula, and textbooks. Elise Burton reports on an extensive study of evolution education in Middle Eastern countries. In this issue we present her comparison of science curricula — and particularly evolution — in Iran and Saudi Arabia. The results might be different from our expectations based on our general impressions of the two countries.

We are also pleased to run a special feature from Shelley Emling about fossil collector Mary Anning. Anning was an impoverished English woman in the 19th century who walked the beaches for odd relics to sell to wealthy tourists. In the process, she was instrumental in the discovery of many previously unknown fossil species and in the advancement of paleontology. And yet, mostly she is remembered in the tongue-twister "She sells seashells by the seashore." Emling paints a more complete picture of this woman and her life.

BOOK REVIEWS

As we promised last issue, we are completing the process of catching up on our book reviews. These are the last of a batch of reviews that we received during the Darwin bicentennial year. These reviews feature books written especially for younger readers as well as some "evolutionary fiction".



Some readers have noted and commented about our heavy emphasis on Darwin lately. This is because of the important anniversary events of 2009. We realize that Darwin died in 1882 and has not written much lately. As Douglas Theobald notes in his review of Richard Dawkins's bicentennial book, *The Greatest Show on Earth: Evidence for Evolution*, evolutionary science in the 21st century is a rich, interdisciplinary field with so much more going on than the framework that Darwin was able to sketch in 1859. In many ways, it is much easier to find this evidence than Darwin could ever have imagined. And we agree that it is important for the public to hear *that* message.

PEOPLE & PLACES

In his regular column on the people and places of evolution, Randy Moore provides a profile of George McCready Price, the (in)famous Seventh-Day Adventist "geologist" whose work formed the basis of the "scientific creationism" of the 1960s, and is still the intellectual foundation for a lot of the so-called scientific evidences against evolution. Price is a paradigm for a lot of the "creation scientists" that followed: he was self-taught in geology and his doctoral degrees were honorary awards from Adventist schools. Like Price, many of the creation scientists were writing and lecturing in fields where they did not have formal training, but felt that their fidelity to biblical texts made up for the difference.

IN THE NEWS

The good news is that most of the anti-evolution legislation this year has died in committee. The bad news is that the strategy of linking evolution and climate change (aka "global warming") as dubious scientific models is catching on — both here and abroad. And a veteran teacher in Connecticut chose to retire rather than work for a school administration that ordered him to downplay Darwin's work in a proposal for a new multidisciplinary course on the South Pacific planned for 2009 — the 150th anniversary of the *Origin*.

RNCSE 30 (3) was printed in June 2010.

UPDATES

California, Riverside: The faculty senate at La Sierra University released a statement on November 6, 2009, supporting the university's biology department, which (as reported in *RNCSE* 2009 Nov/Dec; 29 [6]: 6-11) was recently besieged with complaints about its teaching evolution; the university is associated with the Seventh-Day Adventist Church, which is historically opposed to evolution. The statement (available on-line at <<http://www.today.com/content/lsu-faculty-senate-affirm-academic-freedom-biology-colleagues>>) affirmed the senate's "strong support for our colleagues in the Department of Biology" and its "commitment to the preservation of academic freedom with intellectual and moral integrity in the context of our heritage, and service as a Seventh-day Adventist Christian University." The senate criticized the complaints as not following "the protocol established by Jesus and outlined in Matthew 18:15-17" and as making "the work and lives of these dedicated Adventist professors more stressful and difficult."

Florida, Orlando: A noted evangelical Old Testament scholar resigned from his faculty position at a seminary in the wake of a controversy over his public acceptance of evolution. On March 24, 2010, a video featuring Bruce Waltke, Professor of Old Testament at Reformed Theological Seminary, was posted on the website of the BioLogos Foundation. (Founded by Francis Collins, the BioLogos Foundation "explores, promotes, and celebrates the integration of science and Christian faith.") Entitled "Why Must the Church Come to Accept Evolution?" the video discussed "the danger that the Church will face if it does not engage with the world around it, in particular by acknowledging the overwhelming amount of data in support of biological evolution, which many evangelicals still reject."

On March 29, 2010, however, Waltke told BioLogos that the

administration of Reformed Theological Seminary asked him to request that the video be removed. According to a blog post at BioLogos (2010 Apr 2; available on-line at <<http://biologos.org/blog/why-must-the-church-come-to-accept-evolution-an-update>>):

Dr Waltke himself indicated that he still agreed with the content of the video. Indeed, Dr Waltke has written previously on his support for theistic evolution ... However, given the brevity of the video, Dr Waltke is concerned that his views might not be correctly understood. ... [D]espite repeated attempts to find an alternative solution, it has become clear that Dr Waltke feels that the only remedy to his predicament is to remove the video (emphasis in original).

But removal of the video was apparently not enough for the seminary. *Inside Higher Education* (2010 Apr 9) reported, "Michael Milton, president of the seminary's Charlotte campus and interim president of its Orlando campus, where Waltke taught, confirmed that the scholar had lost his job over the video." (Technically, Waltke offered his resignation, which officials at the seminary decided to accept.) Milton explained that Reformed Theological Seminary's faculty members are allowed to have different views on creation, but "Darwinian views, and any suggestion that humans didn't arrive on earth directly from being created by God (as opposed to having evolved from other forms of life), are not allowed, he said, and faculty members know this."

Waltke's views were already on record. In a post on BioLogos's blog (2010 Apr 8; available on-line at <<http://biologos.org/blog/on-the-courage-of-bruce-waltke>>), BioLogos's president Darrel Falk quoted Waltke's endorsement of theistic evolution from his book

An Old Testament Theology (Grand Rapids [MI]: Zondervan, 2007), and commented:

Bruce made some equally strong statements with the BioLogos camera running and gave us the written permission to post the now-controversial video. What Bruce said on the video was simply an elaboration of things he had written already. ... Decades from now, when the Evangelical Church has come to terms with the reality of evolution, we hope she will look back at those who were the pioneers on its journey toward a fuller understanding of the manner by which God has created.

In a widely circulated letter to his colleagues at the Orlando campus of Reformed Theological Seminary (available on-line at <<http://thegospelcoalition.org/blogs/justintaylor/2010/04/12/updates-from-waltke-and-from-rtts>>), Waltke later commented, "I knew the issue of Genesis 1-3 and evolution was emotionally charged, but not this charged." The real issue, he explained, was that the video posted at BioLogos identified him as a professor at the seminary:

I was speaking as an individual, not as a representative of RTS. It may well be that I am the only one on the faculty holding the view of creation by the process of evolution as understood by mainline science, apart from its normal atheistic philosophy. As it stands, I dragged the whole community in the misunderstandings.

Expressing regret for the turmoil, he added, "I find no fault with the RTS administration; in fact, I think they did the right thing."

Kentucky: Kentucky's House Bill 397 would have, if enacted, allowed teachers to "use, as permitted by the local school board, other instructional materials to



help students understand, analyze, critique, and review scientific theories in an objective manner, including but not limited to the study of evolution, the origins of life, global warming, and human cloning” (see sidebar, right). HB 397 was introduced in the Kentucky House of Representatives on February 8, 2010, and referred to the House Education Committee; the sole sponsor of the bill was Tim Moore (R-District 26).

The text of HB 397, entitled the Kentucky Science Education and Intellectual Freedom Act, is substantially similar to the so-called Louisiana Science Education Act, Louisiana Revised Statutes 17:285.1, which was passed and enacted in 2008, over the protests of the state’s scientific and educational communities (see *RNCSE* 2008 Jul/Aug; 28 [4]: 4–10). A novelty in the Kentucky bill is the phrase “advantages and disadvantages of scientific theories” — a variation on the familiar “strengths and weaknesses” and “evidence for and evidence against” rhetoric.

HB 397 died in committee when the legislature adjourned on April 15, 2010. Remaining on the books is Kentucky Revised Statutes 158.177, originally enacted in 1976 and re-enacted in 1990, that authorizes teachers to teach “the theory of creation as presented in the Bible” and to “read such passages in the Bible as are deemed necessary for instruction on the theory of creation.” But it is unclear whether teachers take advantage of the opportunity. The *Louisville Courier-Journal* (2006 Jan 11) reported that in a November 2005 survey of the state’s 176 school districts, none was teaching or discussing “intelligent design”.

Mississippi: Mississippi’s House Bill 586, which would have required “scientifically sound arguments by protagonists and antagonists of the theory of evolution” to be presented in the state’s schools, died in committee on February 2, 2010, according to the legislative website. In 2009, the bill’s sponsor, Gary Chism (R-District 37), introduced a bill, HB 25, requiring biology textbooks in the state to include a hybrid of two previous versions of the Alabama evolution textbook disclaimer; that bill also

KENTUCKY’S HOUSE BILL 397

AN ACT relating to science education and intellectual freedom.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

SECTION 1.A NEW SECTION OF KRS CHAPTER 158 IS CREATED TO READ AS FOLLOWS:

(1) Teachers, principals, and other school administrators are encouraged to create and foster an environment within public elementary and secondary schools that promotes critical thinking skills, logical analysis, and open and objective discussion of the advantages and disadvantages of scientific theories being studied.

(2) After a teacher has taught the content related to scientific theories contained in textbooks and instructional materials included on the

approved lists required under KRS 156.433 and 156.435, a teacher may use, as permitted by the local school board, other instructional materials to help students understand, analyze, critique, and review scientific theories in an objective manner, including but not limited to the study of evolution, the origins of life, global warming, and human cloning.

(3) This section shall not be construed to promote any religious doctrine, promote discrimination for or against a particular set of religious beliefs, or promote discrimination for or against religion or nonreligion.

(4) This section may be cited as the Kentucky Science Education and Intellectual Freedom Act.

died in committee. For background, see *RNCSE* 2010 Jan-Apr; 30 (1-2): 4–9.

New Jersey: Discussing Bret Schundler, then the nominee for New Jersey’s state commissioner of education, the *Newark Star-Ledger* (2010 Mar 3) wrote:

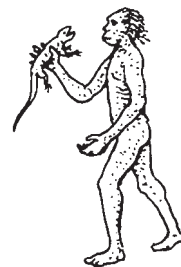
He believes that schools should be allowed to teach “intelligent design” alongside evolution. “I think we should teach evolution, but I wouldn’t tell a district you can’t raise additional questions,” he said yesterday. “People should be humble and let science lead where it leads, and not presume that questions are settled.”

The newspaper editorially called for his confirmation by the state senate nevertheless, commenting, “Confirm the man — he’s the governor’s choice. But cross your fingers.”

Mayor of Jersey City from 1992 to 2001, the Republican nominee for governor in 2001, and currently the chief operating officer of The King’s College, a Christian liberal arts college in New York City operated by Campus Crusade for

Christ, Schundler was nominated as commissioner on January 13, 2010, by governor-elect Chris Christie. On March 1, 2010, the Senate Judiciary Committee voted 11–0 to send his nomination to the full senate for a vote, without endorsing him, “which is rare for the Judiciary Committee,” according to the *Hudson Reporter* (2010 Mar 2). Schundler was confirmed by the full Senate on March 11.

Tennessee, Cheatham County: On March 1, 2010, the Cheatham County Board of Education voted 5–1 to settle a lawsuit brought by two former students and two families of current students, alleging a pattern and practice of the promotion of religious activity dating back to 2001, according to a March 2, 2010, press release from the ACLU of Tennessee, which (along with lawyers from two private law firms) represented the plaintiffs in the case. Two of the allegations of the complaint in the case, *Doe et al v Cheatham County Board of Education et al*, involved creationism: students in a high school English class were told to write everything they knew about the biblical story of creation and then



FROM EVOLUTION TO GLOBAL WARMING IN SOUTH DAKOTA

House Concurrent Resolution 1009, under consideration in South Dakota's legislature, borrowed language from anti-evolution legislation in encouraging teachers to present "a balanced and objective" presentation of global warming, and two NCSE staffers reacted — Steven Newton at the Huffington Post (2010 Feb 25; available on-line at <http://www.huffingtonpost.com/steven-newton/denying-science-legislative_b_476975.html>) and Joshua Rosenau at the Center for American Progress's Science Progress blog (2010 Feb 26; available on-line at <<http://www.scienceprogress.org/2010/02/climate-change-scopes-trial/>>).

Analyzing HCR 1009 as it was introduced, Newton commented on the resolution's "startling lack of knowledge about the particulars of climate science and how science works," observing that it refers to "a variety of climatological, meteorological, astrological, thermological, cosmological, and ecological dynamics" — "Do they think glaciers melt slower when Virgo is ascending?"

Even more disturbing than these errors is the underlying premise of HCR 1009: the assumption that political bodies, rather than scientists, should have the final say over scientific issues. ... This political interference in science education is a problem that extends beyond merely getting the facts wrong. Students deserve better than to be pawns of science denialists.

After discussing the history of creationist activism and its increasing affinity for global warming denial, Rosenau noted that HCR 1009 was revised by the Senate to remove most of the scientific errors — including the reference to astrology, prompting him to speculate, jokingly, that "[t]he stars were not aligned." He warned, however:

the Senate strengthened the final line, insisting now that teachers offer a "balanced and objective" presentation of global warming. However reasonable such advice may be in the abstract, the effect of the law will be chilling to teachers on the ground. Science is not and should not be resolved through the legislative process, and the details of what teachers present as science should not be dictated by legislators with no experience as scientists or teachers.

In the end, however, the House of Representatives accepted the Senate's version of the bill, meaning that both chambers of the South Dakota legislature have officially called "for a balanced approach for instruction in the public schools relating to global climatic change," urging "that all instruction in the public schools relating to global climatic change be presented in a balanced and objective manner and be appropriate to the age and academic development of the student and to the prevailing classroom circumstances."

to read the corresponding section of the Bible, and students in a high school world history class were told that "intelligent design" was a plausible alternative to evolution. In the settlement, the board agreed to ensure that "School Officials

shall not cite the Bible or other sacred text as authority for historical or scientific fact to students during or in conjunction with a[n] Instructional period, at School Events, or at Club Events."

Texas: A new poll suggests that

a slim majority of Texans reject evolution, according to a story in the *Texas Tribune* (2010 Feb 17; available on-line at <<http://www.texastribune.org/stories/2010/feb/17/meet-flintstones/>>), which also noted that "[n]early a third of Texans believe humans and dinosaurs roamed the earth at the same time." David Prindle, a professor of government at the University of Texas, Austin, who composed the questions, quipped that the poll confirmed the comedian Lewis Black's claim that a significant proportion of the American people think that *The Flintstones* was a documentary.

Among the questions on the poll was the standard Gallup question — "Which of the following statements comes closest to your views on the origin and development of human beings?"

- (1) 38% agreed "Human beings have developed over millions of years from less advanced forms of life, but God guided the process" (compared to 36% in the 2008 national Gallup poll);
- (2) 12% agreed "Human beings have developed over millions of years from less advanced forms of life, and God had no part in the process" (compared to 14% in the Gallup poll); and
- (3) 38% agreed "God created human beings pretty much in their present form about 10 000 years ago" (compared to 44% in the Gallup poll).

The remaining 12% chose "Don't know".

It might seem as though Texans are slightly less inclined to creationism than the nation at large — but the explicit presentation of a "Don't know" option in the Texas poll and not in the Gallup poll is probably responsible for the discrepancy. (The Texas poll also only surveyed registered voters.)

By omitting any reference to humans, a different question in the Texas poll in effect tested whether human evolution was especially problematic. Apparently so:

- (1) 53% chose "Life on earth has evolved over time, entirely through 'natural selection,'



but with a guiding hand from God”;

(2) 15% chose “Life on earth has evolved over time, entirely through ‘natural selection,’ with no guidance from God”;

and
(3) 22% of respondents chose “Life on earth has existed in its present form since the beginning of time”;

The remaining 10% chose “Don’t know”.

Respondents were also asked whether they agree or disagree with “Human beings, as we know them today, developed from earlier species of animals”: 35% agreed, 51% disagreed, 15% didn’t know. In a national survey conducted in 2005, as Jon D Miller, NCSE’s Eugenie C Scott, and Shinji Okamoto reported in *Science*, 40% of surveyed Americans agreed, 39% disagreed, and 21% were unsure. Among thirty-two countries discussed in the *Science* article, the United States was second only to Turkey in its rejection of evolution.

Texas: In the March 2, 2010, primary election, avowed young-earth creationist Don McLeroy narrowly lost his bid to be the Republican candidate for the District 9 seat on the Texas state board of education. The *Dallas Morning News* (2010 Mar 3) reported, “The fiercely contested race pitted McLeroy, a dentist from College Station and member of the board’s social conservative bloc, against [Thomas] Ratliff, a legislative consultant and son of former Lt Gov Bill Ratliff,” who is viewed as likely to side with the moderates on the board. There is no Democratic candidate for the seat, so Ratliff is expected to be elected in November 2010.

Since his election in 1998, McLeroy was persistently determined to undermine the treatment of evolution in Texas’s public schools. During the debate over biology textbook adoption in 2003, he was one of the four members of the board who misused the state science standards to oppose adopting the eleven textbooks under consideration. His attacks on science education were in part responsible for the state senate’s refusal to confirm him as chair of the board in May 2009.

McLeroy’s assault on evolution came to a head during a meeting of the board in March 2009 when he declaimed, in a now notorious moment, “Somebody’s got to stand up to experts!” (Video of the scene is available on NCSE’s YouTube channel, <<http://www.youtube.com/user/NatCen4ScienceEd>>) Unfortunately, a majority of the board did so. The board’s revisions to the standards were widely deplored. But McLeroy was unabashed. “Our science standards are light years ahead of any other state when it comes to challenging evolution,” he told the *Washington Monthly* (Jan/Feb 2010), adding, “Evolution is hokey.”

Texas: A three-judge panel from the Fifth Circuit Court of Appeals heard arguments in *Comer v Scott* on April 26, 2010. Chris Comer was forced to resign her post as Director of Science at the Texas Education Agency in November 2007 after she forwarded a note announcing a talk by Barbara Forrest; according to a memorandum recommending her dismissal, “the TEA requires, as agency policy, neutrality when talking about evolution and creationism.” She filed suit in June 2008, arguing that the policy violates the Establishment Clause of the First Amendment. The case was dismissed on March 31, 2009, but Comer appealed the decision to the Fifth Circuit. (For background, see *RNCSE* 2008 Jan/Feb; 28 [1]: 4–7; 2008 Jul/Aug; 28 [4]: 11–4; 2009 Sep/Oct; 29 [5]: 8–13.)

Documents from the case are available on NCSE’s website at <<http://ncse.com/creationism/legal/chris-comer-docs>>, and a brief video about the case is available on NCSE’s YouTube channel (<<http://www.youtube.com/user/NatCen4ScienceEd>>).

National: “Critics of the teaching of evolution in the nation’s classrooms are gaining ground in some states by linking the issue to global warming, arguing that dissenting views on both scientific subjects should be taught in public schools,” reported *The New York Times* (2010 Mar 3). “Wherever there is a battle over evolution now,” Lawrence M Krauss told the *Times*:

there is a secondary battle to diminish other hot-button

issues like Big Bang and, increasingly, climate change. It is all about casting doubt on the veracity of science — to say it is just one view of the world, just another story, no better or more valid than fundamentalism.

The article suggested that the linkage of evolution and global warming was in part due to legal considerations. NCSE’s Joshua Rosenau told the *Times* that he began to notice the linkage after the 2005 decision in *Selman v Cobb County*. At issue was a disclaimer about evolution affixed to textbooks; although the text of the disclaimer was not religious, it was held to be unconstitutional because it endorsed the creationist view that evolution is a problematic theory lacking an adequate foundation. “By insisting that global warming also be debated, deniers of evolution can argue that they are simply championing academic freedom in general.”

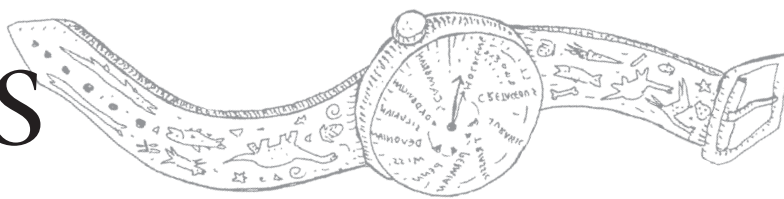
It seems clear that around the country, attempts to undermine the integrity of science education are increasingly likely to include global warming as well as evolution.

Australia, South Australia: A December 2009 decision by the South Australian Non-Government Schools Registration Board will “effectively ban the teaching of creationism,” according to the *Sydney Morning Herald* (2010 Mar 3). The board:

does not accept as satisfactory a science curriculum in a non-government school which is based on, espouses or reflects the literal interpretation of a religious text in its treatment of either creationism or intelligent design.

The chief executive of Christian Schools Australia complained to the newspaper that the policy bans even the mention of creationism in science classes, although a spokesperson for the board countered, “It can be taught in religious studies,” and a spokesperson for the counterpart board in New South Wales explained that its policy is that creationism cannot be taught as science, and “Schools wishing to teach creationism must





The Case of Mark Tangarone

Steven Newton

In September 2008, Mark Tangarone, a veteran public school teacher in Weston, Connecticut, contacted NCSE. Why? Days before he was set to begin teaching a new third grade class, Tangarone received word that a proposed course outline of his had been rejected — due to its evolutionary content.

Tangarone had proposed “AustralAsia,” a year-long talented and gifted (TAG) course that would have involved students learning about the South Pacific region. The hook of “AustralAsia” was that the class would follow Darwin’s voyage through the region on the *Beagle*. Although Darwin would be the touchstone of the course, many other topics besides evolution would be addressed. The class would overlap the bicentennial celebration of Darwin’s birthday, February 12, 2009, fortunate timing that would help students understand the relevance of evolution.

Steven Newton is Programs and Policy Director at NCSE.

“AustralAsia” was designed as an exciting, creative course that integrated information across many disciplines. Such courses are the perfect vehicles to inspire children about learning science. So why did Mark Tangarone’s principal forbid him to teach this course?

In an e-mail dated September 8, 2008 (later published in the *Weston Forum* 2010 Apr 21), Principal Mark Ribbens explained that “[t]he TAG topics need to be altered this year to eliminate the teaching of Darwin’s work and the theory of evolution.”

His primary concern seems to have been avoiding potential controversy. Ribbens acknowledged that “evolution has been a robust theory that has been the basis for much biological thought for the last 150 years,” but he nonetheless chose to reject Tangarone’s course outline because “I do not think it wise to teach a potentially controversial topic.” He added that if evolution were taught, “a number of our parents might object.”

Sadly, this attitude is all too common. A recent study of Florida teachers, for example, reported that 10% of high school teacher respondents had been criticized by colleagues or administrators for the way they taught evolution,

while 27% knew of colleagues who had been criticized (Fowler and Meisels 2010). One respondent commented that an administrator “felt [that] we really shouldn’t teach evolution and if we do we should teach intelligent design as well.” A far cry from the National Science Teachers Association’s position: “Administrators ... should support teachers against pressure to promote nonscientific views or to diminish or eliminate the study of evolution” (NSTA 2003).

EXCUSES, EXCUSES

Ribbens also expressed concern that Tangarone was unqualified to teach evolution — despite the fact that Tangarone is certified to teach K–6 science and social studies in the state of Connecticut and has done so for the last 17 years.

Ribbens asserted that evolution was “not age appropriate” for this TAG class. The “AustralAsia” course was meant for children in third grade; TAG students often are able to use accelerated curriculum several grade levels higher than the standard for their age. Moreover, the 2004 Connecticut science education standards for the third grade include sections on evolution. (Ribbens later acknowledged that

teach it as part of their religious studies.” According to the *Morning Herald*, in New South Wales “there was scope in science courses to include cultural or historical aspects, such as the ‘Dreamtime’, the theories of the ancient Greeks, or biblical perspectives on the nature of the universe.” There are about 90 000 students enrolled in almost 200 non-governmental schools in the state of South Australia, according to the board’s website.

Australia: Questions about creationism are swirling as Australia

seeks to establish a new national science curriculum. First, there is the question of whether the curriculum ought to prohibit the teaching of creationism. The *Sydney Morning Herald* (2010 Mar 4) reported, “The draft national curriculum does not prohibit the teaching of creationism in schools, raising questions about whether this will open the door to its promotion as a science in classrooms.” John Kaye, a Greens Member of Parliament from New South Wales, told the newspaper that the draft national curriculum

“was remarkably silent on the connection between natural selection and the evolution of ancient species into modern forms” and “has left open loopholes that would allow the teaching of intelligent design and old earth creationism as science.” Preferable, he said, was the approach taken by the New South Wales curriculum with its “iron-clad instruction that natural selection and evolution are the driving force behind the diversity of species.”

Second, there is the question of whether the curriculum ought

he might have been incorrect about these statements.)

Ribbens went on to claim, “While evolution is a robust scientific theory, it is a philosophically unsatisfactory explanation for the diversity of life.” How is a public school teacher supposed to respond to such a statement? Requiring that curriculum be “philosophically satisfactory” is a bizarre and unreasonable standard, especially when applied to science. Whether or not evolution is “satisfying” in the subjective opinion of an administrator should be irrelevant; evolution is the only scientific explanation for the diversity of life.

Following the initial rejection of his proposal, Tangarone appealed to an assistant superintendent, Tom Scarice, who confirmed the rejection of the proposal. When he e-mailed other science teachers in his district to ask how they taught evolution, he was reprimanded and fined a day’s salary (*Weston Forum* 2010 Apr 14). “Statements justifying censoring evolution and reprimanding me for gathering information from colleagues [are] deeply disturbing,” he commented.

Throughout this process, NCSE advised Tangarone, providing information about how Connecticut science education standards mandated evolution be taught. We also advised that if students themselves asked questions about evolution in class, they should be answered, even if doing so initiated an administrative rebuke. It is a sad commentary on the state of science education that any teacher in contempo-

rary America has to worry about whether accurately answering a student’s question about evolution will result in a reprimand.

On February 12, 2010 — the 201st anniversary of Darwin’s birth — Tangarone informed the Weston Board of Education of his intention to take early retirement. His letter, quoted in the *Weston Forum* (2010 Apr 14), states, “Because of an unacceptable administrative action, I can no longer continue teaching in Weston.”

He explained, for the first time in public, the administrative reaction to the proposal of his “AustralAsia” course. Board members were shocked. The chair of the board, Phil Schaefer, issued a statement in which he characterized the dispute as a personnel issue on which he was unable to comment, but added as a personal note, “both of my children were fortunate to have Mark, and this is a real loss for our system.”

Schaefer’s sentiments were shared by local parents quoted in the *Weston Forum* (2010 Apr 21). Concerned parents thronged the next meeting of the Weston board of education. According to the *Weston Forum* (2010 Apr 28), “The Board of Education, in a statement read by its chairman, Phil Schaefer, told a standing-room only crowd in the Weston Public Library that the district has, and always will, teach evolution, and that the situation surrounding longtime Talented and Gifted (TAG) teacher Mark Tangarone’s resignation is a ‘personnel matter.’”

Few seem to have been mollified. “This is not going to undo the black eye this town has received,” said Jeff Silverman, citing the press coverage of the incident. “We need to do more to make the statement heard that the town does teach evolution.” Liz Silverman — who was reportedly organizing a retirement party in Tangarone’s honor — added, “How did this happen? Why was a teacher forbidden from teaching evolution? What happens from here?”

REFERENCES

- Fowler SR, Meisels GG. 2010. Florida teachers’ attitudes about teaching evolution. *The American Biology Teacher* 72 (2): 96–9.
- [NSTA] National Science Teachers Association. 2003. The teaching of evolution. Available on-line at <<http://www.nsta.org/about/positions/evolution.aspx>>. Last accessed May 10, 2010.

AUTHOR’S ADDRESS

Steven Newton
NCSE
PO Box 9477
Berkeley CA 94709-0477
newton@ncse.com

Uproar over Evolution in Israel

Glenn Branch

The chief scientist in Israel’s Ministry of Education, Gavriel Avital, “sparked a furor” by

Glenn Branch is NCSE’s deputy director.

to include a discussion of creation myths. Although the draft national curriculum includes a discussion of the Dreamtime, central to Aboriginal creation myths, in the context of science and culture, *The Australian* (2010 Mar 4) reported that it came as a surprise to Barry McGaw, the chair of the Australian Curriculum, Assessment, and Reporting Authority, who commented, “I think Dreamtime is a religious or spiritual interpretation of the beginnings of life. For the same

reason, we wouldn’t let intelligent design or creationism be included. It shouldn’t be in the curriculum, and we’re going to take it out.” McGaw said, however, that it would be acceptable for such topics to be discussed in religion classes. Kaye told the *Morning Herald* that for his part he did not oppose the discussion of Aboriginal or Christian myths in science classes as long as they were not presented as scientific, and said that the Dreamtime was unproblematically included in the New South Wales curriculum.

The national science curriculum is expected to be implemented in 2012.

“No country outside the United States has given creationism a warmer reception than Australia,” according to Ronald L. Numbers (*The Creationists*, rev ed, Cambridge [MA]: Harvard University Press, 2006, p 401). In a 2000 poll, 45% of Australians doubted or were unsure that human evolved from “lower species” via natural selection; while 55% thought that it was definitely or probably true.

questioning the reliability of evolution and global warming, leading to calls for his dismissal, according to *Haaretz* (2010 Feb 21). Avital reportedly said:

If textbooks state explicitly that human beings' origins are to be found with monkeys, I would want students to pursue and grapple with other opinions. There are many people who don't believe the evolutionary account is correct.

There are those for whom evolution is a religion and are unwilling to hear about anything else. Part of my responsibility, in light of my position with the Education Ministry, is to examine textbooks and curricula.

Hava Yablonka of Tel Aviv University told *Haaretz* that Avital's statements were tantamount "to saying that space should be given in textbooks to the view that the earth is flat and the sun revolves around it. It's astonishing that the chief scientist of a government ministry can say such bizarre things." Similarly, Lia Ettinger, a biologist at the Heschel Center for Environmental Learning and Leadership in Tel Aviv, called for Avital's resignation, commenting:

It's clear that, given the nature of science, there is never complete consensus, and that disputes bring us closer to the truth. But this has nothing to do with the things Avital said. If these are his positions, he cannot promote the kind of education necessary for the environment and sustainable ecology.

The reaction from the Israeli scientific community continued unabated. A letter to Minister of Education Gideon Sa'ar signed by ten recipients of the Israel Prize, including Nobel laureates Avram Hershko and Aaron Ciechanover, protested that Avital's remarks served to:

undermine the standing and importance of science and take us centuries backward, even as the world celebrates the importance of Charles Darwin's discoveries and the

great contributions he made to human knowledge and scientific development, and is striving to uproot benighted doctrines such as intelligent design.

They concluded, "We don't see any alternative other than to replace Dr Gavriel Avital with an individual suited to fill the position, one who could do so faithfully and professionally," *Haaretz* (2010 Feb 26) reported.

Avital's academic background is in aerodynamic engineering — when appointed as chief scientist in December 2009, he was the head of aeromechanics at Elbit Systems and a lecturer in aerodynamics at the Technion Israel Institute of Technology — and his appointment was controversial since, as *Haaretz* (2009 Dec 1) reported, it was "apparently the first time the ministry's chief scientist has not come from one of the universities' education schools." A former chief scientist at the ministry told the newspaper, "A chief scientist do[es] not have to know everything about education, but he should at least have extensive knowledge of the field. This is one of the most important posts in the ministry."

Sa'ar apparently took the protests seriously, telling a session of Israel's parliament, the Knesset, that Avital's remarks "are not in line with Education Ministry policy, and are unacceptable to me." *Haaretz* (2010 Feb 25) reported that a letter sent by one of Sa'ar aides to Eyal Morag, a blogger who publicized Avital's statements, explained, "The statements of the chief scientist of the Education Ministry reflect only his personal views and do not reflect the policy of the ministry, those heading it and the professionals in charge [of the said] subjects." A source in the ministry described the letter as in effect a vote of no confidence in Avital; and although Sa'ar told the Knesset that "a process of clarification with the chief scientist" was underway, a source in the ministry told *Haaretz* that Sa'ar would prefer for Avital to resign. Instructed by the ministry not to give any interviews, Avital nevertheless reportedly told a religious website that he stands behind his statements, but would

not make any comment to *Haaretz*.

Despite these hints that Avital was on his way out, the situation was resolved otherwise. In a letter released by Israel's ministry of education on March 3, 2010, Avital promised to follow the ministry's policy on evolution and the environment, *Haaretz* (2010 Mar 4) reported. In his letter, Avital wrote:

Following statements that were published which related to quotes from statements that I made before I assumed [m]y position, and following my conversations with the two of you, I wish to make it clear that the ministry's policy as presented by the education minister at the Knesset is acceptable to me without reservation and I will act accordingly in the context of my position as chief scientist of the Education Ministry.

Haaretz noted, however, that not all of Avital's controversial statements were made before he assumed his position in December 2009. A source in the ministry told the newspaper, "the case ended with the release of Avital's letter."

In any case, Avital's views on evolution may be shared by a sizable segment of the Israeli public. A 2006 survey of public opinion in Israel by the Samuel Neaman Institute found that "a minority of only 28% accepts the scientific theory of the evolution [*sic*], while the majority (59%) believes that man was created by god," while according to the 2000 International Social Survey Programme, a total of 54% of Israeli respondents described "Human beings developed from earlier species of animals" as definitely or probably true, placing Israel ahead of the United States (46%, in last place) for its public acceptance of evolution, but behind twenty-three of the twenty-seven countries included in the report.

AUTHOR'S ADDRESS

Glenn Branch
NCSE
PO Box 9477
Berkeley CA 94709-0477
branch@ncse.com

NCSE NEWS

News from the Membership *Glenn Branch*

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 congratulates **Bruce Alberts** on winning the Vannevar Bush Award from the National Science Board, bestowed upon truly exceptional lifelong leaders in science and technology who have made substantial contributions to the welfare of the nation through public service activities in science, technology, and public policy. An NSB press release issued on April 1, 2010 commented:

We are pleased to recognize Bruce for his dedication to the creativity, openness and tolerance that define science, passion for improving the human condition and transformational and inspirational leadership in science education, international capacity building and the tireless pursuit of a “scientific temperament” for the world.

In the same press release, Alberts added:

In this era of instantaneous, infinite information everywhere, it has become critical to our survival that a scientific way of analyzing problems, based on evidence and logic, become much more dominant around the globe. Those of us who are scientists thus have enormous challenges before us ... that will require that we expand our view of science and its role in society.

Alberts received the award at the National Science Board's Annual Awards Dinner in Washington DC on May 4, 2010.

Alberts is Professor Emeritus in

Glenn Branch is NCSE's deputy director.

the Department of Biochemistry and Biophysics at the University of California, San Francisco, a former president of the National Academy of Sciences, and the editor-in-chief of the journal *Science*. A Supporter of NCSE, Alberts received its Friend of Darwin award in 2004, in recognition of his support of the integrity of science education while at NAS, when it published both *Teaching about Evolution and the Nature of Science* (Washington DC: National Academies Press, 1998) and the second edition of *Science and Creationism* (Washington DC: National Academies Press, 1999).

NCSE congratulates **Francisco J Ayala** on winning the Templeton Prize. The \$1.5-million prize, is awarded annually by the John Templeton Foundation to “a living person who has made exceptional contributions to affirming life’s spiritual dimension.” A March 25, 2010, press release from the Foundation highlighted Ayala’s vigorous opposition to “the entanglement of science and religion while also calling for mutual respect between the two,” saying, “Even as he has warned against religion’s intrusion into science, Ayala, a former Dominican priest, also champions faith as a unique and important window to understanding matters of purpose, values and the meaning of life.”

In his essay “Science and religion: Conflict or dialogue?” posted on the *Washington Post*’s On Faith blog (2010 Mar 25), Ayala sketched his views on science and religion, writing:

Science and religious beliefs need not be in contradiction. If they are properly understood, they cannot be in contradiction, because science and religion concern different matters. ... The proper relationship between science and religion can be, for people of faith, mutually motivating and inspiring. ...

As I see it, scientific knowledge is consistent with a religious belief in God. More so than the ‘creationists[.]’ assertion that everything in the world has been precisely designed by the Creator. Because, then, how to account for human crimes and sins (including the biblical Fall) and for all the catastrophes that pervade the natural world?

His Darwin's Gift to Science and Religion (Washington DC: Joseph Henry Press, 2009) presents his views in greater detail.

A Supporter of NCSE since its founding, Ayala is University Professor, the Donald Bren Professor of Biological Sciences, and Professor of Philosophy at the University of California, Irvine. Among his contributions to the defense of the integrity of science education was his coordination of support for evolution education at the National Academy of Sciences, including his lead authorship of the publication *Science, Evolution, and Creationism* (Washington [DC]: National Academies Press, 2008). NCSE’s executive director **Eugenie C Scott** commented, “Ayala’s contributions to NCSE and its goal of defending the teaching of evolution in the public schools are comparable to his contributions to biology in general: immense.”

NCSE congratulates **Sean B Carroll** for winning the 2010 Stephen Jay Gould Prize from the Society for the Study of Evolution. In announcing the award, the SSE cited Carroll’s “distinguished career both advancing the science of evolution and in conveying that knowledge to the general public,” noting that he is “a leading spokesperson in the public sphere for evolutionary biology” and listing his numerous honors for scientific and educational achievements. The prize is awarded annually by the SSE to recognize individuals whose sustained and exemplary efforts have advanced public understanding of evolutionary science and its importance in biology, education, and everyday life in the spirit of **Stephen Jay Gould**.

Carroll will also become the Howard Hughes Medical Institute’s



Farewell, Susan

Public Information Project Director **Susan Spath**, who went on sabbatical from NCSE in the beginning of 2008 to pursue her scholarly

interests in the history of biology, has decided not to return as a full-time staff member. Spath earned her AB *magna cum laude* in biology at Harvard University and a PhD in history of science at the University of California, Berkeley, with a dissertation on the Dutch microbiologist CB van Niel. She taught history of science courses at Berkeley and at the University of California, Davis, before starting her own technical writing and consulting business. Bringing a biologist's understanding of the nature of scientific research, a historian's perspective on how cultural beliefs are shaped and sustained, and a teacher-cum-writer's expertise in communicating complex scientific ideas, Spath was effective in assisting local activists to defend the teaching of evolution in their communities and states, especially in Missouri, South Carolina, Virginia, and Wisconsin. And she was a marvel at managing complex projects for NCSE. Coordinating the filing of *amicus curiae* briefs in the prospective retrial of *Selman v Cobb County* — a case that ultimately resulted in a victory for the teaching of evolution — and overseeing the comprehensive redesign of NCSE's website are two especially prominent examples. Spath's plan is to return to work as a freelance writer, editor, and consultant. All of us at NCSE wish Spath the very best of luck in her future endeavors.

Vice President for Science Education, beginning in September, 2010. A press release issued on April 7, 2010, described him as "a gifted scientist who also displays an extraordinary talent for translating complicated scientific ideas in compelling, understandable ways to members of the public of all ages." In the same press release, Carroll explained, "We all need inspiration, but how do we nourish curiosity and inspire an interest in science, particularly among young people? These are crucial challenges and I hope to promote the very positive role that science can play in our culture."

A Supporter of NCSE, Carroll is a

Howard Hughes Medical Institute investigator and Professor of Molecular Biology, Genetics, and Medical Genetics at the University of Wisconsin, Madison. He is the author of *Remarkable Creatures* (New York: Houghton Mifflin Harcourt, 2009), and a monthly column published in *The New York Times Science Times*.

Barbara Forrest was profiled in the January 2010 issue of *Church and State*, published by Americans United for Separation of Church and State. "For Barbara Forrest, fighting for church-state separation and quality science education in Louisiana — and the rest of the nation — has become her civic duty," the article (available online at <<http://www.au.org/media/church-and-state/archives/2010/01/intelligent-defense.html>>) explained, citing both her testimony in *Kitzmiller v Dover* and her efforts to mitigate the impact of the so-called Louisiana Science Education Act. Professor of Philosophy at Southeastern Louisiana University, Forrest is the coauthor (with **Paul R Gross**) of *Creationism's Trojan Horse* (rev ed, New York: Oxford University Press, 2007), and a member of NCSE's board of directors.

Daniel K Gladish contributed a guest column to the Hamilton, Ohio, *JournalNews* (2010 Jan 27), responding to a letter from a Norm Pennington expressing skepticism about both climate modeling and evolution. Gladish commented:

Evolution has been studied, tested, debated, retested using modern molecular techniques, and debated for over 200 years. ... Pennington is only correct about evolution insofar as no scientific explanation (theory) is ever completely "settled," but it is a fact that evolution has happened on this planet. That is as settled as the existence of gravity, though we do not yet fully understand what gravity really is. ... The evolution controversy is strictly social. Only people who are unaware of, do not understand, or do not care about the evidence dispute evolution.

Gladish and his colleague **Richard**

C Moore responded to a critic in a subsequent column in the *JournalNews* (2010 Feb 24), explaining, among other things, that evolution is not contrary to the Second Law of Thermodynamics and that there is no lack of transitional forms in the fossil record. Gladish is Associate Professor of Botany and Moore is Assistant Professor of Botany at Miami University of Ohio.

Russell J Hawley responded to a creationist's letter to the editor of the *Casper Star-Tribune*, explaining that a theory is not "a hypothesis proposed as an explanation by a reasonable guess," that creationism is a religious doctrine, and that evolution can explain the existence of the different breeds of animals and plants — "That's precisely what Darwin's *Origin of Species* was all about," he observed. He concluded, "There isn't nearly enough time in the public school curriculum devoted to good science — the last thing we should do is waste our students' time on a pseudoscience such as creationism." His letter was published on April 14, 2010.

According to a February 10, 2010, press release from Valdosta State University, **Leslie S Jones**, working with Marge McCartney, a retired biology teacher, "obtained a grant to send area science teachers to professional development opportunities throughout the region. As part of the grant's first initiative, six Valdosta educators are headed to the Annual Conference of the Georgia Science Teachers Association (GSTA) February 11–12 in Savannah GA." Jones hopes that the project will help to encourage teachers to present evolution despite the prevalence of religiously based resistance. Jones is associate professor of biology at Valdosta State University and coeditor (with Michael Reiss) of *Teaching about Scientific Origins: Taking Account of Creationism* (New York: Peter Lang, 2007).

The February 2010 issue of *The American Biology Teacher* (72:2) was devoted to evolution, and NCSE members were well represented. **William F McComas** contributed a guest editorial, "Where is the 'origin' in the *Origin of*

Species?" (62-3), explaining that the *Origin* sought to explain the origin of species, not the origin of life; **Larry Flammer** contributed "Experience millions of years" (69), offering "a relatively concrete activity to teach the large numbers representing evolutionary deep time"; and **Samantha R Fowler** and Gerry G Meisels contributed "Florida teachers' attitudes about teaching evolution" (96-9), revealing that "many Florida teachers are uncomfortable with the emphasis on evolution in the state's newly revised science standards" and arguing that "it is important to thoroughly explore the reasons for teachers' discomfort so that remedies can be developed." Of interest in the same issue were Bunny Jaskot's editorial "Do you believe in evolution?" (60), Phil Senter's "Were Australopithecines ape-human intermediates or just apes? A test of both hypotheses using the 'Lucy' skeleton" (70-6), Suzanne M Harley's "Charles Darwin's botanical investigations" (77-81), Alan C Love's "Darwin's 'imaginary illustrations': Creatively teaching evolutionary concepts & the nature of science" (82-9), Michael W Schulteis's "Education's missing link: How private school teachers approach evolution" (91-4), Thomas C Jones and Thomas F Laughlin's "PopGen Fishbowl: A free online simulation model of microevolutionary processes" (100-3), William Beachly's "The power of natural selection: A guided investigation of three case studies" (104-9), Anthony D Curtis's "A lesson on evolution & natural selection" (110-3), Wilfred A Franklin's "Evolution & phylogenetic analysis: Classroom activities for investigating molecular & morphological concepts" (114-21), and Maura C Flannery's "Biology Today" column on "From the beginning" (123-6).

The latest issue of *Skeptic* (2010; 15 [3]) featured a tribute to the late **Norman Levitt** by the magazine's founder and publisher, **Michael Shermer**, ending, "Norm, we shall miss you terribly. Your literal voice may be gone, but your literary voice will live on forever" (65). Of interest in the same issue were Levitt's review of Patricia Fara's *Science: A Four Thousand*

Year History (66-9) and a report on a debate on evolution with **Donald R Prothero** and Shermer facing Stephen Meyer and Richard Steinberg (14-15).

In a guest post on the blog of the National Association of Biology Teachers (2010 Feb 18; available at <<http://www.nabt.org/blog/2010/02/18/digging-up-our-family-tree/>>), NCSE's Education Project Director **Louise S Mead** comments on the *Becoming Human* series' implicit comparison of modern chimpanzees and humans, which "fuels the misconception that humans evolved from 'monkeys'." She wrote, "numerous times statements like '[m]illions of years ago, we were apes, living ape lives in Africa' are paired with video segments of modern day chimpanzees and gorillas ... unfortunately promote the misconception that we evolved from modern day chimpanzees, or even monkeys, since I'm guessing many people do not readily distinguish between chimps and monkeys." Overall, though, she recommended the series and the resources for teachers provided at NOVA's evolution website (<<http://www.pbs.org/wgbh/nova/beta/evolution/>>).

NCSE's Education Project Director **Louise S Mead**, **Lawrence S Lerner**, and **Wes McCoy** were among the panelists who helped set achievement standards for the 2009 National Assessment of Education Progress (NAEP) for grades 4, 8, and 12. They met in San Antonio in October 2009 for four days of activities related to assessing the performance of US students on the Science NAEP according to the standards at the Basic, Proficient, and Advanced levels established by the National Assessment Governing Board. Known familiarly as "The Nation's Report Card," the NAEP periodically tests samples of fourth-, eighth-, and twelfth-grade students in various subjects. Because of recent changes in the NAEP Science Frameworks, achievement levels are being developed. Previous achievement levels were developed in 1996. Performance of students at grades 4, 8, and 12 will be reported in 2010 according to these new criteria that were developed.

NCSE Supporter **Kenneth R Miller** was profiled in two local publications: the weekly *Providence Phoenix* (2010 Mar 3) and the *Attleboro Sun-Chronicle* (2010 Mar 22). The *Phoenix* article concentrated on disputes between Miller and the "New Atheists":

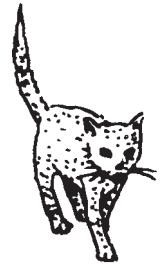
To Miller's critics, his blurring of the lines between science and religion is providing dangerous comfort to those who would use superstition to settle important public policy questions. But Miller rejects any suggestion that the science in his work suffers when he brings in the spiritual. And he argues that the New Atheists, in their forceful rejection of God, are doing damage, in their own right, to a scientific brand already under assault.

The *Sun-Chronicle* interviewed Miller on a number of topics, including the developments in creationism; Miller commented:

Year after year, the anti-evolutionists make exactly the same arguments against evolution. They have no new science, so they continue to argue that the fossil record lacks transitional forms between species, that the evolutionary mechanism cannot generate new biological information and that the process of evolution cannot be directly observed in the field or in the laboratory. All of those arguments are false.

Miller is Professor of Biology and Royce Family Professor for Teaching Excellence at Brown University, coauthor of the most widely used high school biology textbook in the country, and author, most recently, of *Only a Theory: Evolution and the Battle for America's Soul* (New York: Viking, 2008).

Randy Moore reviewed **Carl Zimmer's** *The Tangled Bank: An Introduction to Evolution* (Greenwood Village [CO]: Roberts and Company, 2009) for *CBE Life Sciences Education* (2010; 9 [1]: 22-4), describing it as "an excellent book that all biologists will want to examine and most will



want to buy. It is one of the two best treatments of evolution that I've come across for general audiences, and the best textbook I've seen for a nonmajors introductory biology course about evolution." A long-time member of NCSE and a recipient of NCSE's Friend of Darwin award in 2004, Moore is a professor of biology at the University of Minnesota and a former editor of *The American Biology Teacher*.

Randy Moore, Mark Decker, and Sehoya Cotner's *Chronology of the Evolution-Creationism Controversy* (Westport [CT]: Greenwood, 2010) received a favorable review from *Library Journal* (2010 Mar 15): "Clearly written and easy to understand, the book is highly recommended for school, public, and academic libraries, as well as theological libraries with audiences interested in the topic."

Writing at the Huffington Post (2010 Feb 12; available on-line at <http://www.huffingtonpost.com/steven-newton/five-reasons-why-evolutio_b_459636.html>), NCSE's **Steven Newton** offered, in honor of Charles Darwin's 201st birthday, a list of five ways in which evolution is important to medical practice: improving the understanding of H1N1 and emerging diseases, HIV, vaccines, antibiotic resistance, and drug development. "There are a host of other applications of evolution — agriculture, forensics, bio-engineering," he concluded. "But the importance of evolution extends beyond its practical side; evolution explains the diversity of life on this planet, shows us our connection to other living things, and reveals profound insights into the processes of nature. Today, on Darwin's 201st birthday, take a moment to reflect on the importance of evolution."

Gregory S Paul wrote a letter to *Science* to complain that a story on the origin of religion "did not incorporate the growing body of psychosociological research that is revealing the crucial role of socioeconomics in the origin and popularity of religion, as well as in creationism," citing, among other work, his "The chronic dependence of popular religiosity upon dysfunctional psychosociological

conditions" (*Evolutionary Psychology* 2009; 7 [3]: 398–441). His letter was published in the February 5, 2010, issue (327 [5966]: 642).

Robert T Pennock is a principal investigator on a project at Michigan State University that just was funded to become one of five National Science Foundation Science and Technology Centers, officially named "BEACON, an NSF Science and Technology Center for the Study of Evolution in Action"; BEACON stands for Bio/computational Evolution in Action Consortium. "BEACON will conduct research on fundamental evolutionary dynamics in both natural and artificial systems," said Erik Goodman, MSU professor of electrical and computer engineering and director of the center, in a February 23, 2010 press release. "In addition, we will educate a generation of multidisciplinary scientists, and improve public understanding of evolution at all levels." He added, "Evolution works and being able to see it in action is the ultimate proof." Pennock, a professor of philosophy at Michigan State University, is the author of *Tower of Babel: The Evidence against the New Creationism* (Cambridge [MA]: MIT Press, 1999) and served as an expert witness for the plaintiffs in *Kitzmiller v Dover*.

As Darwin Day 2010 approached, **Bruce Rinker** devoted his regular column for the *Roanoke Star-Sentinel* to the celebration, writing:

Since its publication, Darwin's theory of evolution by natural selection has stood the test of time, taking its well-deserved position alongside Newton's theory of gravity, Bohr's atomic theory, and the germ theory of disease as cornerstones of modern science that explain natural phenomena. Comments by a few vocal uninformed or badly informed antagonists aside, Darwin's theory explains beautifully and simply all the wondrous variety that graces an otherwise lifeless planet.

Rinker is head of the science department at North Cross School

in Roanoke, Virginia. His column appeared on January 28, 2010.

NCSE's **Joshua Rosenau** was asked by the *Washington Post* to comment on a chapter about evolution in a new book — SE Cupp's *Losing Our Religion* (New York: Threshold, 2010) — accusing "the liberal media" of attacking Christianity. The author's "handling of science and religion misrepresents the nature of evolution, obscures the science of biology and dismisses the deeply held religious views of most Christians outside of the fundamentalist subculture," Rosenau explained. A short version of his response appeared in the April 25, 2010, issue of the newspaper (and is available online at <<http://www.washingtonpost.com/wp-dyn/content/article/2010/04/23/AR2010042304712.html>>), with a long version appearing on the *Post's* Political Bookworm blog (<http://voices.washingtonpost.com/political-bookworm/2010/04/cupp_skips_the_facts_in_arguin.html?hpid=news-col-blog>) on April 21, 2010.

"Dobzhansky was right: Let's tell the students." That was NCSE's executive director **Eugenie C Scott's** advice, as published in the journal *BioEssays* (2010; 32 [5]: 372–4; available on-line at <<http://www3.interscience.wiley.com/cgi-bin/fulltext/123370200/HTMLSTART>>). "University instructors are responsible for a good part of the general public's ignorance about evolution," she argued: "it is they who teach the university students who become the science teachers in our schools, as well as the students who become members of the educated public." First and foremost, she recommended that university scientists "think about how they teach evolution. Is evolution as central, integrated, and pervasive in their syllabi as it is in biologic research? Will their students realize that — in the words of Theodosius Dobzhansky's famous 1973 article for high school biology teachers ... — nothing in biology makes sense except in the light of evolution?"

Beyond the classroom, she urged, "scientists need to speak up when evolution is under attack in their schools. And more generally,



scientists have a special responsibility to work to ensure a scientifically literate citizenry, which includes educating them in the importance of evolution to science, and in science education. In a nation where the majority of financial and institutional support for science predominantly depends on the public, it is in the best interests of neither science nor our nation that the public understanding of a major principle of science continues in its dismally low state.”

Several videos featuring NCSE’s executive director **Eugenie C Scott** have recently been added to NCSE’s YouTube channel (<<http://www.youtube.com/user/NatCen4ScienceEd>>):

- a mini-documentary on Scott’s life and work, produced in 2008 by the University of California, San Francisco, to complement the ceremony in which she received the UCSF Medal, the university’s highest honor;
- a talk on “Evolution versus Creationism” that she delivered at a course on “Darwin’s Legacy” at Stanford University in 2008;
- “In the Beginning,” a discussion among Scott, **Francisco Ayala**, and **Denis Lamoureux**, hosted by NPR’s Neal Conan, in Columbus, Ohio, in 2009;
- a reading from and discussion of the second issue of her *Evolution vs Creationism: An Introduction* (Berkeley [CA]: University of California Press, 2009) in Albany, California, in 2010;
- an interview about ways of teaching evolution effectively, recorded at the University of Notre Dame in September 2009;
- a discussion with **Arie Korpelaar** about “Controversial Issues in Science Teaching” broadcast on Los Angeles County’s Educational Telecommunications Network in 1991; and
- an appearance on WRC-TV’s “Headlines on Trial,” hosted by Arthur Miller, in 1987.

Additionally, Scott was recently interviewed for three different podcasts — The Skeptic Zone

(“the podcast from Australia for science and reason”; <<http://www.skepticzone.tv/>>), Skeptically Speaking (<<http://skepticallyspeaking.com/episodes/44-evolution-education>>), and the Rational Alchemy blog (<<http://rational-alchemy.com/guest-interviews/917-dr-eugenie-scott>>) — and by two blogs, one operated by the University of California Press (<<http://www.ucpress.edu/blog/?p=5276>>) and one operated by a group of Spanish scientists (<<http://cnho.wordpress.com/2010/02/18/>>).

Dave Thomas, president of New Mexicans for Science and Reason, was profiled in the February 4–10, 2010, issue of the alternative weekly newspaper *Alibi*. “New Mexico native David Thomas is not your ordinary egghead. He’s also one of the country’s top skeptical investigators. Thomas has degrees in physics and mathematics from New Mexico Tech, where he develops earthquake-detection equipment. He also teaches a course on critical thinking and distinguishing science from pseudoscience. Oh, and he plays mean bass in local act Vigilante Band.” The story focused on Thomas’s critique of the Bible Code and claims of UFOs, but the photograph accompanying the article showed Thomas wearing a “There is grandeur in this view of life” t-shirt, produced by NCSE for a conference a few years ago.

Dave Thomas’s “War of the weasels: An evolutionary algorithm beats intelligent design” appeared in the May/June 2010 issue of *Skeptical Inquirer* (34 [3]: 42–6). He argued that, contrary to the claims of “intelligent design” creationists, “genetic algorithms can solve difficult problems without knowing anything about the answer(s) in advance”; to drive his point home, he then challenged them to outperform a genetic algorithm at a specific task (solving a particular Steiner problem). They failed. Also of interest in the same issue of *Skeptical Inquirer* are **David Morrison’s** “Did a cosmic impact kill the mammoths?” (14–8), Massimo Pigliucci’s “Philosophers against evolution” (discussing Jerry Fodor and Massimo Piattelli-Palmarini’s *What*

Darwin Got Wrong; 23–4); Kenneth W Krause’s “The amazing Ardi” (29–31), and **Glenn Branch’s** review of Damian Thompson’s *Counterknowledge* (56–7).

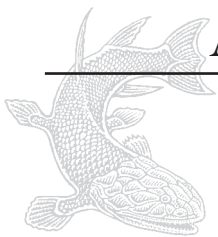
Günter Wagner, the Alison Richard Professor of Ecology and Evolutionary Biology at Yale University, was elected to the American Academy of Arts and Sciences in April 2010. Founded in 1780, the American Academy of Arts and Sciences is an independent policy research center that conducts multidisciplinary studies of complex and emerging problems. The Academy’s elected members are leaders in the academic disciplines, the arts, business, and public affairs.

NCSE congratulates **Carl Zimmer** for winning the AAAS Kavli Science Journalism Award for 2009 in the large newspaper category, in recognition of three articles on aspects of genetics and evolution he wrote for *The New York Times* in 2008 and 2009. A press release issued on November 10, 2009, explained:

From the biology of fireflies to the evolution of viruses to the secrets of RNA, Zimmer “finds fresh and original ways to introduce readers to complex basic science,” said Lauran Neergaard of the Associated Press. “His beautiful writing hooks you to the very end.” Nancy Shute, a freelancer formerly with *US News & World Report*, said Zimmer “brings surprising insight and perspective to subjects as heavily covered as the swine flu virus.” Hotz, of *The Wall Street Journal*, said Zimmer’s work “demonstrates the continuing strength of print journalism and the commitment of newspapers” to convey compelling research to their readers.

Zimmer is also the author of several popular books about biology, including *The Tangled Bank: An Introduction to Evolution* (Greenwood Village [CO]: Roberts and Company, 2009). Zimmer also received NCSE’s Friend of Darwin award in 2005.





Americans' Scientific Knowledge and Beliefs about Human Evolution in the Year of Darwin

George F Bishop, Randal K Thomas, and Jason A Wood

The year 2009 marked the 150th anniversary of the publication of Darwin's *On the Origin of Species by Means of Natural Selection*. Over eighty years ago, the Scopes "monkey trial" in Dayton, Tennessee, marked the beginning of a long battle for the soul of American public opinion, pitting biblical creationism against the teaching of human evolution in public schools. But how well do we understand what Americans know and believe about human evolution? National surveys by Gallup have certainly told us much about trends in Americans' core beliefs about human origins: a relatively stable, sizable plurality (45%), for example, appears to believe in a creationist version of human origins; nearly 40% endorse the theistic supernatural idea that "man has developed over millions of years from less advanced forms of life, but God guided this process, including man's creation"; and only a very small percentage (12–14%) has accepted the naturalistic position that "man has developed over millions of years from less advanced forms of life. God had no part in this process" (<http://www.gallup.com/poll/21814/Evolution-Creationism-Intelligent-Design.aspx>). We have also learned a good deal about the socio-demographic characteristics of those who hold such beliefs (<http://pewforum.org/docs/?DocID=392>). But we know much less about the nuances and structure of these beliefs and the scientific knowledge or ignorance that underlie them. Data from a recent national Harris survey (2008) addresses these deficiencies by measuring multiple dimensions of Americans' beliefs about evolution, their familiarity with scientific concepts in evolutionary biology (for example, adaptation), and their scientific knowledge in general (for example, the age of the earth and of the universe) — all social-psychological facts that the American scientific and educational communities must confront in dealing with the obstacles to full acceptance of the theory of human evolution in the 21st century.

George Bishop is Professor of Political Science and Director of the Graduate Certificate Program in Public Opinion and Survey Research at the University of Cincinnati, Randall K Thomas is Senior Survey Methodologist at ICF International, and Jason A Wood is Research Associate at the Internet Public Opinion Laboratory, Department of Political Science, University of Cincinnati.

Our first analysis of these data has revealed a remarkable diversity of religiously driven and scientifically informed (and uninformed) beliefs about human evolution, much of it seemingly contradictory (see summary table on page 17). To begin with, sizable chunks of the American adult public evidently believe a whole host of creationist articles of faith to be true, among them such claims as:

Archaeological findings have confirmed the authenticity of the people and incidents recorded in the Old Testament of the Bible (65%).

All people are descendants of one man and one woman — Adam and Eve (60%).

The theory of evolution proposes missing links and speculates about how humans developed but does not have strong factual evidence to support it (52%).

The Bible describes the creation of life exactly as it occurred in six days (50%).

The only reliable way to know for certain about what happened in the past is to have a reliable historic record written by someone who was an eyewitness (50%).

Human fossils have been found mixed in with dinosaur fossils showing that humans existed at the same time that dinosaurs existed (43%).

God created the universe, the earth, the sun, moon, stars, plants, animals, and the first two people within the past 10 000 years (39%).

There was a flood within the past 10 000 years that covered all of the earth and was responsible for most of the rock layers and fossils that are seen across the world (60%).

Yet hardly a fifth (18%) actually believes the statement "The earth is less than 10 000 years old." And this is one of many such cognitive-psychological incongruities in the public's belief system.

At the same time, much of the American public appears to endorse as true propositions about the origins of life that are strikingly theistic and in sync with a range of appeals from the "Intelligent Design" movement, namely such claims as:

God created the fundamental laws of physics and chemistry in just the right way, so that life, particularly human life, would be possible (69%).

All living things exhibit evidence of having been purposefully designed which means there must be an Intelligent Force or a God (64%).

**AMERICANS' BELIEFS AND KNOWLEDGE ABOUT CREATIONISM,
THE ROLE OF GOD, "INTELLIGENT DESIGN", AND HUMAN EVOLUTION**

	True	False	Not Sure	(N=)
God created the universe, the earth, the sun, moon, stars, plants, animals, and the first two people within the past 10 000 years.	39%	50%	11%	600
There was a flood within the past 10 000 years that covered all of the earth and was responsible for most of the rock layers and fossils that are seen across the world.	60%	25%	15%	599
The earth is less than 10 000 years old.	18%	69%	13%	531
God made the dinosaurs, along with all other animals and humans, less than 10 000 years ago.	35%	53%	12%	587
Dinosaurs lived at the same time as people.	40%	48%	13%	574
The only reliable way to know for certain about what happened in the past is to have a reliable historic record written by someone who was an eyewitness.	50%	41%	9%	573
Archaeological findings have confirmed the authenticity of the people and incidents recorded in the Old Testament of the Bible.	65%	19%	17%	583
The theory of evolution is not supported by any confirmed facts.	35%	52%	13%	566
The theory of evolution proposes missing links and speculates about how humans developed but does not have strong factual evidence to support it.	52%	33%	15%	580
All of the events recorded in the Old Testament of the Bible are supported by archaeological evidence.	48%	37%	15%	547
Human fossils have been found mixed in with dinosaur fossils showing that humans existed at the same time that dinosaurs existed.	43%	41%	16%	573
All people are descendants of one man and one woman — Adam and Eve.	60%	32%	9%	578
The Bible describes the creation of life exactly as it occurred in six days.	50%	39%	11%	607
There is no such thing as a genetic defect — all genetic changes result from the decisions of a God or an Intelligent Force.	24%	68%	9%	584
All living things exhibit evidence of having been purposefully designed, which means there must be an Intelligent Force or a God.	64%	27%	9%	525
God created the fundamental laws of physics and chemistry in just the right way, so that life, particularly human life, would be possible.	69%	23%	9%	544
God has intervened in the evolutionary process to create millions of species at various times over millions of years.	54%	34%	12%	533
God started the evolutionary process and directed it over millions of years.	56%	34%	10%	521
God allows organisms to survive by way of natural selection in a post-Flood world.	55%	27%	19%	539
God allows variations within each species, like a man or a dog, through natural selection, but does not allow changing from one species to another species.	56%	29%	16%	535
Humans are so complex, advanced, and unique that we cannot have arisen due to chance events.	60%	27%	13%	525
The life processes in cells are so complex that they could not have developed by random events.	61%	29%	10%	530
The complexity of life cannot have arisen by chance or random events.	59%	30%	11%	532
Some traits in humans were produced by intelligent design while other traits evolved by natural selection.	52%	36%	12%	508
The origin of all life in the universe is the result of intelligent design and not chance events.	56%	32%	12%	558

Humans are so complex, advanced, and unique that we cannot have arisen due to chance events (60%).

God started the evolutionary process and directed it over millions of years (56%).

God has intervened in the evolutionary process to create millions of species at various times over millions of years (54%).

There is no such thing as random genetic mutations causing changes in a species — all genetic changes result from the decisions of a God or an Intelligent Force (35%).

And perhaps most amazing:

There's no such thing as a genetic defect — all genetic changes result from the decisions of a God or an Intelligent Force (24%).

Despite all this religiously-rooted reasoning, large percentages of Americans (often the same people) likewise accept as true a multitude of evolutionary scientific *facts* that are seemingly at odds with other statements they accept as true, such as:

Layers of rock containing fossils cover the earth's surface and date back hundreds of millions of years (78%).

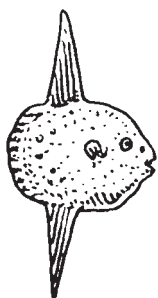
Humans share reflexes with other primates that are not shared with other animals (75%).

Dinosaurs became extinct about 65 million years ago (69%).

All life forms are descended from common ancestors that developed over millions of years (65%).

Birds appear to have evolved from dinosaurs (55%).

Living organisms on earth have evolved over a billion years ago from nonliving chemicals (44%).



Our exploratory factor analysis of sixty such items turned up four fundamental dimensions that underlie most beliefs about human evolution, which we call: (1) Purposeful Complexity-Intelligent Design, (2) God as Biblical Creator of the Universe & Human Life (3) Reality of Genetic Relatedness & Change in Life, and (4) Truth of Scientific Claims on Evolution (details are not included here, but are available on request from the authors). So Americans' beliefs about evolution are a lot more nuanced and multidimensional than heretofore suspected. Not only that, we found a number of anomalous response patterns when we looked at the relationship between responses to our belief items and responses to the Gallup question about human origins.

For example, over a third (35%) of respondents who chose Gallup's creationist category (God created human beings in their present form at one time in the last 10 000 years or so) did *not* believe the creationist tenet "Dinosaurs lived at the same time as people." In fact, over half (56%) of these respondents also agreed with the statement "Dinosaurs became extinct about 65 million years ago." Even better, a solid majority of them (54%) agreed that "All animals share common ancestors that gave rise to all the different types of animals that are alive today." These and other anomalous patterns (not shown here) tell us that the widely cited Gallup question may significantly overestimate the percentage of orthodox creationists in the American public.

We also discovered that, underneath all these

inconsistent and perplexing belief patterns, Americans' knowledge of basic scientific and evolutionary facts looks rather poorly grounded. Less than half (43%) knew (or guessed in a multiple-choice format) that the earth is billions of years old and only 30% knew that the universe was also billions of years old. Barely more than four out of ten Americans (42%) was aware that the last dinosaur existed on earth millions of years ago; roughly a fourth (26%) thought it was a hundred thousand years ago or less. Just a fifth or so (22%) could correctly answer that modern humans emerged hundreds of thousands of years ago, and not unexpectedly, less than one third (28%) could accurately identify when human beings begin to migrate across the world from the continent where they originally emerged: 10 000–100 000 years ago; in fact, 39% believed it was actually less than 10 000 years ago (see "Atlas of the Human Journey" at <<https://genographic.nationalgeographic.com/genographic/lan/en/atlas.html>>).

Furthermore, Americans' self-reported acquaintance or familiarity with key evolutionary concepts looks equally abysmal:

CONCEPT	VERY FAMILIAR	SOMEWHAT FAMILIAR
Natural Selection	19%	28%
Adaptation	16%	29%
Genetic Mutation	14%	14%
Speciation	6%	14%

So, with evolutionary literacy so rudimentary and fundamentalist, theistic, and "intelligent design"-driven beliefs so widespread, it should not be terribly surprising that public resistance to the theory of evolution in American society remains remarkably high, as compared to what has been documented in international surveys of citizens from other economically and scientifically developed nations by Jon Miller, Eugenie C. Scott, and Shinji Okamoto (in their "Public acceptance of evolution," *Science* 2006; 313 [11]: 765–6) — all this, mind you, in the Year of Darwin, 150 years after the publication of the "*Origin of Species*". Surely the graybeard must be turning in his grave.

CORRESPONDING AUTHOR'S ADDRESS

George F. Bishop
Department of Political Science
University of Cincinnati
Cincinnati OH 45221-0375
bishopgf@ucmail.uc.edu

Note: This article is a revised and updated version of a paper presented at the 64th Annual Conference of the American Association for Public Opinion Research, Hollywood, Florida, May 14–17, 2009. The data were originally collected by Harris Interactive with 4626 respondents in two waves of data collection from July to October, 2009. Respondents were drawn from Harris Interactive's on-line panel and weighted based on age, sex, region of country, income, education, and ethnicity to resemble the overall US based on US Census proportions.

Address to the National Academy of Sciences

Eugenie C Scott



NCSE's executive director Eugenie C Scott received the Public Welfare Medal from the National Academy of Sciences in a ceremony on April 25, 2010, in Washington DC. According to a January 11, 2010, press release, "the medal is presented annually to honor extraordinary use of science for the public good"; Scott was chosen "for championing the teaching of evolution in the United States and for providing leadership to the National Center for Science Education." The following are her remarks on receiving the medal.

ing of evolution in the United States and for providing leadership to the National Center for Science Education." The following are her remarks on receiving the medal.

The Public Welfare Medal is awarded for "distinguished contributions in the application of science to the public welfare." My predecessor recipients have done so in impressive ways — in politics, education, agriculture, public health, medicine — so many fields of endeavor.

For me to follow in their footsteps is nothing short of astonishing. That an organization comprised of the finest scientists in the nation would bestow this award on a small, underfunded, understaffed, nonprofit laboring to defend the teaching of evolution is both humbling and inspiring. On behalf of all the people who have worked at NCSE over the last 22 years to make it an effective organization, I thank you from the bottom of my heart.

Life at NCSE is rather different from what most scientists do for a living, so I should tell you a bit more about us. The elevator speech version of NCSE is that we are the people who hand out the fire extinguishers to put out the brushfires set by those who oppose the teaching of evolution. We are a clearinghouse of information and advice for those at the grassroots who are defending the teaching of modern science in their communities or states.

We teach them how to fish, if you don't mind my mixing up the fireman metaphor. Of course this involves scientific information: creationists make statements about science that need correcting, and evolution needs to be presented as we scientists understand it.

But the creationism and evolution controversy also is about religion, and education, and the law, and ultimately, politics. Science is necessary but not sufficient to solve these problems. At NCSE we cultivate an integrated approach, working with not only scientists, but also teachers, attorneys, clergy, parents and other voters, and elected officials to try to keep good science in the classroom.

NCSE's grassroots orientation began at its inception in 1981. The Academy, concerned about legislation promoting equal time for creation science, convened an *ad hoc* committee on creationism, to which I was invited. At the time I was teaching physical anthropology at the University of Kentucky, and we had just had a prolonged struggle at the local school board level combating a proposal by the "Citizens for Balanced

Teaching of Origins" to teach the "cutting-edge new science" of creation science. (Note: if you read "balanced" and "origins" in the same paragraph, there is a 90% probability that you are reading a creationist tract.) It was during this controversy that I learned that these sorts of problems are not solved by scientists alone, but by a coalition of scientists, teachers, clergy, parents, and businesspeople, each of whom has overlapping stakes in good science's being taught in our schools.

At the Academy's *ad hoc* committee meeting, I and some others with grassroots experience contended that scientists were needed at the local level, but (in 1981) the Academy, AAAS, AIBS, NSTA, and other scientific and educational associations had no efficient way to turn out their members in, say, Omaha, to testify at a school board meeting or a committee hearing. Local problems require local solutions, and what eventually evolved was a grassroots-oriented group of scientists and teachers, the NCSE, to complement the national efforts of the associations. It was after this conference that the Academy composed and distributed its extremely valuable and important *Science and Creationism*, and of course there are people here today who made that happen and/or worked on the two subsequent editions. Then as now, the Academy has taken a leadership position to inform the public about the importance of evolution in the sciences.

Contrasting with 1981, after the advent of digital communications, now scientific and educational associations can indeed correspond efficiently with their members and provide them with information about attacks on evolution (or other anti-science actions). Wisely, they have not replicated NCSE, but instead, many associations have formed partnerships with us. Because we monitor science education issues in legislatures and schools around the country, when problems arise, we are able to provide the associations with the what, where, who, and what to do about it, and the associations pass down this information to their members in those communities or states.

It works. The association top-down/NCSE grassroots combination quickly informs scientists of what they need to know and do, and scientists have heeded the call, supporting science at the local level. We also have coordinated *amicus* briefs signed by associations, which have been powerful statements of the unity of scientists regarding evolution education.

The Academy has long been a leader among associations, taking seriously these threats to science, and being the Academy, has a bully pulpit, indeed. I thank the members of the Academy for stepping up to the plate on so many occasions to support evolution education, and look forward to the day when — we can all hope — the public has a better grasp of why our students should be taught 21st-century science.

Thank you for that, and for this truly incredible award.

AUTHOR'S ADDRESS

Eugenie C Scott
NCSE
PO Box 9477
Berkeley CA 94709-0477
scott@ncse.com

Eugenie C Scott is NCSE's executive director.

MOORE, MOORE, MOORE, AND MORE

Moore, as it happens, is the ninth most common surname in the United States, according to census data. It is still a striking fact that three of NCSE's favorite authors are named Moore: James Moore, Professor of History at the Open University; the late John A. Moore, Professor of Biology at the University of California, Riverside, and a Supporter of NCSE; and Randy Moore, Professor of Biology at the University of Minnesota, Twin Cities. Writing on a host of overlapping topics — Darwin, the history of biology, the creationism/evolution controversy, and how to teach evolution effectively among them — the various Moores have provided a staggering array of interesting and illuminating books. (Having the surname is not a guarantee of anything, of course: one of the founders of the Creation Research Society was named John N Moore!) The following books by the various Moores are now available through the NCSE website: <http://ncse.com/store> — look in the “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.

JAMES

Charles Darwin

by Adrian Desmond,

Janet Browne, and James Moore

A slender but authoritative biography of Darwin, written by three of the top Darwin scholars working today, based on the biographical entry from the *Oxford Dictionary of National Biography*, and published in Oxford University Press's Very Interesting People series. “Having almost a hundred years of Darwin-related research [among] the three of us, we have managed the unwieldy subject by triangulating [among] different sides,” the authors explain. “This slim book gives a composite portrait.” Desmond and Moore collaborated to write *Darwin: The Life of a Tormented Evolutionist*, while Browne wrote *Charles Darwin: Voyaging* and *Charles Darwin: The Power of Place*.

Darwin: The Life of a Tormented Evolutionist

by Adrian Desmond and James Moore

Writing in *Nature*, Stephen Jay Gould described Desmond and Moore's *Darwin* as “Unquestionably, the finest [biography] ever written about Darwin.” A thoroughly scholarly work, *Darwin* nevertheless reads like a novel, which prompted Anthony Burgess to comment that “[Darwin's] story

is told here with the right energy, irony and affection. His example has driven these two learned doctors to the making of a huge work whose permanent value hardly seems to be in doubt.” Desmond's other books include *The Politics of Evolution*; Moore's other books include *The Post-Darwinian Controversies*; and they recently collaborated again to write *Darwin's Sacred Cause*.

Darwin's Sacred Cause

by Adrian Desmond and James Moore

From the publisher: “In their new book, timed to coincide with the worldwide Darwin bicentenary celebrations, Desmond and Moore provide a major re-examination of Darwin's life and work. Drawing on a wealth of fresh manuscripts, unpublished letters, notebooks, diaries, and ships' logs, they argue that the driving force behind Darwin's theory of evolution was not simply his love of truth or personal ambition — it was his fierce hatred of slavery. Darwin's abolitionism had deep roots in his mother's family, and it was reinforced by his voyage on the *Beagle* as well as by events in America — from the Civil War to the arrival of scientific racism at Harvard.”

The Darwin Legend

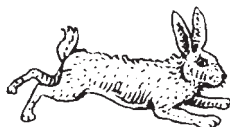
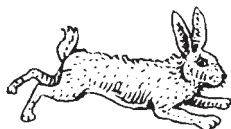
by James R Moore

Did Darwin recant evolution on his deathbed, telling Lady Hope, “How I wish I had not expressed my theory of evolution as I have done”? No — yet the legend continues to circulate among creationists. In his monograph, Moore judiciously assessed the evidence for the story and pondered its significance, arguing that it is important to understand Darwin and his religious development on their own terms. Reviewing the book for *RNCSE*, Kevin Padian commented, “Moore undertook to write the book largely because he could not get away from questions about [the legend] every time he was interviewed about Darwin,” adding, “Moore's book is excellent scholarship.”

The Post-Darwinian Controversies

by James R Moore

Originally published in 1979, *The Post-Darwinian Controversies* contains three parts: a historiographical essay on the idea of the war between science and religion, a summary of the scientific debates over Darwin and evolution, and a novel analysis of the theological reactions to Darwin's ideas, centering on a detailed treatment of twenty-eight 19th-century theologians. Moore's book was described by Ronald L Numbers in *Isis* as “one of the best [books] on the his-



torical relations of science and religion and definitely the best on evolution and theology ... the most intelligent and most wide-ranging (both geographically and chronologically) study of evolution and theology to date."

History, Humanity and Evolution: Essays for John C Greene

edited by James R Moore

A collection of essays in honor of the eminent historian of science John C Greene, *History, Humanity, and Evolution* includes essays by Roy Porter on Erasmus Darwin, Adrian Desmond on Lamarckism and democracy, Jim Secord on Robert Chambers and *Vestiges of Creation*, Martin Rudwick on 19th-century visual representations of the deep past, Peter J Bowler on degeneration and orthogenesis in theories of human evolution, and John R Durant on Darwinian religion in the 20th century. "[I]t is required reading for scholars in any field concerned with evolutionary thought in the 19th century," wrote the reviewer for *Isis*.

JOHN

From Genesis to Genetics: The Case of Evolution and Creationism

by John A Moore

Published in 2001, shortly before Moore's death, *From Genesis to Genetics* lucidly defends the importance of evolution in a sound science education. NCSE's executive director Eugenie C Scott writes, "There are few scientists as knowledgeable and clear about how science works, and as thoughtful about the creation and evolution controversy as John A Moore. A product of Moore's wisdom and his over 60 years experience as a brilliant and productive scholar, *From Genesis to Genetics* will bring understanding to both citizens and scientists who are grappling with the contentious issues of science and religion, evolution and creationism."



Science as a Way of Knowing

by John A Moore

From the publisher: "For the past twenty-five years John Moore has taught biology instructors how to teach biology — by emphasizing the questions people have asked about life through the ages and the ways natural philosophers and scientists have sought the answers. This book makes Moore's uncommon wisdom available to students in a lively and richly illustrated account of the history and workings of life. Employing a breadth of rhetoric strategies — including vividly written case histories, hypotheses and deductions, and chronological narrative — *Science as a Way of Knowing* provides not only a cultural history of biology but also a splendid introduction to the procedures and values of science."

RANDY

Evolution 101

by Randy Moore and Janice Moore
Randy Moore and Janice Moore's *Evolution 101* aims, in the words of its publisher, to provide "readers — whether students new to the field or just interested members of the lay public — with the essential ideas of evolution using a minimum of jargon and mathematics." It succeeds marvelously. The reviewer for *NSTA Recommends* writes, "Seldom is a book so well written and so well researched that it ought to be required reading for every thinking person," adding, "Not only should every high school, community, and university library have a copy of *Evolution 101* but every science teacher in the country should as well."

Evolution in the Courtroom: A Reference Guide

by Randy Moore

Recounting the legal history of the creationism/evolution debate, from the Scopes trial on, *Evolution in the Courtroom* also offers extras such as excerpts from key legal documents, a detailed chronology, and profiles of the major players, such as Frank White, the Arkansas governor who signed a "balanced treatment" act without even reading it. The reviewer for

American Reference Books Annual praised *Evolution in the Courtroom* as "a wonderful addition to a school library, preferably high school, as well as in a science classroom reference library." Randy Moore is a member of NCSE and received its Friend of Darwin award in 2004.

More than Darwin: An Encyclopedia of the People and Places of the Evolution-Creationism Controversy

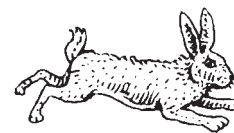
by Randy Moore and Mark D Decker

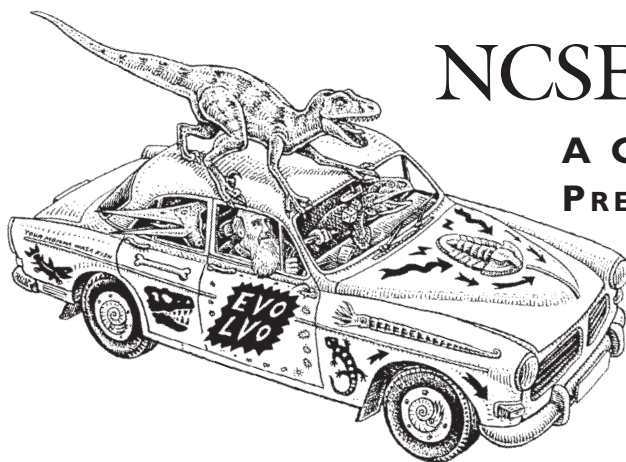
More than Darwin provides a carefully researched and lavishly illustrated account of over 500 people, places, and organizations that figure prominently in the creationism/evolution controversy, from Adam and Eve to Evelle J Younger (who, as attorney general of California in 1975, declared that "balanced treatment" acts were unconstitutional). The reviewer for *Library Journal* wrote, "It is a major source of information on the subject, covering the entire range of topics in the history of the debate. ... This accessible resource is a great tool for anyone looking for short and concise background on the evolution-creationism controversy. Recommended for all public and high school libraries."

Chronology of the Evolution-Creationism Controversy

by Randy Moore, Mark Decker, and Sehoya Cotner

With more than 1400 entries spanning 3000 years as well as a bibliography, a glossary, and appendices on the age of the earth, the geologic timescale, major species of known hominines, and key legal decisions involving the teaching of evolution, *Chronology of the Evolution-Creationism Controversy* is a unique resource. NCSE's deputy director Glenn Branch comments, "Moore, Decker, and Cotner's detailed chronicle of the struggle over evolution tells a fascinating tale. Their book is a salutary reminder that, when it comes to the evolution-creationism controversy, the old saying is true: 'There is nothing new under the sun, but there are lots of old things we don't know.'"





NCSE on the Road

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

DATE August 2-6, 2010
CITY Berkeley CA
PRESENTER Louise S Mead
TITLE Think Evolution II
EVENT Summer Institute for Science Educators
TIME 9:00 AM - 3:00 PM
LOCATION University of California Museum of Paleontology
CONTACT Louise Mead, mead@ncse.com

DATE October 8, 2010
CITY Los Angeles CA
PRESENTER Eugenie C Scott
TITLE Panel discussion: Science and Religion: Confrontation or Accommodation?
EVENT Council for Secular Humanism Conference
TIME 2:00 PM
LOCATION Millennium Biltmore Hotel
CONTACT Tom Flynn, tflynn@centerforinquiry.net

DATE October 23-24, 2010
CITY Washington DC
PRESENTER NCSE Staff
TITLE (Exhibit booth)
EVENT USA Science & Engineering Festival Expo
TIME 10:00 AM - 5:30 PM
LOCATION National Mall
CONTACT USA Science and Engineering Festival, <http://www.usasciencefestival.org/>

VISIT THE GRAND CANYON WITH SCOTT AND GISH!

FEATURING NCSE's executive director, Eugenie C Scott and Alan D Gishlick

DATES July 2011

Twenty-four lucky members will raft the full length of the canyon from Marble Canyon to South Cove, experiencing one of the most beautiful and majestic natural features on the planet. If you missed the 2010 trip, make your plans now for 2011. NCSE's "Creation/Evolution Grand Canyon Raft Trip" is a wonderful way to learn about the creationism/evolution controversy in a fabulous natural setting.

Check the NCSE web site for updates and details — <<http://ncse.com/meeting.asp>>.

JOIN US AT THE NATIONAL CENTER FOR SCIENCE EDUCATION

MEMBERSHIP IN NCSE BRINGS YOU:

- 6 issues of *Reports of the National Center for Science Education*
- Participation in NCSE's efforts to promote and defend integrity in science education

MEMBERSHIP INFORMATION

Name _____
 Address _____
 City _____ State _____ Zip _____
 e-mail _____ Telephone _____ Fax _____

Occupation (Optional)

☐ Check here if you do not want NCSE to share your name and address with other organizations

☐ Check here if NCSE may share your name with activists in your state

☐ Check (US dollars) ☐ Discover ☐ VISA ☐ MasterCard ☐ AmEx

Credit card number _____ Expiration Date _____

Name as it appears on card _____ Signature _____

NCSE MEMBERSHIP

☐ One Year US: \$30 Foreign Air: \$39 _____
☐ Lifetime \$600 _____
 Tax Deductible Contribution to NCSE _____
TOTAL _____

Mary Anning: Fossil Hunter

by Shelley Emling

Last year's twin anniversaries of Charles Darwin's birth in 1809 and the publication of his *On the Origin of Species* in 1859 prompted a string of books on the life of the English naturalist who was so concerned about his evolutionary findings that he delayed their publication for twenty years. Yet there was a woman, also raised religious, who helped blaze the trail for Darwin — an often forgotten and dismissed fossil hunter who was just as surely tortured by her own bizarre discoveries, but who ultimately came to accept the evolution of life.

Born in 1799, Mary Anning — the dirt-poor woman said to have inspired the tongue-twister “She sells seashells by the seashore” — would spend her entire life uncovering and piecing together the fossils of one never-before-seen monster after another: organisms that had been hidden away for nearly 200 million years in the cliffs up and down England's southern coastline. In short, she provided raw material to the scientists — all male — that would be instrumental in forming their evolutionary theories. Stephen Jay Gould later remarked that Anning is “probably the most important unsung (or inadequately sung) collecting force in the history of paleontology” (quoted in Jo Draper's *Mary Anning's Town: Lyme Regis* [Dorchester [UK]: Dorset County Council, 2004]). Yet Anning's place in history happened quite by accident.

Shelley Emling is the author of a biography of Mary Anning, The Fossil Hunter: Dinosaurs, Evolution, and the Woman Whose Discoveries Changed the World (New York: Palgrave Macmillan, 2009).



The coast of Lyme Regis, where Mary Anning searched for fossils. Photo by Shelley Emling.

By birth, Anning never should have become an influential fossil hunter and geologist. She was marginalized not only by her family's poverty but also by her sex, her regional dialect, and her nearly complete lack of schooling. But she enjoyed one natural advantage: the very good fortune of having been born in exactly the right place at the right time, alongside some of the most geologically unstable coastline in the world; it was — and still is — a place permeated with fossils.

After her father died in 1810, young Mary's family was in dire financial straits. In order to put food on her table, she was forced to run the shore's gauntlet of high tides and landslides to hunt for curiosities that she could sell to seafaring tourists. If she hadn't, her family very well could have starved.

Her first discovery, made in 1811 when she was only 12 years old, was of the fossil of an ichthyosaur, a marine reptile about four feet in length with flippers like a dolphin and a chest like a lizard. At first people thought it must be a crocodile. In time, though, the specimen attracted

massive crowds to museums in London, where many soon realized the skeleton was of a creature never before seen.

Indeed, a wide range of life-forms had been safely deposited in ancient sea beds up and down the coast near Lyme Regis, Anning's hometown, rendering the region's stratigraphy uniquely able to store (and later reveal) evidence of 200 million years of evolution. Scientists eventually discovered that the cliffs east and west of Lyme Regis portrayed an almost continuous sequence of rock formations spanning the entire Mesozoic Era, perhaps better than any other locale on the planet. Until the early 1800s, though, the area's residents had no knowledge of this rich resource.

The strange fossils found along England's southern shoreline had baffled the locals for as long as anyone could remember. They came in all forms and sizes — including what later were determined to be bivalves, ammonites, belemnites, and brachiopods — and sometimes even the fragments of giant critters never heard of before. Some people thought the fossils were so lovely and delicate that they surely must be God's decorations, allowed to bubble up from the inside of the earth, a bit like flowers were allowed to ornament the outside. Others thought they must be the remains of the victims of the global flood recorded in Genesis.

Like most everyone in England at the time, Anning and her neighbors had absolute faith in the fact that species never evolved or became extinct. Everything that existed had always existed. Yet the fossils that Anning uncovered as a young woman — including many

of the world's first ichthyosaurs, plesiosaurs, and pterodactyls — had never been seen by anyone, anywhere before.

Indeed her discovery of a nearly intact long-necked plesiosaur (*Plesiosaurus dolichodeirus*) in 1823 was so incredible that even the celebrated French anatomist Georges Cuvier did not believe it could be valid. It was only after British geologist William Conybeare defended Anning's find — and verified that the neck did indeed boast at least 35 vertebrae — did Cuvier admit he was wrong. Eventually he pronounced Anning's fossil a major discovery.

As Anning aged, and began working alongside Britain's clique of male geologists — most of them Anglican clergymen — there were countless attempts to use biblical stories to explain the new knowledge about the natural world that resulted from her fossil discoveries. For example, Anning's friend and associate William Buckland — the well-known English geologist and first professor of geology at Oxford — believed that the fossils found at high altitudes proved that a great flood had once covered the planet, just like the Flood described in the Bible.

Anning worked alongside Buckland for years, not only combing the beach looking for fossils, but also in the study of fossilized feces known as coprology. Anning had found many stones about four inches long inside the skeletons of ichthyosaurs, leading her to believe they might be fossilized clumps of undigested food. Soon they both concluded the stones were feces, which helped them figure out what the creatures had eaten.

In her later years, she also assisted the Swiss naturalist Louis Agassiz during his visits to Lyme Regis. Agassiz was best known as the first person to propose the scientific concept of an Ice Age in 1837. For years he strongly advocated the prime role of glaciers in bringing about physical changes in earth's crust that had formerly been attributed to the biblical Flood. Agassiz had worked closely alongside Cuvier, who believed that the earth was immensely old and also that periodic catastrophes had wiped out a number of

species. At the same time, a rival French intellectual, Jean-Baptiste Lamarck, proposed transmutation, arguing that organisms could transform in such a way that higher forms could emerge from lower ones.

Anning's views on the flood and the disparate theories of the male scientists of her era are not known. But in 1833, she was visited by a tourist, the Reverend Henry Rawlins, and his six-year-old son, Frank. Rawlins believed that God created the world within a week, but Anning described to young Frank how the fossils purchased by his father had been found by her at all different levels in the cliffs, explaining that this meant the creatures possibly had been created and had lived at different times. According to Frank's journals, his father refused to discuss the issue after they left Anning's home.

One can only imagine how frightening it must have been for Anning to find the fragments of these exotic creatures — with their bat-like wings, snake-like necks, and big, bulging eye sockets — and wonder if perhaps the live versions were not about to fly out of the sky or come up out of the sea to terrorize her. The puzzle of Anning's specimens weighed on the public's mind as well. Many religious leaders were convinced that her ichthyosaur and other fossil finds were soiling the sacred teachings of the Bible. "Was ever the word of God laid so deplorably prostrate at the feet of an infant and precocious science!" exclaimed an exasperated evangelical Anglican pastor named George Bugg, author of *Scriptural Geology*, written in 1826.

But according to most accounts from her friends, Anning continued to be a deeply meditative woman who often could be found praying or reading the Bible and who almost never missed a Sunday service. Anning's close friend, Anna Maria Pinney, wrote of how the two often talked of the idea of creation and other spiritual topics. "To think that life shall never have an end quite fills the mind, but to think of God without a beginning is more than a created being can comprehend," Pinney wrote.

Anning tried to reconcile what she was unearthing with her belief in God's omnipotence, a belief she apparently held until her death from breast cancer at the age of 47. Some of her letters to friends suggest that she grew to accept that there had been a progression of living things. A few years before she died, she remarked that — from what she had seen of the fossil world — there is a "connection of analogy between the Creatures of the former and present World." From most accounts, it seems she continued to believe in God throughout her life, but that she also came to accept that evolution was part of God's plan. Toward the end of her life, she copied into her journals many poems and passages laced with religious overtones.

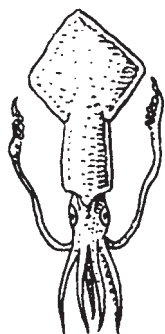
At the Natural History Museum in London, as well as a small museum in Lyme Regis, Anning is recognized as having laid the groundwork for the theory of evolution, not to mention nearly two centuries of discoveries in the still-evolving worlds of paleontology and geology. Today thousands of people continue to go hunting for fossils along England's so-called Jurassic coast — a 95-mile stretch of shoreline declared a Unesco World Heritage Site in 2001. And, to this day, real and startling discoveries are still being made, such as the skeleton of a 195-million-year-old *Scelidosaurus*, the earliest of the armored dinosaurs, in Anning's hometown of Lyme Regis a few years ago.

With over 700 species of dinosaurs already identified and named, reminders of the prehistoric past just keep on surfacing, thrilling paleontologists. But there are plenty of people who are still unsettled by the signs of the completely different world that must have existed on earth before humans arrived — even if they also are able to marvel at the possibilities.

It is most likely a feeling that — nearly two centuries ago — Anning would have shared.

AUTHOR'S ADDRESS

Shelley Emling
c/o NCSE
PO Box 9477
Berkeley CA 94709-0477
info@ncse.com



Teaching Evolution in Muslim States: Iran and Saudi Arabia Compared

Elise K Burton

For the past forty years in the United States, courts have consistently blocked the intrusion of sectarian religious doctrine, such as creationism, into science classrooms. Therefore, it might be expected that science education in general, and treatment of evolution in particular, would be severely undermined in countries that have an official religion or whose governments are subordinate to religious authorities. However, reviewing science textbook and curriculum content for public schools in the Islamic Republic of Iran and the Kingdom of Saudi Arabia reveals several flaws in this presumption. In the West both the Iranian and Saudi governments are often lumped together under as “Islamist states” supposedly sharing anti-modern ideals, but the two countries are quite different in their official attitudes toward the topic of evolution in science education.

THE EDUCATIONAL SYSTEMS

In both Iran and Saudi Arabia, public education is highly centralized: a national ministry of education is responsible for developing the curriculum and textbooks for all schools in the country (UNESCO International Bureau of Education 2006). Use of state-generated text-

books, which are updated and redistributed annually, is mandatory — even in private schools (Saudi Arabian Cultural Mission 2006; Godazgar 2009). The structure of school levels differs only slightly between the two countries (Table 1). Compulsory education extends only to primary school in Saudi Arabia and to intermediary school in Iran (UNESCO Institute of Statistics 2009).

SCIENCE AND EVOLUTION IN SAUDI ARABIA

The Kingdom of Saudi Arabia, as its name indicates, is an absolute monarchy, and King Abdullah himself heads the committee that

determines education policy (Kingdom of Saudi Arabia Ministry of Education 2008). The preamble of the education policy document outlined by the Ministry of Education (Kingdom of Saudi Arabia Ministry of Education 2006) contains the following statement: “Educational policy in the Kingdom of Saudi Arabia is derived from Islam.” The sections that follow affirm belief in Islam and “the complete Islamic conception of the universe, humanity, and life” as a general principle of education, with two specific references to the Qur’an. The stated objectives of science education include highlighting the contributions of the Islamic

Table 1.
STRUCTURE OF EDUCATION IN IRAN AND SAUDI ARABIA

		PRIMARY	INTERMEDIARY	SECONDARY
IRAN	<i>School Level (Duration)</i>	Ebtedayi (5 years)	Rahnemayi (3 years)	Motavaset (3 years) Pish Daneshgahi (1 year)
	<i>Equivalent Grade Range</i>	1–5	6–8	Motavaset: 9–11 Pish Daneshgahi: 12
	<i>Intended Age Range</i>	6–10	11–13	Motavaset: 14–16 Pish Daneshgahi: 17
SAUDI ARABIA	<i>School Level (Duration)</i>	Ibtida’i (6 years)	Mutawasat (3 years)	Thanawi (3 years)
	<i>Equivalent Grade Range</i>	1–6	7–9	10–12
	<i>Intended Age Range</i>	6–11	12–14	15–17

Elise K Burton is a first-year PhD student at Harvard University working on the history of science in the Middle East. This article is derived from her undergraduate thesis on Middle Eastern evolution education completed at the University of California, Berkeley.

world to science and showing the “perfect harmony between science and religion in Islam.” The appearance of Qur’an verses here foreshadows many others that follows in Saudi science textbooks at all levels of education.

In the 6th-grade general science textbook, three of the four Qur’an verses that are cited deal directly with creation. For example, a unit on the human body (al-Thuwaini and others 2007: 11) opens with “We have indeed created man in the best of moulds” (Qur’an 95:45). Chapter 51 (al-Dhariyat), verse 49, precedes a unit on plant and animal reproduction (33): “And of everything we have created pairs” (somewhat paradoxically, the unit includes asexual reproduction). On page 61, the importance of water is attributed to al-Anbiya’ 30: “And we made from water every living thing.” Keeping in mind that this is the last science book any Saudi student is required to read, primary school graduates may end their education with their sole experience of scientific knowledge being irrevocably tied to the concept of divine creation.

The vast majority of Saudi students is able to continue on to intermediary school (UNESCO Institute of Statistics 2009); however, the general science curriculum does not improve at this level. Of course, some topics merit more religious attention than others; biology, astronomy, geology, and climatology sections contain far more Qur’anic references compared to those on physics, chemistry, and technology. This is no doubt due to a greater amount of relevant verses. The verses are presented as authoritative explanations or evidence of various phenomena and are “isolated” from the surrounding text in the sense that the meaning of the verse is not interpreted in any way. Clearly, all verses are intended to be accepted on their face by the students. There is little in the textbooks that alludes to biological evolution or related topics in other fields, such as the origin of life and the universe.

Students who enter the first year of secondary school are required to take a biology course, and the 10th-grade textbook intro-

duces the concept of adaptations in a glossary of biological terms (al-Aqiyyal and others 2007). However, the definition for “adaptation” is not given within the context of evolution or natural selection, but as evidence for divine creation:

There exist structural, functional and behavioral characteristics in organisms that help them to survive in their environment. Allah, glory to him, created for organisms those characteristics and structures that enable them to live in their different environments. (38)

No Qur’anic evidence is given for this particular assertion; it is merely a continuation of the creationist theme that guides all Saudi science education.

The 12th-grade textbook contains the first and only mention of evolution by name; following a chapter on organismal classification (al-Habib and others 2006), there are two pages discussing “The Origin of Humanity” (106–7). The section first reiterates the direct creation of humanity as described in the Qur’an, and mentions the similar creation account “in the Torah and the Gospels” (106). It then continues:

Nevertheless in the West appeared what is called “the theory of evolution” which was derived by the Englishman Charles Darwin, who denied Allah’s creation of humanity, saying that all living things and humans are from a single origin. We do not need to pursue such a theory because we have in the Book of Allah the final say regarding the origin of life, that all living things are Allah’s creation.

After citing two Qur’anic verses on creation, the page firmly concludes “Thus our hearts are at peace with this and no doubt will enter them regarding the origin of life.”

The next page adds:

However, Darwin’s theory (some preceded Darwin to this theory such as Lamarck, but Darwin succeeded in promoting it in his book *The*

Origin of Species [sic], and therefore it is attributed to him) found supporters who developed and justified it, from the West to beyond where Darwin himself had reached. Unfortunately this theory emerged among some Muslims, who immediately set out to support it unaware of the blasphemy and error in it. (107)

Note the emphasis on evolutionary theory’s Western origins and the “blasphemy” of Muslims who support evolution. Reminiscent of American creationism, the book goes on to claim:

Due to this theory’s deviant character and its contradictions to intuition and reason, there were many Western scientists who stood against it and exposed its fallacies in scientific research and rational inferences, raising suspicions against Darwin’s theory that it consists of assumptions and hypotheses that have no evidence or proof.

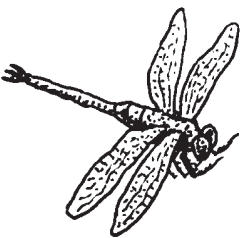
After what appear to be vague references to Piltdown man and Haeckel’s embryo illustrations as examples of evolutionary fraud, the section ends:

And in conclusion evidence for the theory of evolution crumbles at the first test; it has merely resulted from misunderstanding, miscalculation, or the effects of scientific limitations, or due to imagination or speculation, or deceit or forgery.

As might be expected, the rest of the textbook, which focuses on descriptions of the various kingdoms of organisms, makes no further mention of evolution, but includes more Qur’an verses as relevant to certain groups of animals. With only this exposure to biological evolution in their public education, Saudi students may enter science programs in domestic and foreign universities.

SCIENCE AND EVOLUTION IN IRAN

In the Islamic Republic of Iran, power is concentrated in the position of Supreme Leader, a cleric



who in turn determines the eligibility of individuals for elected office or government appointments. The Iranian Ministry of Education is not comprised of clerics but is vetted by religious authorities; however, the Experimental Sciences Division of the ministry, in describing its educational philosophy and general goals for science education, makes no explicit references to Islam, though there are two subtle acknowledgments of a “creator of the world” and a “creator of natural laws” (Guruh-ye Darsi-ye Ulum-e Tajrobi 2009). Far more prominent, however, are the themes of economic development and the principal role of science and technology in the improvement of national infrastructure. Science education objectives stress the learning of practical skills, critical inquiry, and the fostering of a scientifically literate citizenry. In contrast to the Saudi curriculum, science is not described as simply an outgrowth of Islam or subject to the preconceived doctrines of any religion — rather it is affirmed as a separate, valid field of knowledge, and one of crucial interest to individual and societal welfare.

The 5th-grade science curriculum, covering the final year of primary school, mandates “The History of the Earth” as an essential topic in the subject of earth science. The 5th-grade textbook devotes a chapter to the topic, with a subsection on “A Short History of Life” (Tehrani and others 2008: 55). The first sentence in this section highlights the essential difference between the Iranian and Saudi presentations of scientific knowledge: “Geologists, via studies of fossils, have arrived at the conclusion that life began in the sea.” Portraying geologists, and scientists in general, as the authoritative voices of scientific knowledge, and emphasizing the empirical evidence underlying the textbook’s assertions, constitutes the organizing theme of the Iranian science textbooks at all levels.

The evolutionary emergence of life over millions of years is described in simple terms. The transition to terrestrial life is credited to the emergence of plants on dry land: “Afterward, the water and air of planet Earth changed such

that a suitable environment for the development of reptiles came to exist” (56), thus heralding the age of dinosaurs. The extinction of dinosaurs “about 65 million years ago” is noted, followed by the diversification of mammals. The next page contains a section on “The Changing of Continents and Seas,” beginning: “Geologists say in the beginning only one landmass and one giant ocean existed on earth. About 200 million years ago, this large landmass slowly began to divide” (57).

In the science textbook for 8th grade, the final year of compulsory education, the topic of evolution appears alongside geology (Amani 2008). The chapter opens with fossils and a review of the history of life, with a clearly illustrated geologic time diagram (31). The page following the diagram is adorned with fossil images, most strikingly a specimen of *Archaeopteryx* with the caption “This is the first bird on earth, which also has some reptile traits” (32). The next five pages are devoted to a brief introduction to “The Evolution of Organisms” in which the tracing of morphological changes in evolutionary lineages is declared “[o]ne of the most important applications of fossils” (33). In contrast to 10th-grade Saudi students, who are taught that adaptations are the God-given attributes of created kinds, Iranian eighth-graders are taught about adaptations in the context of mutations and natural selection, exemplified by the following:

New traits arising by a mutation are mostly harmful and detrimental to life, [but] sometimes in a rare mutation useful traits also appear. An organism possessing one or more useful traits appears, finds greater compatibility with the environment compared to its conspecifics, and gradually the number of [organisms with those traits] increases in the environment. (35)

Perhaps of greatest concern on the international level is the evolution education of future Iranian scientists — in other words, those Iranian students who complete the secondary experimental sciences track and enroll in the correspond-

ing pre-university course. The biology textbook for *pish daneshgahi* (Karam al-Dini and others 2008) includes a 40-page chapter on evolution, as well as chapters on population genetics and “population dynamics and biological communities” (147). The evolution chapter, divided into three sections, provides a comprehensive introduction to the development of evolutionary theory, with the first section devoted primarily to Darwin and his influences and culminating in the formulation of the new synthesis; the second section to evidence of evolution, including paleontology, molecular and structural homology, and embryology, with discussion of evolutionary rates and punctuated equilibrium (94); and the third section to examples of natural selection, such as peppered moths (97) and the work of Peter and Rosemary Grant on Darwin’s finches (98). The Iranian textbook humanizes Darwin with a relatively detailed account of his life and a discussion of its historical context, along with the development of support for Darwin’s ideas by later scientists. Where the Saudi textbook dismisses evolution as fraudulent science, the Iranian text announces “nearly all biologists today have accepted that Darwin’s theory can explain the basis for the diversity of life on earth” (75).

Human evolution is conspicuously absent throughout discussions of evolution in Iranian textbooks. The population genetics chapter reveals that natural selection does in fact operate on humans, giving the examples of stabilizing selection upon newborn birth weight (122) and heterozygote advantage in relation to malaria and sickle-cell anemia (129–30). However, explicit attempts to place humans within the larger picture of evolution do not appear. It is quite possible that the textbooks’ silence on human evolution is related to the attempts of the Iranian Ministry of Education to reduce the amount of conflicting information taught in science and religion classes (Godazgar 2008).

Regardless, the extension of natural selection to humans is encouraging compared to the Saudi insistence that God “distinguished [humanity] over the rest of His cre-



ation” (al-Habib 2006: 106). Of course, what the Iranian science textbooks lack most prominently relative to the Saudi ones are the previously mentioned stress on the “Western-ness” of evolutionary theory, as well as the pervasive use of a style of “science-in-the-Qur’an” apologetics increasingly common throughout the Muslim world as a whole (see Edis 2007).

SOCIAL AND HISTORICAL FACTORS

There are several conclusions to be made from the comparison of Iranian and Saudi evolution education. First, although it may seem the two governments are operating under similar precepts that state law ought to mirror religious law, and though they share essentially the same religion (Islam), their official attitudes toward the treatment of evolution in science education are quite different. In light of the different social, religious and historical contexts of the Iranian and Saudi states, the differences in science education may not be so mysterious.

First of all, Iranian society is far more complex. Although it is governed by Shi’a Muslim clerics, Iran officially recognizes its significant minorities of Sunni Muslims, Zoroastrians, Christians, and the largest Jewish population in the Middle East outside of Israel (Office of International Religious Freedom 2008a). Though religious instruction is required in public schools at all levels, non-Muslim Iranians are exempt from examinations on the Qur’an and take classes on their own religious traditions. Iranian religious minorities do still face significant educational discrimination (Office of International Religious Freedom 2008a), but such accommodations in the religious curriculum may play a role in the lack of specific Islamic goals imposed upon the science curriculum.

Saudi Arabia claims a 100% Muslim population (about 90% Sunni and 10% Shi’ite), and its nationals are overwhelmingly Arab (Office of International Religious Freedom 2008b). In comparison, Iran’s total population is nearly triple that of Saudi Arabia’s, and its primary ethno-linguistic group,

Persians, comprise about half the population; dozens of other groups with distinct languages and cultural histories make up the rest.

Also relevant is the difference between the traditional practice of Shi’a religion in Iran, with its emphasis on *ijtihad* (roughly, “interpretation”), and the Wahhabi version of Sunni Islam endorsed by the Saudi state, which is more pre-occupied with Qur’anic literalism. Furthermore, influential Shi’ite scholars, including several who were closely involved in Iran’s Islamic revolution, are not opposed to evolutionary ideas in general, disagreeing that evolution necessarily conflicts with the Muslim worldview (Godazgar 2009).

Of course, issues of theology form only a small portion of both states’ educational policy motivations to include or discredit evolution in their biology education; as in the US, historical and socioeconomic circumstances may be more important in shaping such policy.

The Saudi kingdom was established as a state in 1932, by the same dynasty of Wahhabi Sunnis that rules the country today. The population of Saudi Arabia, as recently as five decades ago, was predominantly nomadic or semi-nomadic, with much education occurring in Islamic religious schools outside the state system. The widespread urbanization of the country that occurred in the 1970s as a result of the oil boom led to the rapid proliferation of public schools. So Saudi Arabia lacks any real tradition of secular government or education.

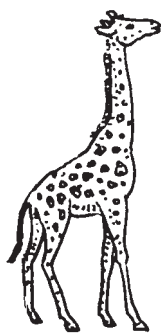
By contrast, Western-style secular education, particularly the French model, had already emerged in Iran in the mid-19th century, about the same time the country began its first wave of urbanization. Iran under the Pahlavi dynasty (1925–1979) experienced secularization and Westernization “on a massive scale” (Godazgar 2008: 87), and the Pahlavi shahs aggressively promoted their ideology through the state education system. The topic of evolution entered Iranian biology textbooks at this point, and its inclusion was evidently left unchallenged for the years immediately following the Islamic Revolution.

In 1984, however, “the name of Darwin was omitted from the textbooks” (Godazgar 2008: 146), more due to anti-Western than Islamic ideology. Godazgar (2008) documents related textbook content changes, and the conversions of Western names and terminology into Persian, as educational manifestations of the reactions against the Pahlavis’ imposition of Westernization and past foreign domination of Iranian industry. The reappearance of Darwin in textbooks in 1998 (Godazgar 2009) coincided with the presidency of Mohammad Khatami who was considerably more conciliatory than his predecessors in foreign policy matters.

EVOLUTION EDUCATION AS SOCIOECONOMIC POLICY

Saudi Arabia is probably the closer example to the Western image of fundamentalist Islam: an authoritarian state declaring the core Islamic texts to be its constitution and refusing public recognition of other religions or even other interpretations of Islam (Office of International Religious Freedom, 2008b). Yet much of the Saudi condemnation of evolution, as presented in the Saudi textbooks, is tied to a perception of Western (secular) science as a corrosive force upon the *religious* and *social* mores of Muslims. Furthermore, the Saudi government, content until now with its oil wealth, has only recently begun to show interest in developing science as an economic sector.

Meanwhile, Iranian anti-Westernism is distinctly related to a historical experience of foreign interference and domination that never occurred in Saudi Arabia; as such, Iranian anti-Western expression, even in its most vociferously religious forms, does not have the same revisionist effect upon science. Scientific development in Iran, especially the health-related aspects of biology, has been a goal of the Islamic government since the revolution (Godazgar 2008), and Iranian prominence in such fields as stem-cell research has arisen with government funding and support. Indeed, for Iran, creating an internationally-renowned scientific community is a source of



national pride (Jafarzadeh 2009). As a result, Iran thus far appears to have the most in-depth and consistent coverage of evolution in its compulsory science curriculum and textbooks (Burton, unpublished data) when compared to Saudi Arabia, Israel, and Turkey.

These examples make it clear that a religious government is not necessarily a barrier to an essentially secular science education, nor to the accurate inclusion of evolution. Secular science research and education seems to be carried out relatively freely within the Islamic ideology of Iran (with some caveats; see Bohannon 2006). It is crucial to understand the history of creationism within the larger context of national political, social, and economic histories to promote evolution education effectively worldwide. If scientists and science educators can also attach evolution education to desirable political and economic goals, they may succeed more consistently on a policy level as well.

ACKNOWLEDGMENTS

The author would like to thank Hossein Godazgar for reading the first version of this manuscript and providing much-valued feedback.

TRANSLATION NOTE

All translations from Arabic are by the author with assistance from Jakhan Nguyen. All translations from Persian are by the author with assistance from Brian

Alford. The only exceptions are Qur'anic verses, for which the English translation of the Qur'an by Abdullah Yusuf Ali has been used. The author takes full responsibility for any errors.

REFERENCES

- Amani M, Mahmudzadeh G, Ershadi N, Hosseini A, Karam al-Dini M, Asbaghi A. 2008. *Ulum-e Tajrobi Sevvom Rabnemayi*. Tehran: Vezarat Amuzesh va Parvaresh.
- al-Aqiyyal FN, al-Mutairi MH, al-Ghamdi SM, al-Habib SM, al-Sa'adun AN, al-Suwaid MS, al-Fawzan AA. 2007. *al-Abya' lil-saff al-awwal al-tbanawi*. Riyadh: Al-Mamlakat al-'Arabiya al-Sa'udiya Wizarat al-Tarbiya wal-Ta'alim al-Tatwir al-Tarbawi.
- Bohannon J. 2006. Science in Iran: Picking a path among the fatwas. *Science* 5785: 292-3.
- Edis T. 2007. *An Illusion of Harmony: Science and Religion in Islam*. New York: Prometheus Books.
- Guruh-ye Darsi-ye Ulum-e Tajrobi. 2009. *Rabnama-ye Barnameh-ye Darsi*. Available on-line at <<http://science-dept.talif.sch.ir/>>. Last accessed August 20, 2009.
- Godazgar H. 2008. *The Impact of Religious Factors on Educational Change in Iran: Islam in Policy and Islam in Practice*. New York: Edwin Mellen Press.
- Godazgar H. 2009 May 24. [Personal communication].
- al-Habib SM, al-Awwad FA, al-Shamrani SA, al-Quraishi SA, al-Zughaibi MA, al-Aqiyyal FN. 2006. *al-Abya' lil-saff al-tbalath al-tbanawi: al-fasl al-darasi al-awwal*. Riyadh: Al-Mamlakat al-'Arabiya al-Sa'udiya Wizarat al-Tarbiya wal-Ta'alim al-Tatwir al-Tarbawi.
- Jafarzadeh S. 2009 Apr 15. Iran at forefront of stem cell research. *Washington Times*.
- Karam al-Dini M, Bahbudi BS, Nikonam V, Alavi E, al-Mohammad S. 2008. *Zist Shenasi*. Tehran: Vezarat Amuzesh va Parvaresh.
- Kingdom of Saudi Arabia Ministry of Education. 2006. *Siyasat al-ta'alim*. Available on-line at <<http://www.moe.gov.sa/>>. Last accessed August 20, 2009.

Kingdom of Saudi Arabia Ministry of Education. 2008. *National Report on Education Development in the Kingdom of Saudi Arabia*. Riyadh: Kingdom of Saudi Arabia Ministry of Education.

Office of International Religious Freedom. 2008a. *Iran. International Religious Freedom Report*. Washington DC: United States of America Department of State.

Office of International Religious Freedom. 2008b. *Saudi Arabia. International Religious Freedom Report*. Washington DC: United States of America Department of State.

Saudi Arabian Cultural Mission. 2006. *Education System in Saudi Arabia*. Washington DC: Saudi Arabian Cultural Mission to the United States of America.

Tehrani, MA, Daneshfar H, Shamim M, Hosseini A, Pazeshpur M, Rastegar T, Farnush B, Motamedi E, Alvandi H, Ershadi N. 2008. *Ulum-e Tajrobi Panjom Dabestan*. Tehran: Vezarat Amuzesh va Parvaresh.

al-Thuwaini MA, Bakirman KA, al-Habib SM, al-Shumari SA, al-Salim AM, al-Abdulkarim SA, al-Damigh AS, al-Quraishi KS, Abu 'Aba AA. 2007. *Kitab al-'Ulum lil-saff al-sadis al-ibtida'i*. Riyadh: Al-Mamlakat al-'Arabiya al-Sa'udiya Wizarat al-Tarbiya wal-Ta'alim al-Tatwir al-Tarbawi.

UNESCO Institute for Statistics. 2009. *Education Systems*. UNESCO Institute for Statistics Data Centre. Available on-line at <<http://stats.uis.unesco.org/>>. Last accessed August 20, 2009.

UNESCO International Bureau of Education. 2006. *Islamic Republic of Iran*. World Data on Education. 6th ed. Available on-line at <<http://www.ibe.unesco.org/Countries/WDE/2006/index.html>>. Last accessed August 20, 2009.

AUTHOR'S ADDRESS

Elise K Burton
c/o NCSE
PO Box 9477
Berkeley CA 94709-0477
info@ncse.com

COLD COMFORT DOWN UNDER

After his November 2009 distribution of copies of the *Origin of Species* disfigured with his own creationist, and allegedly plagiarized, introduction on college campuses in the United States and Canada (see *RNCSE* 2010 Jan-Apr; 30 [1-2]: 14-6), Ray Comfort took his act to Australia and New Zealand, where he claims to have disseminated a further 26 000 copies in March 2010.

[Cartoon copyright 2009 by Atheist Cartoons, <<http://www.atheistcartoons.com/wordpress/wp-content/uploads/2009/11/rayandkurt.jpg>>, and used with permission.]





George McCready Price

George Edward Price (Figure 1) was born on August 26, 1870, in New Brunswick, Canada. As a youth, Price joined the Seventh-Day Adventists, a small fundamentalist sect founded by Ellen White. Price attended the Adventists' Battle Creek College (now Andrews University) from 1891 to 1893 and then taught English and other subjects while a high school principal in the fishing village of Tracadie. In 1902, Price published his first book, *Outlines of Modern Christianity and Modern Science*. On the title page of that manuscript, Price listed his name as George E McCready Price (McCready was his mother Susan's maiden name). Thereafter, he dropped "Edward" from his name. Price was a self-taught geologist; the degrees often listed after his name were honorary degrees from Adventist schools.

In *Outlines*, Price argued for an uncompromising return to "primitive Christian principles," claiming that biblical literalism was the only explanation of the Bible that a Christian can accept. Price also claimed:

No believer in the Sabbath ... will hesitate to give as the distinct, positive teaching of Genesis that life has been on our globe only some six or seven thousand years; and that the earth as we know it, with teeming animal and vegetable life, was brought into existence in six literal days.

Price worked at the Adventists' Loma Linda Sanitarium in Loma Linda, California, where he met Ellen White. White's teachings became a foundation for Price's views of geology.

In 1906, Price published a 93-page book *Illogical Geology, the Weakest Point in the Evolution Theory*, in which Price labeled theistic evolution a "truly pagan ... heathen religion" and claimed that Darwin's theory is "a most gigantic hoax." Price rejected the fossil evidence for evolution, noting that "the doctrine of any particular fossils[]" being essentially older than others is a pure invention, with nothing in nature to support it." Price paid most of the publication costs of *Illogical Geology* himself (it would take him many years to get out of debt) and sold the book for 25 cents (or 10 for \$1.75). Despite his financial problems, Price offered a \$1000 reward to anyone who could "prove that one kind of fossil is older than another." Price believed that other geologists "never had the courage to face this problem fairly and squarely" and that they therefore "cannot be trusted." Price considered Charles Darwin "slow" and "unimaginative."

In ensuing years, Price published a variety of books, including *God's Two Books* (1911), *Back to the Bible, or the New Protestantism* (1916), and *Q.E.D., or New Light on the Doctrine of Creation* (1917). In each book, Price continued to pro-

mote "primitive Godliness" while claiming that life did not originate from natural causes, that geological evidence supports catastrophism and not uniformitarianism, that true "species" are those described as "kinds" in Genesis, and that fossils in lower strata are not older than those in upper strata. Price also claimed that because:

we do not know anything in a scientific way as to how the world was made, or how life or the species of plants and animals came into existence, the conclusion is inevitable that creation was something different, essentially and radically different, from what is now going on.

Q.E.D. attracted the attention of non-Adventists such as Frank Norris, John Straton, and William Riley, who promoted Price as "one of the real scientists of the day [whose] writings are destined to profoundly influence the thinking of the future." Price claimed that "a belief in the former destruction of the world by water is in accord with a belief in its coming destruction by fire," and that "Christ Jesus, our Lord and Savior, was associated with the Father in all the primary work of Creation." Price denounced evolution as "a fraud, originated and perpetuated by malevolent spiritual powers," and argued that if evolution were true, God is a "tyrant and a fiend".

PRICE'S "FLOOD GEOLOGY"

In 1923, following a yearlong sabbatical, Price published his most influential book, the 726-page *The New Geology*. This textbook described Price's most comprehensive synthesis of "flood geology" and included his "great law of



FIGURE 1. George McCready Price.

conformable stratigraphic sequences" which claimed that there was no natural order to fossil-bearing rocks. Price then declared his law "the most important law ever formulated with reference to the order in which the strata occur." *The New Geology* contained several arguments that continue to be invoked by creationists (for example, dating techniques used by geologists to estimate the ages of sediments are unreliable, and all fossils are the same age because they were all deposited during the biblical Flood). Although Price fared poorly in a highly publicized 1925 debate in London with priest-turned-philosopher Joseph McCabe (Price's only public debate about evolution), in 1926 *Science* declared Price "the principal scientific authority of the Fundamentalists".

In 1925, William Jennings Bryan — at the urging of Frank Norris — asked Price to help him prosecute John Scopes at the famous "monkey trial" in Dayton, Tennessee. Although Price could not attend (he was teaching at Stanborough Missionary College, just outside of London), he urged Bryan to avoid scientific arguments and to claim instead that it is un-American to force parents to pay taxes for un-Christian teachings. At the trial, when Bryan cited Price as his chief authority in his testimony, Clarence Darrow snapped back, "You mentioned Price because he is the only human being in the world so far as you know that signs his name as a geologist that believes like you do." After the trial, Price turned against "poor Bryan, with his day-age theory of Genesis", noting that Bryan "really didn't know a thing about the scientific aspects of the case." In the 1940s, Price described the Scopes Trial as a crushing defeat for fundamentalism and "a turning point in the intellectual and religious history of mankind."

Price next published *The Phantom of Organic Evolution*, his most extensive criticism of biological evolution. In it, Price noted:

Randy Moore is the HT Morse-Alumni Distinguished Professor of Biology at the University of Minnesota.

the modern theory of evolution is about 95% due to the geology of Lyell and only about 5% to the biology of Darwin ... What is the use of talking about the origin of species if geology cannot prove that there has actually been a succession and general progress in the life upon the globe?

Price, who chafed at the failure of others to endorse his "flood geology," dismissed Darwin, Lyell, and Hutton as "mere children when attempting to handle the larger problems of science."

In 1928, Price returned permanently to the US and began teaching at Emmanuel Missionary College in Michigan. In *Genesis Vindicated*, Price continued to argue for a six-day creation while branding all other claims about creation as distortions of the truth. After discussing "the almost pathetic devotion of a large school of thinkers to the religion founded by Hutton" and Lyell, Price urged that the Sabbath be a divine memorial of creation and demanded that the church "insist that the geologist and the biologist hold steadily to the exact wording" of the Bible.

In the 1930s, Price helped found the Religion and Science Association, which was committed to a six-day creation and flood geology, and repudiated gap theory and day-age theory as "the devil's counterfeit" and "theories of Satanic origin". When the Association disbanded in 1938, Price helped organize the Society for the Study of Deluge Geology and Related Sciences, often called the Deluge Society. The society's voting members had to accept a literal, 6-day, *ex nihilo* creation and agree that a worldwide flood was responsible for much of the geological record. By the early 1940s, the society included more than 600 members, most of whom were Seventh-Day Adventists. By the collapse of the society in late 1945, Price equated evolution and similar "laws of nature" with idolatry "part of the great modern apostasy, predicted a long time ago in the Bible".

Price claimed that racial mixing violated God's intentions and was responsible for a rapid degenera-

tion that produced not only apes, but also "Negroes" and "Mongolians", which Price labeled "degenerate or hybridized man". In Price's view, the Tower of Babel triggered reverse evolution — apes evolved from men. Price believed that satanic intervention, not natural selection, explained the origin of many species. In his later years, Price invoked Satan to attack several of his enemies, claiming that Satan was:

the real instigator of all the mixing and crossing of the races of mankind and also the mixer of thousands of kinds of plants and animals which God designed should remain separate.

When Harold Clark — one of Price's former students — substituted a non-Adventist text for Price's *The New Geology* at Pacific Union College, Price denounced Clark as under the influence of Satan and filed heresy charges against Clark with the church.

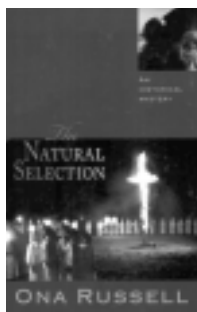
Price died on January 24, 1963, in Loma Linda, California. He rests beneath a humble tombstone in Montecito Memorial Park and Mortuary Cemetery near there. In the decades following Price's death, virtually every fundamentalist attack on evolution was based on Price's work. In 1961, Price's claims were resurrected as "creation science" in *The Genesis Flood: The Biblical Record and its Scientific Implications*, which the late Stephen Jay Gould described as "the founding document of the creationist movement". (As of 2009, *The Genesis Flood* had sold more than 250 000 copies; it is in its 44th printing, but has never been revised.) Henry Morris, one of the authors of *The Genesis Flood* and the most influential creationist of the 20th century, first read *The New Geology* in 1943. For Morris, reading Price's book was "a life-changing experience."

AUTHOR'S ADDRESS

Randy Moore
University of Minnesota, MCB 3-104
420 Washington Avenue SE
Minneapolis MN 55455
rmoore@umn.edu



BOOKREVIEWS



THE NATURAL SELECTION

by Ona Russell
Santa Fe (NM): Sunstone Press,
2008. 308 pages

Reviewed by Susan Branch

The *Natural Selection* is a historical mystery set, in part, in Dayton, Tennessee, during the Scopes trial. Through her heroine Sarah Kaufman, Ona Russell provides another view of the trial — through the eyes of a woman for a change.

At the end of a previous book by Russell, Kaufman, head of the Toledo Women's Probate and Juvenile Court, unveiled a Ku Klux Klan plot and almost lost her life through the treachery of someone she thought was a friend. Recovering from her ordeal, she takes a trip to Tennessee to visit her cousin Lena, a professor of English at fictional Edenville College.

She finds Lena distracted; her mentor, department head Professor Nicholas Manhoff, a man beloved by colleagues and students, has been found dead. The shock deepens when the coroner finds that Manhoff has been murdered. As Sarah goes through Manhoff's papers to find material for a paper he and Lena planned to write jointly, she finds items in his notes that indicate that he interprets Darwin's thoughts through a cloud of racism and Southern chauvinism. She also discovers a memo suggesting that plans to meet with HL Mencken during Mencken's stay in Dayton.

Susan persuades Officer Perry, the Edenville policeman, to deputize her and let her keep Manhoff's

appointment with Mencken. She observes at least part of the trial, and speaks with Clarence Darrow, whom she's met before. Mencken tells her more about Manhoff's ideas, including his repeated pleas to have his story about a decadent United States ruled by an uneducated, ignorant black president published in the *American Mercury*. Manhoff had also told Mencken about how he prevented a particular black student, Jacob Lee, from attending Edenville, unusual because Edenville, to encourage contributions from Northern benefactors, normally enrolled a few black students.

Sarah's information gives the police reason, they think, to arrest Lee, especially after an eyewitness says that he saw Lee running from the scene of the shooting. But Sarah is convinced that he is innocent. As the last days of the Scopes trial unfold in Dayton, Sarah is involved in a murder trial in Edenville, full of unexpected testimony. The tragic ending of the trial leaves Sarah sure that a murderer is still at large. She continues to look for the truth, though afraid that she may jeopardize Lena's position at the college and antagonize the students she's befriended. The more she looks, the more she's convinced that Manhoff's misinterpretation of Darwinism has poisoned students' minds.

Even worse, it is clear that there is Klan involvement in the case, forcing Sarah to face her worst fears. She asks help from Mitchell Dobrinski, a reporter for the *Toledo Blade* who is in Dayton for the trial (and who has been courting her). He uses what he had learned in a case in Toledo case to go undercover and pretend to be a Klan member. A secret meeting reveals part of the truth, but it takes a chance encounter with a stu-

dent's essay to put Sarah on the right track at last.

Russell limns strong characters. Sarah is forty years old, on her own from an early age, except for the brother and sister she helps to support. Sarah has worked for years in the court system, and while she is not a lawyer, knows how to listen and how to question emotionally distraught people.

Perry, the local policeman, may be uneducated but he is not bigoted, a nice change from writers who assume that all Southerners are cut from the same, undesirable, cloth. Lena, intelligent and more interested in men than the local ladies would consider proper, is always aware that as the first Jew on the Edenville faculty, she must mind her manners. Mencken expresses views that, historically, he developed more fully in the 1930s and 1940s.

Overshadowing everything is the unseen (except in a brief prolog) personality of Manhoff himself. Sarah recognizes his manipulation of others, but much to her frustration they still adulate him. Manhoff's thinking is more Nietzschean than Darwinian. Since he thinks that rules do not apply to men like him, he is willing to lie and help himself to the work of others. As the steamy heat that plagued Dayton smothers, too, the people of fictitious Edenville, the influence of Manhoff stifles town and gown alike.

Certainly this is not a book that one would turn to for scientific historical information about the Scopes trial, though the few pages that describe it are interesting. Those who enjoy historical novels, however, will like this well-researched book and a reminder of summers without air-conditioning, or even electricity. Even more important is its positive portrayal of the progressive movement, at a time when it seems thwarted by electoral politics, religious bias, and the reluctance of many to use their intelligence to overcome their prejudices.

AUTHOR'S ADDRESS

Susan Branch
c/o NCSE
PO Box 9477
Berkeley CA 94709-0477
info@ncse.com

ONE BEETLE TOO MANY: THE EXTRAORDINARY ADVENTURES OF CHARLES DARWIN

by Kathryn Lasky
Somerville (MA):
Candlewick Press, 2009. 48 pages

Reviewed by Kate Miller

These are good times for kids who want to read about evolution and Charles Darwin. A fleet of new books have recently set sail from children's book publishers, taking advantage of the warm winds of Darwin's bicentennial year. Among them is *One Beetle Too Many*, a narrative account of Darwin's life for readers ages 9 to 12, written by Kathryn Lasky and illustrated by Matthew Trueman. My kids and I have given it a good thorough read.

The title refers to a famous incident from Darwin's early life. One day he was out "beetling," one of his favorite pastimes, when he spied two new species of beetle. Hoping to add to his collection, he scooped one up in each hand, only to see yet a third new species on the same tree. To free up a hand, he popped the first beetle into his mouth, whereupon it spewed out a vile, bitter liquid. In the ensuing mayhem, he lost all three beetles. Score: beetles, 1; Darwin, 0.

The longish text of *One Beetle Too Many* is filled with such details about Darwin's life. Lasky's tone is often playful but also infused with complex sentences and ideas that are best digested by readers at the upper end of the age range. As for the illustrations, Trueman gives us stylized figures with highly expressive faces and hands, and gorgeous natural scenes with a recurring motif of whorls or concentric circles. He uses pencils and paint in muted earth tones as well as mixed media such as string, paper, weeds and wildflowers. For close

observers, the illustrations hold secrets not revealed in the text. One page shows Darwin with his children, for example, and one little girl's basket holds the label "Annie" Darwin's favorite child whose death at age ten troubled him his whole life). Other pages include half-hidden animals or mini-sight gags, such as Robert FitzRoy, the creationist captain of the *Beagle*, about to tumble comically off a rock in the Galápagos Islands.

My collection of children's books about Darwin and evolution includes about ninety titles spanning nearly fifty years. Considering the whole lot together, I've come up with three yardsticks for measuring the way Darwin is presented to children. These yardsticks are subjective, idiosyncratic, and entirely impossible for me to resist. Let's pull them out and see how *One Beetle Too Many* measures up.

First, is Darwin a totally awesome dude? Or, in adult language, could the book light up kids' minds with his most important traits: curiosity, passion and persistence? Lasky does a good job here, as Darwin is a relatable, sometimes funny character whose great intellectual journey centrally propels the book. With every chapter, something in the natural world sets his mind running with questions. For interested kids — perhaps the older ones — this progression of ideas will be captivating. For younger ones it might be harder to grasp.

Second, how does the author simplify the story and the science for children? I have trouble understanding some of Lasky's choices on certain details. For example, the beetle story is central to the book, told on the very first page and even providing the title. Yet Lasky leaves out the punch line about the bitter liquid and losing all three beetles. I have a few other such quibbles, but overall Lasky has chosen to simplify the storyline by focusing on Darwin's journey of ideas, as fine a choice as any.

Third, how does the book address what I call the sticky wickets? These are the parts of Darwin's life that some view as ethically inappropriate for today's young readers. One sticky wicket is Darwin's sharp encounters with

slavery, including vicious child beatings, in Brazil. Many children's books understandably avoid this altogether, but Lasky addresses it head on, which I appreciate. She presents Darwin's deep revulsion at what he sees — a great way to lead kids through a tough topic.

Another sticky issue is the way Darwin and his sea mates hunted, killed, captured, stuffed and ate animals with abandon, including the vaunted Galápagos tortoise. This was quite normal behavior at the time, but we wouldn't want kids emulating it today. Lasky deals with this with humor, stating that "Darwin unwittingly ate his way through many of the most important animal specimens."

The stickiest wicket of them all is Darwin's challenge to religion. Most children's books discuss the battle of ideas that Darwin unleashed during his time, but what interests me is how books settle the question for today's readers. Many dodge the issue entirely, while some squarely assert that the theory of evolution fits the evidence much better than creation stories. Others, like *One Beetle Too Many*, reassure kids that evolution and religion can coexist. Lasky skillfully weaves in a subplot of Darwin's insistent questioning of FitzRoy's biblical literalism. Yet she concludes by presenting Darwin's religious views this way: "Charles ... felt that his notions did not disprove God in the least but in fact made God more powerful ... who else but God could make things happen in such a marvelous way? ... He wrote that we should praise God for this power." For me, this makes Darwin out to be more religious than he perhaps actually was, but for some readers it might fit nicely with their own worldviews.

So what's the measure of *One Beetle Too Many*? In my view, it is an engaging contribution to a bountiful Darwin year. The ideas are deep, the characterization of Darwin is appealing, and the illustrations are absorbing. I recommend it for kids on the older side of 9-12.

AUTHOR'S ADDRESS

Kate Miller
Charlie's Playhouse
999 Main Street, Unit 708
Pawtucket RI 02860
kmiller@charliesplayhouse.com



Kate Miller is the founder and president of Charlie's Playhouse, which produces games and toys that introduce kids to evolution, natural selection, and Darwin (<<http://www.charliesplayhouse.com>>). She earned her PhD in demography from the University of Pennsylvania.



EVOLUTION, ME, AND OTHER FREAKS OF NATURE

by Robin Brande
New York: Alfred A Knopf, 2007.
268 pages

Reviewed by Laurel Saiz

Robin Brande's young-adult novel, *Evolution, Me, and Other Freaks of Nature*, reads like the *Dover v Kitzmiller* court case being told by Tina Fey, writer of the teen flick *Mean Girls*, and Diablo Cody, Academy Award-winning screenwriter of the film *Juno*.

There's a *Mean Girls* vibe as 14-year-old protagonist, Mena Reece, finds herself pitted against a group of cruel and mostly one-dimensional characters, who are born-again Christians. And there's a preternaturally bright and socially precocious high school student like the main character in *Juno*. Kayla Connor, editor of the high school newspaper, comes to Mena's aid in her ongoing struggles with the mean girls, or in this case, the "Back Turners".

The Back Turners are members of Mena's former church, from which she has been ostracized. As soon as the biology teacher at New Advantage High says the dreaded word "evolution", they instantaneously flip their chairs so they're facing away from the blackboard "just like it was a musical number they'd been rehearsing for weeks," Mena observes.

This confrontation is a stand-in for the controversy in the Dover, Pennsylvania, school district in 2004. In *Freaks of Nature*, the principal allows the local pastor to come into the biology class to read a statement that parallels the Dover disclaimer:

Experts agree that Darwin's so-called theory of evolution is just that — a theory. Because it is a theory, it continues to be tested as new evidence is discovered. Until

such time as evolution is proven, it remains a theory, not a fact. Intelligent design is an alternative explanation of the origin of life that differs from Darwin's view. Students are encouraged to question Darwin's unproven theory and to request and expect answers related to intelligent design.

A central sentence in the pastor's disclaimer closely echoes another phrase from Dover: "Intelligent Design is an explanation of the origin of life that differs from Darwin's view." The wording of both reveals their proponents to be woefully unfamiliar with the views they attempting to foist onto unsuspecting pupils, since neither "intelligent design" nor evolutionary theory is really an explanation of how life began.

However, Mena might be one of the most fortunate high school students in America. Her science teacher, Ms Shepherd, who earned multiple advanced degrees in biology, is a teacher willing to stand her ground and devote a solid, multi-week unit to evolutionary theory. Shepherd's passionate response to the pastor's announcement is an easily understandable explanation, which would work well as the starting point for any class discussion of what a theory is and how science works.

Mena is included in Shepherd's inner circle of high-performing students and embarks on some scientific — and interpersonal — experimentation of her own, including a first romance with Kayla's brother Casey, Mena's science lab partner. However, what is especially strong about Brande's novel is that this is just *part* of Mena's journey of self-discovery, in what is essentially a coming-of-age tale with a controversy over evolution as a huge plot device.

Freaks of Nature keeps the reader in a high state of suspense with an ongoing secondary storyline — the mysterious crisis that caused Mena to be banned from church in the first place. Mena's parents are suffering severe economic hardship. Their insurance company is going under as the churchgoers boycott their business, since fully

"eighty percent of their customers come from the church."

"I knew today would be ugly. When you're single-handedly responsible for getting your church, your pastor, and every one of your former friends and their parents sued for millions of dollars, you expect to make some enemies," Mena recounts in the novel's opening passage, set at the start of her first day of high school — precarious ground for any young person. "I wasn't thinking about anything back then except trying to right a terrible wrong."

The novel starts out strong and remains an engrossing and fast-paced page-turner as the secret about "what Mena did" to right that wrong is revealed bit by bit. In the struggle for existence that is being an adolescent in America's educational system, Mena is proven to be not a "freak of nature" at all, but a genuine heroine. The lesson is the value of moral courage for teenagers, as well as biology teachers.

Evolution, Me, and Other Freaks of Nature is a well-constructed story that keeps a reader's attention with a sympathetic main character, a tantalizing and mysterious sub-plot and a realistic sense of urgency and teenage angst. Brande's book would be useful as a text in a middle school English class, ideally as part of a team-teaching approach with a science class. This might help open dialogue on an issue many educators view with hands-off trepidation.

RNCSE keeps its readers abreast of anti-evolution challenges as they arise in places like Kansas, Dover, or "New Advantage". *Evolution, Me, and Other Freaks of Nature* offers a warm, teen's-eye view of what happens when these turn into messy and bitter controversies that rend a community apart. The novel can help focus *RNCSE's* readers' attention on the very human, impressionable young people — with complex emotions and problems of their own — who are really what these cases are all about.

AUTHOR'S ADDRESS

Laurel Saiz
English, Reading, and Communication
Onondaga Community College
Syracuse NY 13215
saizl@sunyocc.edu

Laurel Saiz is Associate Professor of English, coordinator of the journalism program, and Chair of the Faculty Association at Onondaga Community College.



OPTICAL ALLUSIONS

by Jay Hosler
Columbus
(OH):Active
Synapse, 2008.
127 pages

Reviewed by T Ryan Gregory

Most animals can see. That is to say, they possess some kind of specialized organ capable of receiving and processing information carried in the form of light. Though they represent only one of more than half a dozen fundamentally different sorts of visual organs, the camera-type eyes of vertebrates (and cephalopod molluscs) are the most familiar and are among the most complex. Prior to the rise of evolutionary theory, such eyes were presented as a prime example of design in nature. How else could such intricate and eminently functional organs come to exist? Darwin considered it an important challenge to explain the origin of eyes, and provided the first effort to resolve this puzzle. While eyes are still offered by some as a challenge to evolutionary biology, research over the past century and a half — and especially in the past few decades — has reinforced and greatly expanded Darwin's early insights.

The problem, as I discovered while editing a special issue of *Evolution: Education and Outreach* on the evolution of eyes (2008; 1 [4]; available on-line via <http://www.springerlink.com/content/120878/>), is not a lack of information about how eyes of various types are likely to have evolved. Rather, the challenge lies in conveying the enormous amount of available knowledge in this area in an accessible way. My approach was to rely on experts in

particular areas of the broad field of eye evolution to describe what they know, and what they are still striving to discover, about the origins of eyes. Faced with the same challenge, Jay Hosler, a biology professor at Juniata College (and, it so happens, a gifted cartoonist), has taken an entirely different tact in his quirky and charming *Optical Allusions* — a book billed as “the cure for all those clamoring for a painstakingly researched, scientifically accurate, eye-themed comic book adventure.”

In *Optical Allusions*, Hosler assembles a whimsical, all-star cast of clichés, including swashbuckling pirates, killer robots, mad scientists, vampires and zombies, superheroes, a cyclops (specifically Polyphemus from Greek mythology, known to friends as “Polly”), and witches complete with the requisite bubbling cauldrons and eyes of newt (*Notophthalmus viridescens*, to be precise). These characters populate the various worlds visited by the book's protagonist, Wrinkles the Wonder Brain, a self-described “brain without a person”. You see, Wrinkles has lost the “magic eye” belonging to his blind witch employers, and must dive into a concoction of “distilled imagination” in search of it. To get from one imaginary world to another, Wrinkles need only eat one of the newt eyes he has brought with him. His only other resources are his wits (he is, after all, a walking brain) and the kindness of the strange people he encounters along the way. The details of the story are simply too weird and wonderful to summarize here.

It may be difficult to imagine how such a bizarre comic book tale could teach anything about the complexities of eye evolution. That is, until you consider that the pirates are stalk-eyed flies who explain the pressures of sexual selection, the killer robot (C.Y.K.L.O.P.S.) is a giant replica of the human eye complete with maladaptive scars of evolutionary history, the zombies are G-proteins, and so on. All told, the story incorporates details of eye anatomy, the functions of rod and cone cells, the molecular components of photo-transduction (rhodopsin, opsin,

retinal, and G-protein coupled receptor proteins), the basis of trichromatic color vision, loss of eyes in cave-dwelling fish, imperfections of the vertebrate eye such as the well-known blind spot and the easy clogging of the canal of Schlemm (which results in glaucoma strong enough to destroy the aforementioned killer robot), and even analyses of phylogenetic trees. Oh, and the process of mutation and natural selection is not just explained, but *caused*, by a voracious and extremely long-lived Charles Darwin.

Between chapters of the comic book, Hosler interleaves more detailed technical discussions of some of the many complex topics in eye evolution. These remain succinct and readable, and add to the overall value of the book. (However, I confess that the comics were my favorite.)

There is much to recommend this unique book, and little to criticize about it besides a few minor quibbles. The particular definition of “theory” given on page 22 (“a hypothesis supported by a substantial amount of accurate data”) is misleading, though by no means rare. Various typos also seem to have escaped the gaze of copy editors, though even these may bring a smile (on page 25, for example, we read “Most animals like penguins and tulip trees have generation times measured in years”).

Optical Allusions provides a large amount of basic information in an unapologetically silly form that is just plain fun to read. If indeed you are clamoring for a scientifically accurate, eye-themed comic book adventure — and even if you're not — Jay Hosler's brain-child is well worth a look.

AUTHOR'S ADDRESS

T Ryan Gregory
Department of Integrative Biology
University of Guelph
Guelph, Ontario N1G 2W1
Canada



T Ryan Gregory is an Assistant Professor in the Department of Integrative Biology at the University of Guelph. His research focuses primarily on the evolution of genome size in animals. His first book, an edited volume entitled *The Evolution of the Genome* (San Diego: Elsevier), was published in 2005.

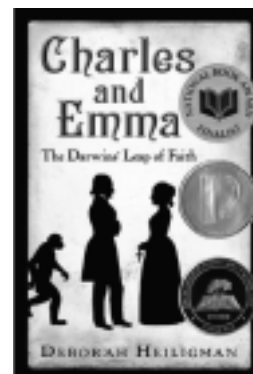
THE TRUE ADVENTURES OF CHARLEY DARWIN

by Carolyn Meyer
Orlando (FL): Harcourt. 2009. 272 pages

CHARLES AND EMMA: THE DARWINS' LEAP OF FAITH

by Deborah Heiligman
New York: Henry Holt. 2009. 320 pages

Reviewed by Anne H Weaver



The True Adventures of Charley Darwin, by Carolyn Meyer, and Deborah Heiligman's *Charles and Emma: The Darwins' Leap of Faith* are two excellent new additions to Darwiniana for young people. Meyer gives us an engaging account of Darwin's youth up until his marriage. Heiligman offers a poignant account of Darwin in maturity through the story of his family life and collegial relationships.

Despite some inevitable overlaps, the books are remarkably complementary. Both authors recount classic anecdotes; both authors describe Darwin's youthful, ill-fated flirtation with Fanny Owen; and both document Darwin's infamous 1838 list, jotted on the back of a letter, outlining the pros and cons of marriage (Darwin 1838). In fact, that list represents the pivot point between Meyer's lively historical romance for adolescents and Heiligman's well-crafted story of an older Darwin for a slightly older audience.

THE TRUE ADVENTURES OF CHARLEY DARWIN

Carolyn Meyer has a devoted following of adolescent readers who love her fictionalized, first-person historical biographies (of Mozart's sister, Grand Duchess Anastasia, Queen Anne, and others). In this vein, Meyer's *The True Adventures of Charley Darwin* introduces the reader to the schoolboy who preferred to catch beetles and hunt

for newts in the old quarry rather than study Latin and Greek; the young man who was more comfortable on horseback galloping across the pampas of Argentina than he was sipping tea in an English drawing room" (p 320).

Meyer is a novelist, exercising a novelist's prerogative in introducing occasional minor anachronisms, arranging fictional encounters to move the action forward, and putting words into the mouths of her characters. On the other hand, she is also a meticulous researcher, who keeps her artistic license well within the bounds of credibility. She makes good use of the little information available about Darwin's early childhood, relying on his *Autobiography* (1958) and Janet Browne's *Charles Darwin: Voyaging* (1995) to create an account of school days alive with friendships, pranks, and rivalries, all in the grim context of institutional thin blankets, unwashed sheets, and stale bread.

The dramatic arc is significantly interrupted by a long chronological account of Darwin's five-year voyage on the *Beagle*. But Meyer deftly keeps the narrative flow intact by referring to the letters Darwin received from family and friends at intervals during the voyage; and, true to the genre of historical romance, her narrative ends with Darwin's ambivalent courtship and marriage to Emma Wedgwood.

Meyer gives us the young Darwin as an adored younger brother, a discontented schoolboy, an adolescent romantic; an intrepid explorer, a passionate hunter, a desirable catch, a preoccupied young scientist, and a hesitant suitor. And she offers her readers a rich and lively picture of upper-

class English country life in the 19th century.

CHARLES AND EMMA

Deborah Heiligman's *Charles and Emma: The Darwins' Leap of Faith* springs to life at the point where Meyer's draws to a close. Heiligman's research is grounded in the available sources, especially the correspondence and diaries of Emma Wedgwood Darwin, Charles's notebooks, and correspondence among Darwin's colleagues and friends. From this rich trove, the author has drawn a nuanced and engaging portrait of the Darwins' lifelong devotion to each other despite divergent religious beliefs.

From the late 18th century onward, scientific explanations for natural phenomena challenged the conventional Anglican world view of supernatural intervention and biblical literalism. A growing movement of freethinkers and Unitarians believed that human affairs should be governed based on reason and empirical evidence. The Darwins' divergent spiritual perspectives embodied the contemporary tension between religious orthodoxy and science.

Heiligman reconstructs Emma's perspective from letters, memories recorded by the Darwin children, short moral tales she created to teach her children to read, and from notes in the margins of her Bible. Heiligman depicts Emma as a complex woman: thoughtful, intelligent, honest, highly principled, and devout.

Growing up in a freethinking, Unitarian household, Emma took to heart the Unitarian commitment to rational and independent thought. And yet Emma had a

Anne H Weaver is a physical anthropologist and the award-winning author of The Voyage of the Beetle: A Journey around the World with Charles Darwin and the Search for the Solution to the Mystery of Mysteries, as Narrated by Rosie, an Articulate Beetle (Albuquerque [NM]: University of New Mexico Press, 2007).

deeply devotional side, which is revealed in her letters.

Heiligman places much weight on three letters in particular. The first, written shortly after the death of Emma's sister Fanny: "Such a separation as this seems to make the next world feel such a reality — it seems to bring it so much nearer to one's mind and gives one such a desire to be found worthy of being with her" (Wedgwood 1832).

In a second letter, written by Emma to Charles after their engagement in 1839, she worried that "our opinions on the most important subject should differ widely. My reason tells me that honest & conscientious doubts cannot be a sin, but I feel it would be a painful void between us. I thank you from my heart for your openness with me & I should dread the feeling that you were concealing your opinions from the fear of giving me pain" (Wedgwood 1838). In a later letter she says, "May not the habit in scientific pursuits of believing nothing till it is proved, influence your mind too much in other things which cannot be proved in the same way, & which if true are likely to be above our comprehension" (Wedgwood 1839). At the bottom of this letter, discovered among Darwin's papers after his death, is a short note: "When I am dead, know that many times, I have kissed & cried over this. C.D."

Like Emma, Darwin grew up among freethinkers and Unitarians. Darwin's father had little patience for religion, but his sisters made sure he knew his Bible, which he interpreted literally in his youth. Heiligman provides a succinct summary of natural selection theory and a detailed description of the decades of inquiry that convinced Darwin that species have their origins in natural processes, leading him to describe himself as a materialist and an agnostic.

Despite Emma's concern about the state of Charles's soul and her fear that he was jeopardizing their chances of being together through all time, the Darwins' marriage was strong and fruitful in many dimensions. Heiligman writes about their love, their family life, and their very human struggles to be true to themselves and to each other.

Charles and Emma is a

poignant and intimately researched portrayal of the deep bond between two mature people with a commitment to each other, to their family, and to the truth. It is a worthy departure from the format of Heiligman's earlier brightly illustrated children's books.

TWO WELL-WRITTEN PERSPECTIVES

Each of these fine books — *The True Adventures of Charley Darwin* and *Charles and Emma* — is unique in tone and emphasis. Each portrays a different and fascinating phase of Darwin's long and productive life. Together, they offer the young reader (or the devoted Darwin fan) a lively and rich depiction of Charles Darwin and his intimate world.

REFERENCES

Browne J. 1995. *Charles Darwin: Voyaging*. New York: Alfred A Knopf.

Darwin C. 1838. To marry, not to marry. *The Complete Works of Charles Darwin Online*. Available on-line at <<http://darwin-online.org.uk/content/frameset?viewtype=text&itemID=CULDAR210.8.2&pageseq=1>>. Last accessed January 26, 2009.

Darwin C. 1958. *The Autobiography of Charles Darwin 1909-1882*. Edited by Nora Barlow. New York: WW Norton & Company.

Wedgwood E. 1832 Sep 15. [Letter to her aunt Mme Sismondi.] *The Complete Works of Charles Darwin Online*. Available on-line at <<http://darwin-online.org.uk/content/frameset?viewtype=text&itemID=F1553.1&pageseq=219>>. Last accessed January 26, 2009.

Wedgwood E. 1838 Nov 21-22. [Letter to Charles Darwin.] *Darwin Correspondence Project*. Available on-line at <<http://www.darwinproject.ac.uk/darwinletters/calendar/entry-441.html>>. Last accessed January 26, 2009.

Wedgwood E. 1839 Feb. [Letter to Charles Darwin.] *Darwin Correspondence Project*. Available on-line at <<http://www.darwinproject.ac.uk/darwinletters/calendar/entry-471.html>>. Last accessed January 26, 2009.

AUTHOR'S ADDRESS

Anne H Weaver
1119 South Plata Circle
Santa Fe NM 87501



THE GREATEST SHOW ON EARTH: THE EVIDENCE FOR EVOLUTION

by Richard Dawkins
New York: The Free Press, 2009.
480 pages

Reviewed by
Douglas Theobald

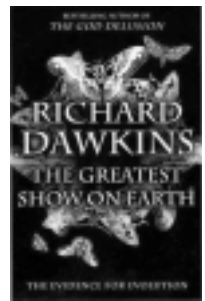
Richard Dawkins, Darwin's latter-day pit-bull, has a missing link. Or, rather, had. With the publication of his tenth book, *The Greatest Show on Earth*, Dawkins finally gets around to filling a conspicuous void in an evolutionary oeuvre that spans nearly forty years. As Dawkins himself explains, all his previous books primarily deal with the power of natural selection and simply assume that evolution has happened. Dawkins outlines the goal for his latest tome in the introduction:

Evolution is a fact, and this book will demonstrate it. No reputable scientist disputes it, and no unbiased reader will close the book doubting it.

That ostentatious declaration sets the bar high, but by the final flowery chapter, after over 400 pages of dramatic evidence, it is apparent that the author has successfully cleared the hurdle.

The book's September 2009 release was just in time for the sesquicentennial anniversary of the publication of Charles Darwin's *On the Origin of Species*, certainly no mere coincidence. In fact, Dawkins's book shares many conspicuous parallels with Darwin's first edition from 1859. Both have 14 chapters (including Dawkins's appendix) and follow much the same outline for "one long argument" intended to establish the scientific case for evolution. Both begin by setting out the evidence for natural selection, first

Douglas Theobald is Assistant Professor of Biochemistry at Brandeis University and author of "29+ evidences for macroevolution: The scientific case for common descent" (available on-line at <<http://www.talkorigins.org/faqs/comdesc/>>).



treating artificial selection in the origin of domesticated animals and plants and then moving to *bona fide* natural selection in the wild. Like Darwin, Dawkins next proceeds methodically to the ample evidence from the fossil record, from developmental biology, from biogeography, and finally from vestiges and other remnants of historical contingency. But Dawkins's job is much easier than Darwin's was, and it is correspondingly more compelling. Here in the 21st century, the evidence for evolution is indeed great, much more diverse and extensive than 150 years ago when Darwin wrote the *Origin*.

Chapter after substantial chapter, we are treated to the many independent, converging lines of evidence that all point to the same conclusion: the fact that "all living things are cousins". Dawkins devotes an entire chapter to geological dating, covering radioactive methods, tree rings, geological strata, and leading fossils, with a clear refutation of the oft-made charge that fossil dating is circular.

Dawkins really finds his stride in the fifth chapter, "Before our very eyes". Here Dawkins discusses several cases of evolution observed in real-time in both the lab and the wild, including the impressive Lenski experiments on twenty years of controlled bacterial evolution.

By the sixth chapter (on transitional fossils) one gets the feeling that Dawkins is really batting them out of the park, and he keeps on hitting homers for the rest of the book. Dawkins covers topics often given short shrift in other books of this kind, and his treatment of the modern molecular evidence, ranging from protein folding to molecular phylogenetics, is particularly satisfying. His consideration of the molecular clock and the neutral theory of evolution is especially useful and avoids some of the more common misconceptions that have persisted even in the primary literature.

I was singularly pleased to see David Penny's formal test of common descent brought to a larger audience, where five independent protein phylogenies are shown to display statistically significant similarities — a result expected if the species harboring these proteins

are genetically related. In the closing chapter, Dawkins deconstructs line by line, as if explicating a poem, the famous final paragraph of Darwin's *Origin*. This unorthodox conclusion is perhaps the finest chapter of the book, touching on the universal genetic code, abiogenesis, thermodynamics, the RNA world, and the anthropic principle.

Stylistically, this latest offering harbors no surprises, and if you have enjoyed Dawkins's previous books, you will not be disappointed with this one. Dawkins is the prince of scientific analogies and is uniquely adept at conveying difficult and complex scientific concepts by extracting otherwise arcane similarities from more familiar things. The embryonic development of an animal is likened to "inflating origami". Protein folding is compared to the spontaneous bunching of magnetic beads on a beaded necklace. If, over the millennia, you could hear the ticking of neutral fixations in the molecular clock, it would sound, according to Dawkins, like the random crackling of a Geiger counter.

Dawkins's frustration with creationists and the excesses of religion are plainly sensed in this book, as in his others, and his indelicate remarks, though largely justified, will undoubtedly be off-putting for many potential readers:

The history-deniers [Dawkins's euphemism for anti-evolution creationists] themselves are among those that I am trying to reach in this book. But, perhaps more importantly, I aspire to arm those who are not history-deniers but know some ... and find themselves inadequately prepared to argue the case.

Flaws and quirks aside, Dawkins's message will quite likely hit its intended target, as well as open some of the more hardened minds of evolutionary skeptics.

In a book on evolutionary evidence, it is hard to avoid a few nods towards debunking the common creationist fallacies. Nevertheless, unlike many other popular books that cover the evidence for evolution, this is not primarily a refuta-

tion of creationism or "intelligent design" arguments. Rather, Dawkins's latest book is a positive commemoration of the triumph of a grand arching theory that has withstood the continuous onslaught of 150 years of new data, including the tsunami of molecular, genetic, and sequence data from the past fifteen years.

In the final analysis, *The Greatest Show on Earth* will take a deserved place alongside other "must-read" evolution books. No other book currently available approaches Dawkins's comprehensive yet accessible treatment of the extraordinarily diverse and massive body of data that drives ineluctably to the same conclusion, the only conclusion that makes sense of everything in biology: that all the "endless forms" of known life share a common genetic kinship, as they have been, and are being, evolved.

AUTHOR'S ADDRESS

Douglas L Theobald
Department of Biochemistry
Mailstop 009
Brandeis University
Waltham MA 02454-9110
dtheobald@brandeis.edu



THE SCOPES TRIAL: THE BATTLE OVER TEACHING EVOLUTION

by Stephanie Fitzgerald
Minneapolis (MN): Compass Point Books, 2007. 96 pages

Reviewed by Carrie Sager

When I was in eighth grade, we read *Inherit the Wind* in English class. Even when taught as litera-

Carrie Sager is NCSE's Project Assistant. She studied American history at the University of Toronto.

ture, however, the idea that the play is inspired by the Scopes trial translates easily in young minds to the idea that they are more or less the same story, despite the fact that *Inherit the Wind* is about as historically accurate as Disney's version of *Pocahontas*.

The addition of a book like Stephanie Fitzgerald's *The Scopes Trial* to the pre-teen marketplace is therefore a boon to historically-minded educators, as well as parents who want to introduce their children to this exciting chapter in American history. Unfortunately, I would recommend a book like Fitzgerald's *The Scopes Trial*, which itself has enough flaws that I cannot recommend it.

Certainly, there are things to be admired about the book. It is well-paced and attractive, evolution is treated as the only scientific explanation of life, and there is significant reliance on and reference to primary sources. However, certain elements of the book are less appealing.

The select bibliography includes Marvin Olasky and John Perry's atrocious, pro-"intelligent design" *Monkey Business: The True Story of the Scopes Trial* (2005; reviewed in *RNCSE* 2006 May/June; 26 [3]: 45-6) among a collection of primary sources, while Edward J. Larson's definitive *Summer for the Gods* (1997) is conspicuously absent. Though there is no evidence that Fitzgerald is sympathetic to anti-evolutionists — quite the opposite, actually — the risk that students or teachers might use the select bibliography for further reading makes this a concern.

In pursuit of the laudable goal of balance, Fitzgerald may overstate the nobility of her subjects. She is sympathetic to the Tennessee government, downplaying their support of the bill:

[T]he people who voted on [the bill] did not feel very strongly about the issue. ... The Tennessee House of Representatives approved the bill by a vote of 71-5. Those who voted for it probably expected the members of the Tennessee Senate to kill it. But when the bill got to the senate it was passed by a vote of 24-6. Most of the

members of the senate expected Tennessee Governor Austin Peay to veto the bill. (p. 32)

Peay also supposedly signed the bill for fear that failing to do so would prevent fundamentalists from supporting a tax increase to increase school funding.

On the other side, Fitzgerald avoids the anti-defense team attitude taken by Olasky and Perry as she describes Darrow as famous for being a defender of "the poorest and most downtrodden people"; while it is true that he had gained fame defending union members and political radicals, he also defended wealthy murderers, and it was for this that he was most famous by the time of the trial (Larson 1997: 71).

Though Fitzgerald makes motions towards dispelling some of the stereotypes about the trial and its players in the body of the text, in the first chapter she unfortunately plays into many of them for the purposes of summary: Bryan was fighting for the Bible! Darrow was fighting for truth and reason! Scopes was an evolutionist rebel! The people of Dayton were ignorant hillbillies! Though only the first two are directly stated, readers go into the rest of the book with their preconceptions reinforced — not the ideal mindset for absorbing new ideas.

This simplification is not limited to the trial itself. In the chapter summarizing the history of evolution, Fitzgerald follows a perfectly serviceable description of Lamarckian inheritance with the dismissal that Lamarck was "just dealing with guesswork and did not have any evidence to support [his] ideas" (p. 24). Though this was a criticism leveled at him both in his own time and by some modern scientists, it ignores the nature of science in his era and the comprehensive nature of the framework he developed. While some simplification is necessary when summarizing the entire history of evolu-

tionary theory in twelve pages, it does no one any favors to dismiss an important figure in the history of biology.

Perhaps the greatest weakness in the book is one of language choices that a casual reader would likely overlook entirely — which is exactly why it is so dangerous in a book for pre-teens, who almost certainly lack the background to read between the lines. The most obvious example to *RNCSE* readers is Fitzgerald's repeated use of the cringe-inducing phrase "believe in" evolution — a common but sloppy expression which carries religious undertones (a better alternative is "accept evolution"). There is also a problem with language that means different things to scientists and non-scientists. For example, Fitzgerald claims that the discovery of Neanderthal skeletons "offered proof" of primitive humans, and *Archaeopteryx* "proved Darwin's claim that birds had evolved from reptiles" (p. 24). When dealing with an audience that is unfamiliar with the scientific process, to imply that scientific claims are proved true or false, and by a single piece of evidence, sets them up for misunderstanding basic scientific concepts later on.

Fitzgerald's efforts are admirable, and there is no smoking gun in this book, no sentence one can point to and say, "There, that's wrong." And it is clear that her heart is in the right place. But all the small objections that might seem petty taken individually add up to a book that just doesn't make the cut.

REFERENCES

- Larson EJ. 1997. *Summer for the Gods*. New York: Basic Books.
Olasky M, Perry J. 2005. *Monkey Business*. Nashville (TN): Broadman and Holman.

AUTHOR'S ADDRESS

Carrie Sager
NCSE
PO Box 9477
Berkeley CA 94709-0477
sager@ncse.com



NATIONAL CENTER FOR SCIENCE EDUCATION
PO Box 9477
Berkeley CA 94709-0477

Non-Profit Org.
U.S. Postage
PAID
Permit 1197
Berkeley CA

Change Service Requested

30(3)

EDITOR

Andrew J Petto
Department of Biological Sciences
University of Wisconsin, Milwaukee
PO Box 413, Milwaukee WI 53201-0413
(414) 229-6784; fax (414) 229-3926

SUPPORTERS

Bruce Alberts, *UC San Francisco*
Francisco J Ayala, *UC Irvine*
Frederick Borsch, *LTSP*
Stephen G Brush, *U MD*
Sean B Carroll, *U WI*
Johnnetta B Cole, *Bennett College*
Joel Cracraft, *AMNH*
Brent Dalrymple, *OR State U*
James E Darnell Jr, *Rockefeller University*
Richard E Dickerson, *UCLA*
Robert H Dott Jr, *U WI*
Niles Eldredge, *AMNH*
Milton Fingerman, *Tulane*
Douglas J Futuyma, *SUNY Stony Brook*
Alfred G Gilman, *U Texas SMC*
Laurie Godfrey, *U MA*
Donald Hornig, *Harvard*
Duane E Jeffery, *Brigham Young*
Donald Johanson, *Inst Hum Origins*
Patricia Kelley, *UNC Wilmington*
Philip Kitcher, *Columbia*
Richard C Lewontin, *Harvard*
Lynn Margulis, *U MA*
Malcolm McKenna, *AMNH*
Keith B Miller, *Kansas State U*
Kenneth Miller, *Brown*
David Morrison, *NASA Ames*
Bill Nye, *The Science Guy*
Robert L Park, *U MD*
James Randi, *Conjuror*
Michael Ruse, *Florida State U*
James W Skehan, *SJ, Weston Obs*
Elliott Sober, *U WI*
Frank Sonleitner, *U OK*
Richard Stucky, *Denver Mus Nat & Sci*
Neil DeGrasse Tyson, *AMNH*
Marvalee Wake, *UC Berkeley*
Mary Jane West-Eberhard, *Smithsonian Inst*
Tim D White, *UC Berkeley*

OFFICERS AND DIRECTORS

Kevin Padian, *President*
Brian Alters, *President-Elect*
Jack B Friedman, *Past President*
Robert M West, *Secretary/Treasurer*
Barbara Forrest, *Director*
Martha J Heil, *Director*
Michael McIlwrath, *Director*
Andrew J Petto, *Director*
Frank J Sonleitner, *Director*
Lorne Trotter, *Director*
Bernard Winograd, *Director*

Eugenie C. Scott, *Executive Director*
Stanley L. Weinberg, *Founder*

NCSE is a nonprofit, tax exempt corporation
affiliated with the American Association
for the Advancement of Science.

Membership in the National Center for Science Education brings you

- One year's subscription to *Reports of the National Center for Science Education* (6 issues)
- Participation in NCSE's diverse efforts to promote and defend the integrity of science education

MEMBERSHIP / SUBSCRIPTION / DONATION

Name			
Address	City	State	Zip
Home Phone		Work Phone	
Occupation			
<input type="checkbox"/> Check here if NCSE may share your name with activists in your state			
<input type="checkbox"/> Check here if you object to our sharing your name with other nonprofit organizations			

NCSE MEMBERSHIP		
ONE YEAR	US: \$30 Foreign Air: \$39	
LIFETIME	\$600	\$
TAX DEDUCTIBLE CONTRIBUTION TO NCSE		\$
BACK ISSUES		
NCSE Reports / C/E Newsletter (Vol 1-16, \$3 per issue; \$18 per volume; all 16 vols, \$150) C/E Journal (1-9 copies, \$6 each; 10 or more, \$5 each; full set, nrs 1-39, \$150) RNCSE (Vol 17-30, \$5 per issue; \$24 per volume)		\$
SHIPPING		
\$1.25 for 1 issue, add \$1 for each additional issue; maximum of \$10		\$
TOTAL		
<input type="checkbox"/> Check (US dollars) <input type="checkbox"/> Discover <input type="checkbox"/> VISA <input type="checkbox"/> MasterCard <input type="checkbox"/> AmEx		\$

Credit Card Number	Expiration Date
Name as it appears on card	
Signature	

SUBSCRIBER INFORMATION
Subscriptions are fully tax deductible. NCSE is tax exempt under Federal IRS Code 501(c)(3) and the corresponding provisions of the California law. Amounts paid to NCSE are tax-deductible to the extent permitted by law.

MISSING ISSUES
If your issue fails to arrive or is badly damaged in transit, send us the date of issue and we will rush you a replacement.

Please mail all correspondence about your subscription to NCSE, PO Box 9477, Berkeley, CA 94709-0477 or call (510) 601-7203 or (800) 290-6006 or e-mail us at NCSE@ncse.com

MOVING TO A NEW ADDRESS?
Let us know your new address as early as possible and we will update our records of your subscription accordingly. Please allow 4 weeks for an address change.