REPORTS OF THE NATIONAL CENTER FOR SCIENCE EDUCATION

DEFENDING THE TEACHING OF EVOLUTION IN THE PUBLIC SCHOOLS

Volume 29, Number 1 JAN-FEB, 2009

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FROM THE EDITOR

It will hardly be news to our readers that 2009 is the bicentennial of the birth of Charles R Darwin … and the sesquicentennial of the first publication of *On the Origin of Species*. The occasion is being marked by major media in many fields — including popular science-related media such as *Discover, Natural History, Scientific American, National Geographic,* and *The American Biology Teacher*. We recommend those to our readers who are interested in a summary of the scientific, historical, and social impact of Darwin's work.

In this issue, we add another perspective on Darwin's work. The "genius" of Darwin was that he knew how to resolve the scientific questions of the day: make careful observations about the natural world and use those observations to make testable predictions about how the world works (note to "intelligent design" proponents: follow Darwin's lead and do the research).

Our lead article by Sara Hoot brings home this point elegantly. Darwin spent the years between his voyage on the *Beagle* and the publication of the *Origin* making detailed observations about organisms, communities, and ecosystems. Hoot insightfully reviews three specific areas of Darwin's botanical work that made significant scientific contributions to the field in their own right — and not just because they helped fine-tune evolutionary theory.

Hoot's article also puts to rest the claim that Darwin's work would not have passed peer review — a futile attempt by anti-evolutionists to justify their failure to produce such work. Particularly in her example of Darwin's work with his son Francis on plant movements in response to light (phototropism), we see a "classic" practice of the process of scientific inquiry: hypothesize–predict–test–evaluate–revise–repeat. Although the instrumentation and materials might not meet 21st-century standards, the research design, analysis, interpretation, and conclusions would not be out of place in a modern science research program.

Also in this edition is the debut of a recurring column by Randy Moore. Drawn from the pages of his book (with Mark Decker) *More than Darwin: An Encyclopedia of the People and Places of the Evolution–Creationism Controversy* (see Glenn Branch's review on p 27), each column will explore a new example of the important discoveries and events that helped to provide scientific foundations for the emerging science of evolution in the 19th century. In this issue, Moore introduces us to Siccar Point, where geologist James Hutton was convinced of earth's vast age. Similarly, future columns will introduce important people and places that made similar contributions to natural science and led us to our modern understanding of the history and diversity of life on earth.

IN THE NEWS

It is a new legislative year, and that means a spate of new anti-evolution bills introduced into state legislatures all over the country. "Academic freedom" is the new euphemism. To those familiar with the evolution/creationism issue, the main arguments and rationale for these bills sounds suspiciously like the "equal time", "fair treatment", and "balanced treatment" bills that have repeatedly been struck down by the courts. Get a quick overview in Updates, and then check our website for the latest (<http://ncseweb.org>).

New science education standards are in the works in several states. Glenn Branch reports on the current state of the revisions in Texas. "Strengths and weaknesses" is the current buzzword in these proceedings. However, for some reason, students are only asked to consider the "strengths and weaknesses" of *certain* scientific theories and models — those of the evolutionary sciences. One does not need to wonder why.

BOOK REVIEWS

Our reviewers focus on books with "Darwin" in the title. NCSE's deputy director Glenn Branch, as mentioned, reviews Moore and Decker's *More than Darwin*, which he describes as "a marvelous trove for the curious browser."

Rebecca Cann reviews Norman Johnson's *Darwinian Detectives*, which she calls "a delight to read." Cann points out Johnson's careful presentation of the significance of modern genetic and genomic research for understanding evolutionary processes. The take-home message: "A designed biota would not be as messy, as haphazardly constructed, or as truly jerryrigged as the genetic systems cobbled together by the last billion years of random processes and presented here for your total wonderment."

NCSE's Faith Project Director Peter Hess reviews *Negotiating Darwin* — a look at the response of the Roman Catholic Church in the decades following the publication of the *Origin*.

Also in this issue is Andrew Petto's review of *Darwin and the Bible*. This edited collection is a polyvocal book that allows a greater autonomy of expression by the authors whose viewpoints on the meaning and even the validity of evolutionary science differ dramatically.

Remember to check out our centerfold pages, letting you know how to order recommended books and support NCSE financially with every purchase.

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NEWS

Moves and Countermoves in Texas

Glenn Branch

The end of 2008 was replete with moves and countermoves in the controversy over the place of evolution in Texas's state science standards, beginning with the release of proposed drafts of the state's science education standards on September 22, 2008. Not surprisingly, the media focused on the place of evolution in the draft standards, with the *Dallas Morning News* (2008 Sep 23) reporting, "Proposed curriculum standards for science courses in Texas schools would boost the teaching of evolution by dropping the current requirement that students be exposed to 'weaknesses' in Charles Darwin's theory of how humans and other life forms evolved. Science standards drafted by review committees of teachers and academics also would put up roadblocks for teachers who want to discuss creationism or 'intelligent design' in biology classes when covering the subject of evolution."

In particular, a requirement in the current standards for high school biology that reads "The student is expected to analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information" would be replaced with "The student is expected to analyze and evaluate scientific explanations using empirical evidence, logical reasoning, and experimental and observational testing," and a description of the limits of science (adapted from the recent National Academy of Sciences publication *Science, Evolution, and Creationism*) — "Science uses observational evidence to make predictions of natural phenomena and to construct testable explanations. If ideas are based upon purported forces outside of nature, they cannot be tested using scientific methods" — would be added.

Such revisions may seem small and unimportant, but in 2003, the "strengths and weaknesses" language in the Texas state science standards was selectively applied by members of the board attempting to dilute the treatment of evolution in the biology textbooks then under consideration. At the time, board member Patricia Hardy observed that it was invidious to apply the language only to a single topic; while if it were applied across the board, "we'd need a crane to carry the books to the schools." In the end, all of the textbooks were adopted without substantial changes, but it was clear that the "strengths and weaknesses" language would be a matter of contention when the standards were next revised. As Kathy Miller of the Texas Freedom Network told *The New York Times* (2008 Jun 4), "'Strengths and weaknesses' are regular words that have now been drafted into the rhetorical arsenal of creationists."

Groups supporting the integrity of science education unsurprisingly applauded the draft standards. In a September 23, 2008, press release (available on-line at <http://www.tfn.org/site/News2?page=NewsArticle&id=5453>), the Texas Freedom Network's Kathy Miller was quoted as saying, "These work groups have crafted solid standards that provide a clear road map to a 21st-century science education for Texas students ... These commonsense standards respect the right of families to pass on their own religious beliefs to their children while ensuring that public schools give students a sound science education that prepares them to succeed in college and the jobs of the future." "It's time for state board members to listen to classroom teachers and true experts instead of promoting their own personal agendas," she added. "Our students can't succeed with a 19th-century science education in their 21st-century classrooms. We applaud the science work groups for recognizing that fact."

In a September 23, 2008, blog post for the *Houston Chronicle* (available on-line via <http://www.chron.com/commons/readerblogs/evosphere.html>), Texas Citizens for Science's Steven Schafersman also welcomed the addition of the description of the limits of science and the removal of the "strengths and weaknesses" language, which he described as "the primary weapon that creationists have to attempt to damage and corrupt science textbooks." He expressed regret, however, that those revisions were not emulated in all of the standards. Schafersman also lamented the omission from the biology standards of any requirement to learn about human evolution in particular, commenting, "I'm sure the competent teachers on the biology panel discussed a requirement for human evolution, but they ultimately decided against it. They should have included it and forced the [state board of education] members to remove it by majority vote rather than by giving their prior permission to continue censorship."

The chair of the state board of education, avowed creationist Don McLeroy, defended the "strengths and weaknesses" language, telling the *Austin American-Statesman* (2008 Sep 23), "I'd argue it doesn't make sense scientifically to take it out ... Evolution shouldn't have anything to worry about — if there's no weaknesses, there's no weaknesses. But if there's scientifically testable explanations out

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Glenn Branch is deputy director of NCSE.

there to refute it, shouldn't those be included too?" The newspaper added, "he prefers the 'strengths and weaknesses' language because it allows the board to reject a textbook that doesn't cover the weaknesses of evolution." But Kevin Fisher, who helped to write the draft biology standards, told the *American-Statesman*, "Something doesn't become a theory if it's got weaknesses. There may be some questions that may yet to be answered, but nothing that's to the level of a weakness."

Clearly the treatment of evolution in the standards — and especially the omission of the "strengths and weaknesses" language — was going to continue to be controversial. Summarizing the political situation on the state board of education, the *American-Statesman* reported, "In previous public discussions, seven of 15 board members appeared to support, on some level, the teaching of the weaknesses of evolution in science classrooms. Six have been opposed, and two — Geraldine Miller, R–Dallas, and Rick Agosto, D–San Antonio — are considered swing votes." And, as Schafersman commented, "Since there are no scientists on the SBOE and since seven members are young-earth creationists — most of whom have publicly stated their intention to distort evolution standards and damage science instruction — it is likely that the public debate and approval will be contentious."

Schafersman was not wrong. The next focus of contention was the composition of a six-member committee appointed by the board to review the draft set of science standards. Included were three anti-evolutionists, and defenders of the integrity of science education were livid. "The committee was chosen by 12 of the 15 members of the board of education, with each panel member receiving the support of two board members," as the *Dallas Morning News* (2008 Oct 16) explained. Six members of the board "aligned with social conservative groups" chose Stephen C Meyer, the director of the Discovery Institute's Center for Science and Culture; Ralph Seelke, a biology professor at the University of Wisconsin, Superior; and Charles Garner, a chemistry professor at Baylor University.

Meyer, Seelke, and Garner are all signatories of the Discovery Institute-sponsored "Dissent from Darwinism" statement (see *RNCSE* 2001 Nov/Dec; 21 [6]: 22–3). Meyer and Seelke are also coauthors of *Explore Evolution: The Arguments For and Against Neo-Darwinism* (Melbourne: Hill House, 2008), which, like *Of Pandas and People*, is a supplementary textbook that is intended to instill scientifically unwarranted doubts about evolution. A recent review by biologist John Timmer (available on-line at <http://arstechnica.com/reviews/other/discovery-textbook-review.ars>) summarized, "But the book doesn't only promote stupidity, it demands it. In every way except its use of the actual term, this is a creationist book." (Timmer's review of *Explore Evolution* will be reprinted in a future issue of *RNCSE*.) Garner, for his part, reportedly told the *Houston Press* (2000 Dec 14) that he "criticizes evolutionary theory in class."

Meyer and Seelke also testified in the 2005 "kangaroo court" hearings held by three anti-evolutionist members of the Kansas state board of education, in which a parade of anti-evolutionist witnesses expressed their support for the so-called minority report version of the state science standards (written with the aid of a local "intelligent design" organization), complained of repression by a dogmatic evolutionary establishment, and claimed to have detected atheism lurking "between the lines" of the standards (transcripts are available on-line at <http://www.

Coalition Defends Draft Standards in Texas

"The State Board of Education's decisions in the coming months will affect both the college preparation and future job qualifications of our children. Our students deserve a sound education that includes the latest findings of scientific research and excludes ideas that have failed to stand up to scientific scrutiny." That was the message of the 21st Century Science Coalition's advisory committee — Daniel I Bolnick, RE Duhrkopf, David M Hillis, Ben Pierce, and Sahotra Sarkar — delivered in twin op-eds published in two Texas newspapers, the *Waco Tribune* (2008 Oct 19), and the *Austin American-Statesman* (2008 Oct 21).

In their op-eds, after describing the vast amount of scientific research that supports evolution, and the absence of any compelling evidence against it, Bolnick and his colleagues responded to the charge of censorship: "Evolution opponents who promote such phony 'weaknesses' claim we are trying to censor them, suppressing free speech. But the entire point of education is to provide students with the best information available, without wasting time on bogus arguments. We don't teach alchemy alongside chemistry, for example, or astrology alongside physics. We don't ask students to decide for themselves whether Earth revolves around the Sun or vice versa. Is that 'censorship'?"

They also emphasized the increasing economic importance of evolution education, writing, "We can't expect future citizens of Texas to be successful in a 21st-century world with a 19th-century science education. Once our children enter the work force, they will find that understanding evolution is central to many innovations in medicine, agriculture, engineering and biotechnology. Undermining biology education risks driving away biotechnology and other industries from our state." The *Austin American-Statesman* (2008 Oct 6) already editorially agreed, noting that biomedical industries "have not looked favorably on communities that water down science studies with vague and unproven ideas."

The 21st Century Science Coalition (on-line at <http://www.texasscientists.org/>) was organized to resist attempts of creationists to maintain the "strengths and weaknesses" language in the Texas state science standards, which are currently undergoing revisions. Already over 1300 Texas scientists with or working towards advanced degrees in life, physical, and mathematical science have signed the coalition's statement calling on the state board of education to approve science standards that "acknowledge that instruction on evolution is vital to understanding all the biological sciences" and that "encourage valid critical thinking and scientific reasoning by leaving out all references to 'strengths and weaknesses', which politicians have used to introduce supernatural explanations into science courses."

AAAS Concerned About Texas Science Standards

Writing in the *Houston Chronicle* (2008 Oct 22), the chief executive officer of the American Association for the Advancement of Science, Alan I Leshner, deplored the recent appointment of three anti-evolutionists to a committee charged with reviewing a draft of Texas's state science standards. "The new standards will shape how science education is taught in Texas for the next decade, and it would be a terrible mistake to water down the teaching of evolution in any way," he wrote, adding, "At a time when most educators are working to prepare students for 21st century jobs, the board members' action threatens to confuse students, divide communities and tarnish Texas' reputation as an international science and technology center."

Leshner's op-ed emphasized the strength of the scientific consensus on evolution ("Mainstream science and medical organizations in the United States and worldwide, representing tens of millions of scientists, accept evolution as the best explanation for how life developed on Earth"), the fact that many people of faith, including scientists and clergy alike, regard evolution as no threat to their faith, and the importance of preserving the integrity of science education. But what he hammered home was the economic importance of a quality science education: "To maintain the state's strength as an engine of US research and innovation, Texas education leaders should stick to the basics. Students need a solid science foundation to thrive in the 21st century."

In supporting a scientifically appropriate and pedagogically responsible treatment of evolution in the Texas state science standards, Leshner joined the 21st Century Science Coalition, the Texas Freedom Network, and Texas Citizens for Science, as well as the editorial boards of the *Waco Tribune* (2008 Oct 3) and the *Austin American-Statesman* (2008 Oct 6). As the world's largest general interest scientific organization, the AAAS regularly defends the teaching of evolution in the public schools, and presents a useful collection of relevant statements, publications, resources, and links in a section of its on-line press room (<http://www.aaas.org/news/press_room/evolution/>).

talkorigins.org/faqs/kansas/kangaroo.html>). A version of the minority report was adopted in 2005, despite criticism from the National Academy of Sciences, the American Association for the Advancement of Science, and the National Science Teachers Association, but the balance of power on the board changed, and supporters of the integrity of science education quickly restored a proper treatment of evolution to the Kansas standards.

Referring to the appointment of Meyer, Seelke, and Garner, Dan Quinn of the Texas Freedom Network told the *Austin American-Stateman* (2008 Oct 16), "I think these state board members have really lifted the veil on what their real agenda is here ... It's clear they picked a few experts and a few people with a clear conflict of interest and a political agenda." Similarly, in a press release issued on October 15, 2008 (available on-line at <http://www.texscience.org/releases/creationists-science-review-panel.htm>), Texas Citizens for Science's Steven Schafersman lamented, "It is unfortunate that some SBOE members have such a poor regard for the education of Texas science students that they must resort to pushing their own anti-evolutionist and creationist religious ideologies into the science standards revision process."

The three remaining members of the committee — "veteran science professors from major Texas universities," as the *Morning News* observed — were David Hillis, a professor of biology at the University of Texas, Austin; Gerald Skoog, a professor of education at Texas Tech University, and Ronald Wetherington, a professor of anthropology at Southern Methodist University. The *American-Statesman* noted, "a seventh panel member could be nominated. The panel is expected to send recommendations on the proposal back to the board in the coming months." In the end, there was no seventh member. And although the recommendations of the individual committee members were completed and posted on the Texas Education Agency's website (available on-line at <http://www.tea.state.tx.us/teks/science/expertfeedback.html>), there was little reaction to or comment on their suggestions in the media. The panels that wrote the standards for the various subjects were furnished with the outside reviews as well as feedback from the public, a comparison of the draft standards to the Texas College Readiness Standards, and a comparison of the draft standards with the highly regarded Massachusetts science standards.

Meanwhile, the scientific community, both in Texas and nationally, was not remaining silent about the need for a proper treatment of evolution. The 21st Century Science Coalition's advisory committee published a pair of op-eds urging the state board of education to accept the draft standards, emphasizing the scientific centrality and the economic importance of evolution (see sidebar, p 5). The chief executive officer of the American Association for the Advancement of Science, Alan I Leshner, argued, "The new standards will shape how science education is taught in Texas for the next decade, and it would be a terrible mistake to water down the teaching of evolution in any way" (see sidebar, left). Barbara Forrest explained "Why Texans shouldn't let creationists mess with science education" in a November 11, 2008, lecture at Southern Methodist University in Dallas (video is available on-line at <http://smu.edu/flashvideo/?id=248>; audio is available on-line at <http://smu.edu/newsinfo/audio/barbara-forrest-11nov2008.mp3>). And a study conducted by the Texas Freedom Network Education Fund and Raymond Eve demonstrated that a vast majority of scientists at public and private universities in Texas reject the arguments advanced by those seeking to undermine the treatment of evolution in Texas's state science standards (see sidebar, p 7).

At last the day appointed for the Texas state board of education to hear testimony about the proposed new set of state science standards arrived, November 19, 2008 — and plenty of the testimony concerned the treatment of evolution in the standards. As the *Dallas Morning News* (2008 Nov 20) explained, the standards "will dictate what is taught in science classes in elementary and secondary schools and provide the material for state tests and textbooks. The standards will remain in

place for a decade after their approval by the state board." The standards under consideration were not the version released in September 2008, but a revised version drafted in November 2008 and not posted on the Texas Education Agency's website until November 17, 2008. A significant difference is that the September version omitted the "strengths and weaknesses" language of the old standards, which was selectively applied in 2003 by members of the board seeking to dilute the treatment of evolution in biology textbooks, while the November version included a variant of it: "strengths and limitations."

Texas Citizens for Science's Steven Schafersman told the board that the "strengths and weaknesses" language was unscientific and pedagogically inappropriate, according to the *Austin American-Statesman* (2008 Nov 20). He was not alone in defending the teaching of evolution at the meeting. In a story significantly headlined "Evolution proponents descend on state education panel," the *Fort Worth Star-Telegram* (2008 Nov 20) observed, "With few exceptions, the speakers — scientists, teachers, clergy and grassroots activists — took the side of evolution," a situation that evidently vexed the chair of the board, avowed creationist Don McLeroy, who complained, "This is all being ginned up by the evolution side."

Reflecting on the spectacle, the *Corpus Christi Call-Times* (2008 Nov 20) editorially commented, "Members of the state board of ducation, as they prepare to establish a new science curriculum, should certainly heed the advice of the state's top science teachers: Teaching the 'weaknesses' of the theory of evolution raises questions about its validity, questions that are not shared by established science. Public schools should teach evolution. Period. Texas students will have to compete in the real world, not the flat earth of the past." In addition to the newspaper reports, detailed running commentary on the meeting was posted on their blogs by representatives of two of the groups defending the integrity of science education in Texas: Texas Citizens for Science, on the Houston Chronicle's Evo.Sphere blog (<http://www.chron.com/commons/readerblogs/evosphere.html>), and the Texas Freedom Network, on its own blog (<http://tfn-blog.wordpress.com/>). Both groups are going to continue to monitor the standards, which are expected first to return to the writing committee for revisions in December 2008, and then return to the board for consideration in January 2009.

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Texas Scientists Overwhelmingly Reject Anti-evolution Arguments

Scientists at public and private universities in Texas overwhelmingly reject the arguments advanced by the anti-evolutionists seeking to undermine the treatment of evolution in Texas's state science standards, according to a report released by the Texas Freedom Network Education Fund. "This survey leaves no doubt that the political crusade against evolution and other attempts to dumb down our public school science curriculum are deeply misguided," TFN Education Fund president Kathy Miller said in a press release (available on-line at <http://www.tfn.org/site/News2?page=NewsArticle&id=5621>). "Texas scientists are clearly worried that failing to provide a 21st-century science education in our public schools will harm our children's chances to succeed in college and the jobs of the future."

The report, entitled *Evolution, Creationism, and Public Education: Surveying What Texas Scientists Think about Educating Our Kids in the 21st Century* (available on-line as a PDF at <http://www.tfn.org/site/DocServer/FinalWebPost.pdf?docID=861>), details a survey conducted by the TFN Education Fund in conjunction with Raymond Eve, a sociology professor at the University of Texas, Arlington, who is the coauthor with Francis B Harrold of *The Creationist Movement in Modern America* (Boston: Twayne, 1990). The survey was sent to the 1019 biologists and biological anthropologists on the faculty of all 35 public and the 15 largest private colleges and universities in Texas. The response rate was high — 45% of those surveyed responded. "Their responses should send parents a clear message that those who want to play politics with science education are putting our kids at risk," Eve commented.

The TFN Education Fund's press release summarizes five key findings from the survey: "1. Texas scientists (97.7%) overwhelmingly reject 'intelligent design' as valid science. 2. Texas science faculty (95%) want only evolution taught in science classrooms. 3. Scientists reject teaching the so-called 'weaknesses' of evolution, with 94% saying that those arguments are not valid scientific objections to evolution. 4. Science faculty believe that emphasizing 'weaknesses' of evolution would substantially harm students' college readiness (79.6%) and ability to compete for 21st-century jobs (72%). 5. Scientists (91%) strongly believe that support for evolution is compatible with religious faith."

Evolution, Creationism, and Public Education was released just as the Texas State Board of Education was preparing to consider a new draft set of state science standards from November 19 to November 21, 2008, hearing testimony from the public on November 19. The *Dallas Morning News* (2008 Nov 17) reported that "a majority of members have voiced support for retaining the current mandate to cover both strengths and weaknesses of major scientific theories, notably evolution, in science courses." But the TFN Education Fund's Kathy Miller told the newspaper that it would be a mistake for the board not to heed the clear consensus of Texas science professors: "This survey leaves no doubt that the political crusade against evolution and other attempts to dumb down our public school science curriculum are deeply misguided."

UPDATES

California: After her lawsuit challenging the Understanding Evolution website (<http://evolution.berkeley.edu/>) on constitutional grounds was dismissed for lack of standing on March 13, 2006, Jeanne Caldwell appealed the decision to the United States Court of Appeal for the Ninth Circuit (see *RNCSE* 2006 Jan–Apr; 26 [1–2]: 4–11). In a ruling dated October 3, 2008, the appeals court rejected her appeal, affirming the lower court's decision.

Understanding Evolution, a collaborative project of the University of California Museum of Paleontology (with funding from the National Science Foundation and the Howard Hughes Medical Institute) and the National Center for Science Education, was originally intended as a resource for teachers; it subsequently expanded to appeal to everyone interested in learning about evolution.

Among the resources for teachers is a brief discussion of the idea, labeled as a misconception, that evolution and religion are incompatible. The website notes, "Of course, some religious beliefs explicitly contradict science (e.g., the belief that the world and all life on it was created in six literal days); however, most religious groups have no conflict with the theory of evolution or other scientific findings," and provides a link to NCSE's publication *Voices for Evolution*.

Arguing that Understanding Evolution thereby endorses particular religious doctrines in violation of the Establishment Clause of the First Amendment, Caldwell filed suit in the United States District Court for the Northern District of California. But her suit was dismissed because she failed to allege that she had federal taxpayer standing, failed to sufficiently allege state taxpayer standing, and failed to establish that she suffered a concrete "injury in fact".

Upholding the lower court's decision in *Caldwell v Caldwell et alia* (the first defendant was Roy Caldwell, the director of UCMP), the appeals court's decision concluded, "Accordingly, we believe there is too slight a connection between Caldwell's generalized grievance, and the government conduct about which she complains, to sustain her standing to proceed." The decision is available as a PDF on-line at <http://caselaw.lp.findlaw.com/data2/circs/9th/0615771p.pdf>.

Jeanne Caldwell was represented by Kevin T Snider of the Pacific Justice Institute and her husband Larry Caldwell. It was a further legal defeat for Larry Caldwell, who previously sued his local school district, alleging that his civil rights were violated, after it declined to implement his proposals for evolution education; on September 7, 2007, the defendants won a motion for summary judgment (see *RNCSE* 2007 Sep–Dec; 27 [5–6]: 20–4).

The Pacific Justice Institute announced, in a January 6, 2008, press release (available on-line at <http://www.pacificjustice.org/resources/news/focusdetails.cfm?ID=PR090106a>), that it was appealing the decision to the Supreme Court. Commenting on the appeal at The Panda's Thumb blog (available on-line at <http://pandasthumb.org/archives/2009/01/caldwell-asks-s.html>), Timothy Sandefur wrote, "By skimming over the central issue in the entire case, the Caldwell petition seems to present a couple interesting arguments. But they are a façade for a baseless lawsuit that was properly dismissed."

Florida: After a long and contentious wrangle, the Florida state board of education voted 4–3 at its February 19, 2008, meeting to adopt a new set of state science standards in which evolution is presented as a "fundamental concept underlying all of biology" (see *RNCSE* 2008 Jan/Feb; 28 [1]: 19; 2008 Mar/Apr; 28 [2]: 4–7). But now there are concerns that, due to a recent state law, the standards will have to be approved again. The *St Petersburg Times* (2008 Nov 6) explains, "The new law requires the state Board of Education to adopt new academic standards by the end of 2011. That may include a new set of science standards, because the Board of Education adopted the latest standards a few months before the bill passed and was signed into law by Gov Charlie Crist."

It is not yet clear whether the standards will indeed have to be approved again, but Brian Moore, a staff attorney, with the state legislature's Joint Administrative Procedures Committee (which reviews the rules proposed by state agencies to ensure that they are in compliance with state law), told the department of education that he thought so. According to *Education Week*'s curriculum blog (2008 Nov 5; available on-line at <http://blogs.edweek.org/edweek/curriculum/2008/11/about_those_new_florida_scienc.html>), "It's possible, Moore explained, that Florida's Commissioner of Education could seek to have various experts certify that the recently approved science standards comply with the Next Generation law. But it appears likely that new standards would have to be re-approved in some form by the state board of education."

If so, the prospect of a renewed fight over the treatment of evolution in the standards looms. "Hallelujah" was the response of Terry Kemple, who opposed the treatment of evolution in the new standards. "This is an opportunity for both sides to step back and let this be a fairer endeavor," he said. Brandon Haught of the grassroots organization Florida Citizens for Science told the *Times*, "Maybe the legislators simply overlooked this, and there's a simple solution," adding that the group would "hope for the best but plan for the worst." For now, the situation remains uncertain. A spokesperson for the department of education told the *Times*, "We are currently researching the matter so there are no specifics to offer at this point."

Michigan: When the Michigan legislature ended its last voting session for 2007–2008 on December 19, 2008, two anti-evolution bills — House Bill 6027 and Senate Bill 1361 — died in committee. (For background, see *RNCSE* 2008 May/Jun; 28 [3]: 5–10 and 2008 Mar/Apr; 28 [2]: 16–8.) The identical bills were instances of the "academic freedom" strategy for undermining the teaching of evolution; as NCSE's Glenn Branch and Eugenie C Scott recently wrote in their article "The latest face of creationism", published in the January 2009 issue of *Scientific American*, "'Academic freedom' was the creationist catchphrase of choice in 2008: the Louisiana Science Education Act was in fact born as the Louisiana Academic Freedom Act, and bills invoking the idea were introduced in Alabama, Florida, Michigan, Missouri and South Carolina, although, as of November [2008], all were dead or stalled. ... The appeal of academic freedom as a slogan for the creationist fallback strategy is obvious: everybody approves of freedom, and plenty of people have a sense that academic freedom is desirable, even if they do not necessarily have a good understanding of what it is."

The Michigan bills contended that "the teaching of some scientific subjects, such as biological evolution, the chemical origins of life, human impact of climate change, and human cloning, can cause controversy and that some teachers may be unsure of the expectations concerning how they should present information on such subjects." If enacted, the bills would have required state and local administrators "to create an environment within public elementary and secondary schools that encourages pupils to explore scientific questions, learn about scientific evidence, develop critical thinking skills, and respond appropriately and respectfully to differences of opinion about controversial issues" and "to assist teachers to find more effective ways to present the science curriculum in instances where that curriculum addresses scientific controversies" by allowing them "to help pupils understand, analyze, critique, and review in an objective manner the scientific strengths and scientific weaknesses of existing scientific theories pertinent to the course being taught."

In a press release dated May 20, 2008 (available on-line at <http://michigancitizensforscience.org/main/nfblog/2008/05/20/mcfs-press-release-on-hb-6027>), Michigan Citizens for Science blasted HB 6027, writing that "it does a disservice to teachers, school administrators and local school boards by urging them to incorporate material into science classes that is at odds with well-established science ... HB 6027 ushers schools down a path that will inevitably lead to expensive and divisive court battles." Similarly, in July 2008, the Michigan Science Teachers Association decried both bills, arguing (in a document available on-line at <http://www.msta-mich.org/downloads/about/Academic_Freedom_Law.doc>) that the stated goals of the bills are already addressed by the state's educational system. The MSTA added:

> Whereas evolution, climate change and cloning are the only "controversial topics" cited in these bills while "controversial topics" in non-scientific fields are noticeably omitted and whereas the Curriculum Expectations already address the pedagogical & educational goals of these bills, the legislative intent of these bills is called into question. ... .This type of legislation may enable the introduction of non-scientific ideologies, such as "intelligent design" (ID) creationism, into the public science classroom.

Ohio, Cincinnati: "A promotional deal between the Cincinnati Zoo and the Creation Museum was scuttled Monday after the zoo received dozens of angry calls and emails," reported the *Cincinnati Enquirer* (2008 Dec 1). The promotion involved a package deal for tickets to the zoo's annual Festival of Lights and to a Christmas-themed event at Answers in Genesis's Creation Museum. The museum, which opened its doors in northern Kentucky during Memorial Day weekend 2007, aims to illuminate "the effects of biblical history on our present and future world" — that is, to evangelize for Answers in Genesis's particular brand of young-earth creationism.

On November 30, 2008, biologist and blogger PZ Myers complained about the promotion at his blog Pharyngula, writing, "the Cincinnati Zoo has betrayed its mission and its trust in a disgraceful way, by aligning [itself] with a creationist institution that is a laughing stock to the rest of the world and a mark of shame to the United States," and urging his readers to write to the zoo to "point out the conflict between what they are doing and what their goal as an educational and research institution ought to be" (see <http://scienceblogs.com/pharyngula/2008/11/shame_on_the_cincinnati_zoo.php>). Other bloggers echoed his call, and the zoo was evidently flooded with calls and e-mails, prompting it to cancel the promotion because of the uproar. No packages of tickets had been sold.

NCSE's previous coverage of the Creation "Museum" includes Daniel Phelps's review and overview (available on-line at <http://scienceblogs.com/pharyngula/2008/11/shame_on_the_cincinnati_zoo.php>) and Timothy H Heaton's account of his visit (*RNCSE* 2007 Jan–Apr; 27 [1–2]: 21–4; available on-line at <http://ncseweb.org/rncse/27/1-2/visit-to-new-creation-museum>). NCSE also sponsored a statement (available on-line at <http://sciohost.org/states/?p=3>), signed by almost one thousand scientists in the three states surrounding the museum — Kentucky, Ohio, and Indiana — expressing their concern about the effect of the scientifically inaccurate materials displayed there: "Students who accept this material as scientifically valid are unlikely to succeed in science courses at the college level. These students will need remedial instruction in the nature of science, as well as in the specific areas of science misrepresented by Answers in Genesis."

International: Salman

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!

On October 27, 2008, **Peter Dawson Buckland** gave a talk — entitled "Thou shall not inhibit academic freedom: The evolution of anti-evolutionism" — sponsored by the Educational Policy Studies Student Association, the Anthropology Graduate Student Association, the Penn State Atheist Agnostic Association, and the Biology Department Graduate Student Association. The student paper *The Daily Collegian* (2008 Oct 28) reported, "Buckland's main topic was the controversy involving teaching 'intelligent design' in public schools. Buckland cited the 2005 case in Dover PA, in which the school board of Dover was sued for teaching 'intelligent design'. Buckland said he followed the case 'voraciously'. He also talked about the legal background of 'intelligent design', including Senate Bill 733, also known as the Louisiana Science Education Act, which was signed into law in June, even though Louisiana scientists were against it, he said, adding that the bill is 'a Trojan horse designed to get religion into the classroom.'" The talk is summarized on Buckland's blog (<http://formsmostbeautiful.blogspot.com/>) under the heading "Louisiana's Trojan Horse". Buckland is a graduate student in Penn State's Department of Educational Theory and Policy.

NCSE Supporter **Sean B Carroll**'s *Into the Jungle: Great Adventures in the Search for Evolution* (San Francisco: Benjamin Cummings, 2008) was published. The publisher writes, "Each of the nine stories in this brief reader chronicles the dramatic adventures of an influential zoologist, geologist, paleontologist, or geneticist on their path to some of the most important discoveries that have shaped our understanding of how life has evolved." Featured are the voyages and discoveries of Charles Darwin, Alfred Russel Wallace, Henry Walter Bates, Eugene Dubois, Roy Chapman Andrews, Walter and Luis Alvarez, Marjorie Courtenay-Latimer, Tony Allison, and Ditlef Rustad and Arthur DeVries. Carroll is a professor of biology at the University of Wisconsin, Madison.

NCSE Supporter **Laurie R Godfrey** was in the news for her participation in a century-long effort to reconstruct a lemur fossil. According to *The Massachusetts Daily Collegian* (2008 Nov 11), "The reconstruction effort began in 1899 when an expert fossil collector Franz Sikora found the first specimen of the recently extinct *Hadropithecus stenognathus*, one

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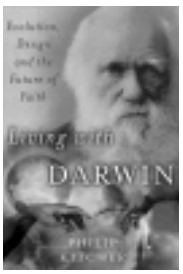
Hameed of Hampshire College addressed the challenge of Islamic creationism in the December 12, 2008, issue of *Science* (322 [5908]: 1637–8), warning that "although the last couple of decades have seen an increasing confrontation over the teaching of evolution in the United States, the next major battle over evolution is likely to take place in the Muslim world (i.e., predominantly Islamic countries, as well as in countries where there are large Muslim populations)." He added, "Relatively poor education standards, in combination with frequent misinformation about evolutionary ideas, make the Muslim world a fertile ground for rejection of the theory."

"We do not know much about general views about science in Muslim countries, let alone on the specific question of evolution," Hameed observed, although he discussed a recent survey asking, "Do you agree or disagree with Darwin's theory of evolution?" He reported, "Only 16% of Indonesians, 14% of Pakistanis, 8% of Egyptians, 11% of Malaysians, and 22% of Turks agree that Darwin's theory is probably or most certainly true," he reported — although 37% of Kazakhs agreed, which is comparable to the 40% of Americans who regard "Human beings, as we know them, developed from earlier species of animals" as probably or definitely true, as reported by Jon D Miller, NCSE's Eugenie C Scott, and Shinji Okamoto in 2006 (*Science* 313 [5788]: 765–6).

Similarly, not much is known about the state of evolution education in Muslim countries. The national academies of science of fourteen Muslim countries are signatories to the Inter-Academy Panel statement in support of evolution education (included in the third edition of *Voices for Evolution*), but what is actually presented about evolution in those classrooms is unclear. Citing work by Anila Asghar and Brian Alters (a member of NCSE's board of directors) surveying Pakistani textbooks and teachers as well as a recent study of Muslim university students studying in the Netherlands, Hameed tentatively suggested that in the Muslim world it is the idea of human evolution that elicits the most resistance.

Also contributing to the rejection of evolution in the Muslim world, unsurprisingly, is the view that evolution is tantamount to atheism. In a December 11, 2008, interview posted on *New Scientist*'s website (available online at <http://www.newscientist.

of the most poorly understood species of lemur. The discovery was made in the Andrahomana caves located in south-eastern Madagascar. More recently in 2003, Godfrey and colleagues made an important discovery of additional lemur bones and fragments belonging to the same species that was discovered over 100 years ago." "Because pieces actually fit together like a jigsaw puzzle, we knew we were dealing with a single individual, and that we had the most complete skeleton of this species ever discovered," Godfrey told the newspaper. A professor of anthropology at the University of Massachusetts, Godfrey coedited *Scientists Confront Creationism: Intelligent Design and Beyond* (New York: WW Norton, 2008) with **Andrew J Petto**.



Philip Kitcher's *Living with Darwin: Evolution, Design, and the Future of Faith* (New York: Oxford University Press, 2006) was the recipient of a Lannan Literary Award for Notable Book for 2008 from the Lannan Foundation, which "hopes to stimulate the creation of literature written originally in the English language and to develop a wider audience for contemporary prose and poetry." The award includes a $75 000 prize. A Supporter of NCSE, Kitcher is the John Dewey Professor of Philosophy at Columbia University. Discussing *Living with Darwin* in *BioScience* (57 [3]: 278–84), NCSE deputy director **Glenn Branch** wrote that Kitcher's aim was "not only to debunk 'intelligent design' and expound the case for evolution but also 'to respond to the concerns of the thoughtful people who are beguiled by the advertisements for intelligent design, to expose just what it is that is threatening about Darwinism, and to point to the deeper issues that underlie this recurrent conflict' ... He succeeds brilliantly."

Responding to creationist criticisms of a pro-evolution editorial in the Barre-Montpellier *Times Argus*, **John Klimenok Jr** noted, "The nature of science is to explain various observations by using naturalistic ideas and by doing experiments. Most creationist and ID 'scientists,' on the other hand, do little, if any, scientific research. Instead, they quote outdated scientific papers and books or misquote, often blatantly, passages in various recent publications that support evolution." He added, in response to a description of the editorial as repeating "radical atheistic talking points": "The vast majority of biologists and paleontologists, including many scientists of faith, accept both chemical and biological evolution because they are the best current explanations for the origin and development of life. To equate evolution with atheism is not only unfounded, it is insulting." His letter appeared in the October 17, 2008, issue of the newspaper.

In San Francisco for a speaking tour, **Lauri Lebo**, who reported on the *Kitzmiller v Dover* case for the *York Daily Record* and then wrote *The Devil in Dover: An Insider's Story of Dogma v Darwin in Small-Town America* (New York: The New Press, 2008), was interviewed by the *San Francisco Chronicle*'s Nanette Asimov, with the result appearing both in the newspaper (2008 Oct 31) and on its podcast (available on-line at <http://www.sfgate.com/cgi-bin/blogs/sfgate/detail?blogid=5&entry_id=32059>). Discussing the genesis of the case, Lebo explained that at first, the creationists on the Dover Area School Board "had been talking about creationism. They said the earth is 6000 years old. They believe man walked with dinosaurs. They also knew they could not push God into science class. They needed

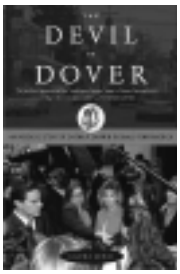
com/article/dn16258-how-to-stop-creationism-gaining-a-hold-in-islam.html>), Hameed commented, "If evolution is presented as a choice between evolution and religion, people are going to pick religion." Similarly, in the *Science* article, he explained, "Evolutionary ideas about human origins may face serious obstacles, but a peaceful religious accommodation is also possible. However, efforts that link evolution with atheism will cut short the dialogue."

There is already a substantial creationist movement in the Muslim world, Hameed observed, writing in a December 12, 2008, essay posted on the *Guardian*'s science blog (available on-line at <http://www.guardian.co.uk/science/blog/2008/dec/12/islamic-creationism-evolution-muslim>) that "the dominant voice shaping the evolution–creation debate in the Muslim world is that of Turkish creationist Adnan Oktar, who uses the pen name Harun Yahya." (For background, see Taner Edis's "Cloning creationism in Turkey," *RNCSE* 1999 Nov/Dec; 19 [6]: 30–5; available on-line at <http://ncseweb.org/rncse/19/6/cloning-creationism-turkey>.) Both in his *Guardian* essay and in his *Science* article, Hameed urged the scientific community to take action: "Scientists, especially biologists, should write for newspapers and magazines read by a Muslim audience and seize back the initiative from creationists like Yahya."

Malta, Mosta: "Far from becoming extinct 65 million years ago, the dinosaurs actually co-existed with early humans, and even helped in the construction of the pyramids. So says Vince Fenech, Evangelist pastor and director of a fully licensed, State-approved Creationist institution which admits children aged between four and 18" (*Malta Today* (2007 Oct 14), referring to the Accelerated Christian Academy in Mosta, a town in central Malta. The unsympathetic reporter "sent questions to Education Director Cecilia M Borg on the subject of the Accelerated Christian Academy in Mosta, and all the unscientific nonsense evidently taught therein," citing the Council of Europe's Parliamentary Assembly's resolution urging its member governments to oppose the teaching of creationism as science (see *RNCSE* 2007 Sep–Dec; 27 [5–6]: 20–5), but to no avail. Borg's response cited freedom of belief and parental rights. [*Thanks to PZ Myers for the news.*]

something a little sneakier. This is what 'intelligent design' was." "Intelligent design" itself she described as "revamped creationism, the idea that life is so complex that it demands a guiding hand."

A lawsuit eventuated, of course, in which NCSE aided the legal team for the plaintiffs and in which three members of NCSE's board of directors, **Brian Alters**, **Barbara Forrest**, and **Kevin Padian**, served as expert witnesses. Lebo explained that the judge "said not only that the [Dover Area School] Board members lied, he chided the 'breathtaking inanity' of what the board had done in trying to push their religious views into science class. The big question was: Would he also rule that 'intelligent design' was not science? And that is what he did." Asked to assess the impact of the decision, Lebo said, "It only affects Dover. However, outside Dover, a lot of districts have been paying attention. Ohio took its "intelligent-design"–friendly curriculum guidelines out. This cost Dover taxpayers $1 million. So districts are paying heed. "



The Devil in Dover was also recently reviewed in *The FASEB Journal* (2008; 22: 3101–2) by Paula Stern of Northwestern University. "Lauri Lebo, the education reporter for the *York Daily Record* in a town near Dover[,] has written a compelling account of the trial. Her book has many aspects to recommend it. It is a delightfully readable narrative. She is a captivating storyteller, relating the lives and experiences that have shaped the protagonists," Stern wrote, concluding, "I think you will learn much and have some fun if you read this book."

Lawrence S Lerner spoke on "The creationist chameleon: Past, present, and maybe a bit of the future" to the Peninsula Humanist Community in Palo Alto, California, on September 28, 2008. According to the abstract of his talk:

> Creationism is a peculiarly American institution. Its immediate aim is to introduce a very specific kind of religion into public school science classrooms. But this aim ties in with a much broader vision of a theocratic society. As the courts have invalidated various creationist initiatives, the movement has evolved without altering its real goals. ... One thing is certain; the creationist movement is not going to go away, and it typifies the historical activities of a movement that existed long before it was tagged with the name Religious Right.

Lerner is Professor Emeritus of California State University, Long Beach, a recognized expert on state science standards, and the recipient of a Friend of Darwin award from NCSE in 2003.

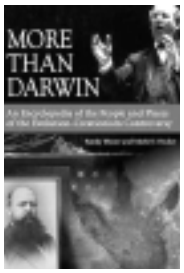
Stephen Matheson was a guest on Minnesota Atheists's radio and podcast show "Atheists Talk" on October 5, 2008, defending his form of theistic evolution — although he dislikes the term — in a long, civil, and amusing exchange with host Mike Haubrich (available on-line at <http://mnatheists.org/content/view/181/32/>). On his blog (<http://sfmatheson.blogspot.com/>), Matheson commented:

> It was fun, and I even took an email question from **PZ Myers**. (Well, it was more like the abstract of a dissertation than a radio show question, but maybe Mike will have me back and we can talk longer.) Some of the questions we discussed:
>
> How do you separate your science from your belief?
> What is your take on theistic evolution?
> Were humans the goal of creation?
> All of the facets that shape evolution involve lots of cruelty and pain only partially tempered by the joy of sex. I have trouble reconciling a loving God with what we know about evolution. How do you defend this view of evolution?

Matheson is Associate Professor of Biology at Calvin College.

Michael McIlwrath, a member of NCSE's board of directors, was honored with the Innovations award for 2008 from the Centre for Effective Dispute Resolution, a non-profit organization that promotes alternative dispute resolution in Britain and internationally. According to the award citation, McIlwrath was honored "for the International Dispute Negotiation [podcasts] available on the website of the International Institute for Conflict Prevention and Resolution in New York. By finding interesting speakers and challenging topics each week, Michael is providing thought-provoking content on important issues for the ADR community." Among the podcasts that will be of interest to readers of RNCSE are the interview of **Kevin Padian** on dispute resolution in paleontology (available at <http://www.cpradr.org/tabid/45/articleType/ArticleView/articleId/321/Default.aspx>) and the interview of **Robert Carneiro** on dispute resolution in early human societies (<http://www.cpradr.org/NewsArticles/Podcasts/tabid/319/Default.aspx>). McIlwrath is Senior Counsel, Litigation for GE Infrastructure — Oil & Gas.

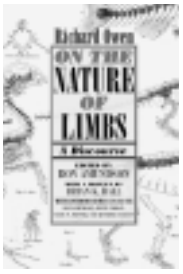
Randy Moore was the winner of the 2008 Evolution Education Award from the National Association of Biology Teachers. The award, sponsored by the American Institute of Biological Sciences and the Biological Sciences Curriculum Study, recognizes innovative classroom teaching and community education efforts to promote the accurate understanding of biological evolution. "This is a great honor, especially considering the roles AIBS and BSCS have played in defending the teaching of evolution," Moore said. "Evolution is a unifying theme in biology; teaching it as such is the best way to show students what biology is about and how they can use evolution as a tool to under-



stand our world. [Evolution] is as important an idea as there is in science — it is a great gift to give to students." Moore received the award, which includes a plaque and a prize of $1000, at the NABT national conference in Memphis, Tennessee, in October 2008. A long-time member of NCSE who received its Friend of Darwin award in 2004, Moore is Professor of Biology at the University of Minnesota, Twin Cities. His latest book, coauthored with **Mark Decker**, is *More than Darwin: An Encyclopedia of the People and Places of the Evolution-Creationism Controversy* (Westport [CT]: Greenwood Press, 2008).

Interviewed by *Mother Jones* about environmentalism, NCSE Supporter **Bill Nye** ("The Science Guy") remembered to include a plug for evolution education while bemoaning the lack of basic scientific literacy: "Here, we have a huge number of voters who don't believe in evolution. And evolution is not climate change. But evolution is the fundamental idea in all of biology. It makes everything go. It would be like meeting a geologist who doesn't believe in tectonic plates. It'd be like meeting a geologist who thinks the earth is hollow." The interview appeared in the November/December 2008 issue of *Mother Jones*.

Kevin Padian contributed "Richard Owen's Quadrophenia: The pull of opposing forces in Victorian cosmogony" to a new edition of Owen's *On the Nature of Limbs*, edited by Ron Amundson and with a preface by Brian K Hall (Chicago: University of Chicago Press, 2008). In his forthcoming review of the book in *Integrative and Comparative Biology*, Phillip R Sloan explains, "Utilizing the concept of 'Quadrophenia' drawn from rock star Peter Townshend's opera *Tommy*, to denote a state of mind that is being pulled, without reconciliation, in four opposing directions, Padian depicts Owen as stretched intellectually between the opposing forces of Geoffroy and Cuvier, Paley and the German transcendentalists, with the result being a somewhat incoherent mix of ideas and concepts that is never worked through." President of NCSE's board of directors, Padian is Professor of Integrative Biology at the University of California, Berkeley.



NCSE Supporter **Robert L Park**'s new book *Superstition: Belief in the Age of Science* (Princeton [NJ]: Princeton University Press, 2008) was published. The publisher describes it as follows:

> From uttering a prayer before boarding a plane, to exploring past lives through hypnosis, has superstition become pervasive in contemporary culture? Robert Park, the best-selling author of *Voodoo Science*, argues that it has. In Superstition, Park asks why people persist in superstitious convictions long after science has shown them to be ill-founded. He takes on supernatural beliefs from religion and the afterlife to New Age spiritualism and faith-based medical claims. He examines recent controversies and concludes that science is the only way we have of understanding the world. Park sides with the forces of reason in a world of continuing and, he fears, increasing superstition. Chapter by chapter, he explains how people too easily mistake pseudoscience for science. He discusses parapsychology, homeopathy, and acupuncture; he questions the existence of souls, the foundations of intelligent design, and the power of prayer; he asks for evidence of reincarnation and astral projections; and he challenges the idea of heaven. Throughout, he demonstrates how people's blind faith, and their confidence in suspect phenomena and remedies, are manipulated for political ends. Park shows that science prevails when people stop fooling themselves. Compelling and precise, *Superstition* takes no hostages in its quest to provoke. In shedding light on some very sensitive — and Park would say scientifically dubious — issues, the book is sure to spark discussion and controversy.

NCSE's **Eugenie C Scott** comments, "*Superstition* is yet more evidence that Bob Park is always worth reading."

Daniel J Phelps was named the Kentucky Academy of Science's Distinguished Professional Scientist in a Non-Academic Position for 2008. The citation noted, "He is founder and President of the Kentucky Paleontological Society (<http://www.kyps.org>); one of the most respected amateur paleontological organizations in the United States. In 2004 the Kentucky Section of the American Institute of Professional Geologists, awarded Dan its 'Geologist of the Year' award for his efforts in educating the public about geology and paleontology. Additionally, Dan is well known for his efforts in organizing Kentucky's scientific community to oppose teaching creationism and 'intelligent design' creationism in public school science classes. He has written numerous letters to the editor and op-eds on this subject." Phelps reviewed Answers in Genesis's creation museum for NCSE's website (<http://ncseweb.org/creationism/general/anti-museum-overview-review-answers-genesis-creation-museum>.)

NCSE Supporter **Michael Ruse** reviewed Steve Fuller's *Dissent over Descent: Intelligent Design's Challenge to Darwinism* (Cambridge: Icon Books, 2008) for *Science* (2008: 322 [5898]: 47–8). (Fuller, a sociologist of science, testified for the defense in the *Kitzmiller v Dover* trial.) Addressing "the heart of Fuller's case against Darwinian evolutionary theory and for ['intelligent design']," Ruse comments, "The important thing is that all of this is

completely wrong and is backed by no sound scholarship whatsoever." He concluded his review by writing, "At Dover, the author supported the wrong side. 'Intelligent design' theory is a form of Christianity made up to look like science. The judge correctly ruled that it has no place in science classrooms. Reading *Dissent over Descent* should not change anyone's verdict. As a historian and philosopher of science, I can only hope that the science community does not judge us all by Fuller's example." Ruse is Lucyle T Werkmeister Professor of Philosophy at Florida State University; among his recent books is *Charles Darwin* in the Blackwell Great Minds series (Oxford: Blackwell, 2007).

Michael Ruse also reviewed David N Livingstone's *Adam's Ancestors: Race, Religion, and the Politics of Human Origins* (Baltimore [MD]: Johns Hopkins University Press, 2008) for *Books & Culture* (2008 Nov/Dec). "I confess that in over thirty years of researching and writing about evolution and science and religion and that sort of thing, I just had not thought about Adam and Eve and the problem of early humans — as were increasingly revealed in the fossil record, as are pressed upon us as we survey the different races of humans around us today, and above all as we try to fit this with the sacred text," Ruse wrote. "Livingstone shows how much I was missing and goes a long way, in what will surely be the definitive treatment, to fill the gaps in my knowledge."

The late **Robert J Schadewald**'s book *Worlds of Their Own* was reviewed in *Skeptical Inquirer* (2008 Jul/Aug; 32 [4]: 56–7) by Donald Simanek. "This book can be enjoyed on several levels," Simanek writes, "for Schadewald writes with droll humor, and many of his characters have comic dimensions. ... This is an informative and entertaining book of continuing relevance, for pseudoscientific ideas of this sort never die but are continually reborn in new clothing." Schadewald served on NCSE's board of directors from 1986 to 1992, including two years as its president. Of interest in the same issue of *Skeptical Inquirer* are **Greg Laden**'s "Likely voters prefer evolution over creationism" (13–4), reporting on a public opinion survey on evolution and education conducted by a coalition of scientific societies; and a review of *Mind, Life, and Universe: Conversations With Great Scientists of Our Time*, coedited by NCSE Supporter **Lynn Margulis** (57–8).

On October 10, 2008, NCSE's executive director **Eugenie C Scott** was presented with the Field Museum's Award of Merit at a ceremony at the museum, where she gave a talk, attended a gala dinner, and received a $7500 honorarium for NCSE. The award is presented by the Field Museum's Founders' Council each year to "a leading scientist who has brought issues of cultural and environmental understanding to the forefront of public attention." Previous recipients include NCSE Supporter **Stephen Jay Gould**, Edward O Wilson, James Watson, Richard E Leakey, Jane Goodall, NCSE Supporter **Lynn Margulis**, Walter Alvarez, and NCSE Supporter **Niles Eldredge**.

NCSE's executive director **Eugenie C Scott** was asked by *Nature* to recommend the single science book that the next president should read. She responded, "We want a president who understands the practical importance of evolution, so he/she should read **David Mindell**'s *The Evolving World: Evolution in Everyday Life*. We also want a president who can understand that evolution is a source of startling and delightful insights into why we and all other organisms are the way we are, so he/she should read Neil Shubin's *Your Inner Fish: A Journey into the 3.4-Billion-Year History of the Human Body*, and then [he] should ... support improved funding in science research and science education." Her response appeared on *Nature*'s website (<http://network.nature.com/groups/naturenewsandopinion/forum/topics/3072>). Published in *Nature* (2008: 455: 464–7) were recommendations from Steven Shapin, **Jerry Coyne** (recommending Richard Dawkins's *The Blind Watchmaker*), Rita Colwell, Martin Novak, Jerry Ravitz, and **Kevin Padian** (recommending Seth Shulman's *Undermining Science*).

On October 15, 2008, **Vince Sperrazza** spoke to the Central New York Skeptics on "First contact: Teaching evolution to middle level students" — a topic that he addressed in his "Evolution and middle-level education: Observations and reflections" (*RNCSE* 2005 Jan–Apr; 25 [1–2]: 36–7), an expanded version of which is now available on the Central New York Skeptics website (<http://cnyskeptics.org/2008/10/teac/>). Sperrazza taught middle level science, including evolution, in the Mount Markham Central School District, in Herkimer County, New York, for 33 years before retiring in 2006.

The Legacy of the Mastodon: The Golden Age of Fossils in America, by **Keith Stewart Thomson**, was published (New Haven [CT]: Yale University Press, 2008). The reviewer for *Nature* (2008; 455: 464–5) described it as "a delicious read, instructive and amusing, [that] will entertain anyone who has wondered how we came to know the mastodon and its tribe." Interestingly, a biographical section appended to the end of a favorable review in the *Times Higher Education Supplement* (2008 Aug 28) discussed creationism: "When asked about the differences between paeleontology [*sic*] in Europe and America, he says that the main one is the scholarly attention given to creationism in the US. He believes that paeleontology [*sic*] can change people's attitudes to the theory of evolution, saying that 'the fossils and the geological evidence are the evidence for evolution. It's not evolutionary theory; it's evolutionary fact'." Thomson is Professor Emeritus of Natural History at Oxford University, where he also served as director of the Oxford University Museum of Natural History.

Selected Works of Charles Robert Darwin

In his time, Darwin was a productive researcher who made many significant contributions to natural science. This highly selected list of his major works just brushes the surface, but it also shows that Darwin did not merely "lie low" between returning from the voyage of the *Beagle* in 1836 until the publication of the *Origin* in 1859. Most of these items are available on-line at <http://darwin-online.org.uk/contents.html> along with hundreds of other works by Charles Darwin.

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Happy birthday!

The year 2009 is at once the bicentennial of Darwin's birth and the sesquicentennial of the publication of the *Origin of Species*, so it's time to wheel out the superlatives. "A brilliant mind, great intellectual boldness, and an ability to combine the best qualities of a naturalist — observer, philosophical theoretician, and experimentalist — the world has so far seen a combination only once, and it was in the man Charles Darwin," as Ernst Mayr remarked (*One Long Argument: Charles Darwin and the Genesis of Modern Evolutionary Thought*, Cambridge: Harvard University Press, 1991, p 11). As for the *Origin*, Thomas Henry Huxley wrote in 1887, and it remains true today, "Wherever the biological sciences are studied, the 'Origin of Species' lights the paths of the investigator; wherever they are taught it permeates the course of instruction." With such momentous anniversaries to commemorate, how better to celebrate than to read a good book — or two, or a bunch? So check out the following books by and about Darwin and the *Origin*, now available through the NCSE website: <http://ncseweb.org/store>. And remember, every purchase benefits NCSE!

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

Darwin introduced

Charles Darwin: The Concise Story of an Extraordinary Man
by Tim M Berra
From the publisher: "Tim M Berra, whose 'Darwin: The Man' lectures are in high demand worldwide, tells the fascinating story of the person and the idea that changed everything. Berra discusses Darwin's revolutionary scientific work, its impact on modern-day biological science, and the influence of Darwin's evolutionary theory on Western thought. But Berra digs deeper to reveal Darwin the man by combining anecdotes with carefully selected illustrations and photographs. This small gem of a book includes 20 color plates and 60 black-and-white illustrations, along with an annotated list of Darwin's publications and a chronology of his life."

The Autobiography of Charles Darwin
by Charles Darwin,
edited by
Nora Barlow
Written for his children and their children, Darwin's autobiography is direct, personal, quirky, and compelling — a must read. On the appearance of the unbowdlerized edition of Darwin's autobiography, Loren Eiseley wrote, "No man can pretend to know Darwin who does not know his autobiography. Here, for the first time since his death, it is presented complete and unexpurgated, as it exists in the family archives. It will prove invaluable to biographers and cast new light on the personality of one of the world's greatest scientists. Nora Barlow, Darwin's granddaughter, has proved herself a superb editor. Her own annotations make fascinating reading."

Darwin: Discovering the Tree of Life
by Niles Eldredge
Written by NCSE Supporter Niles Eldredge and with no fewer than one hundred illustrations, *Darwin: Discovering the Tree of Life* is the companion to the American Museum of Natural History's exhibition celebrating the two hundredth anniversary of Darwin's birth, but it's more, too: a rich and inspiring reconstruction of Darwin's life through his writings and discoveries. The reviewer for *Science News* writes, "Using four of Darwin's notebooks as his starting point, Eldredge considers the speculation, intuitive leaps, and logical reasoning that Darwin undertook to arrive at his theory …What results is a fascinating exposition of Darwin's skill as an experimental scientist and deductive reasoner."

The Reluctant Mr Darwin
by David Quammen
Focusing on the 21-year period between Darwin's return from his travels on the *Beagle* and the eventual publication of *On the Origin of Species*, Quammen illuminates the development of Darwin's thoughts and his hesitation to tell the world. Kevin Padian, president of NCSE's board of directors, described *The Reluctant Mr Darwin* as "a fresh and original look at one of history's greatest scientists, written by one of our very best science writers." A prolific writer, Quammen also wrote *The Song of the Dodo*, *The Flight of the Iguana*, and the cover story — "Was Darwin Wrong?" — for the November 2004 issue of *National Geographic*.

Darwin biographized

Charles Darwin: Voyaging
by Janet Browne
Charles Darwin: Voyaging is the first volume of Janet Browne's acclaimed biography of Darwin, followed by *Charles Darwin: The Power of Place*. Reviewing it for *Newsday*, Ernst Mayr wrote, "There is no better chronicle of Darwin as human being, friend, and indefatigable scientist, nor anywhere a richer description of his milieu, his

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family life, his social circle, and his scientific connections. Browne's extraordinary knowledge of the literature of the period makes her account particularly insightful.... [A] masterpiece.... Browne knows how to spellbind the reader.... The definitive Darwin biography." Browne is Aramont Professor of the History of Science at Harvard University.

Charles Darwin: The Power of Place
by Janet Browne
Charles Darwin: The Power of Place is the second volume of Janet Browne's acclaimed biography of Darwin, preceded by *Charles Darwin: Voyaging*. Browne continues her brilliantly detailed story of Darwin's life, beginning in 1858 with the events that forced him to unveil his theory of evolution by natural selection to the world. The reviewer for *The New York Times* wrote, "This biography is matchless in detail and compass, and one feels an abiding gratitude that Browne was willing to sacrifice so many years of her life to reconstruct Darwin's." The book won the 2002 National Book Critics Circle Award for Biography.

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."

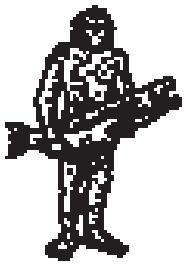
Darwin: The Life of a Tormented Evolutionist
by Adrian Desmond and James Moore
Writing in *Nature*, Stephen Jay Gould described Desmond and Moore's *Darwin* as "Unquestionably, the finest [biography] ever written about Darwin." A thoroughly scholarly work, *Darwin* nevertheless reads like a novel, which 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*.

The Origin

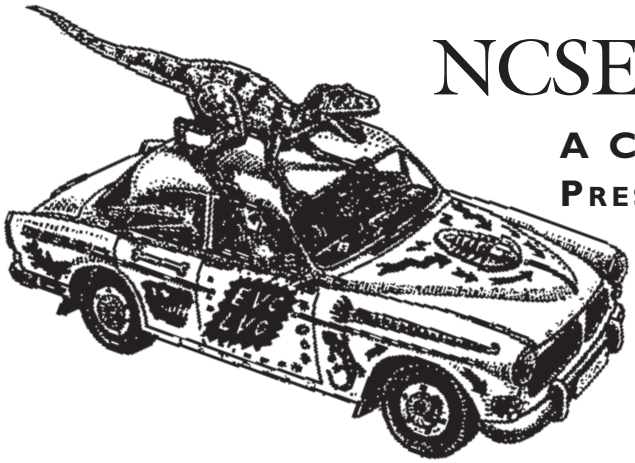
Darwin's Origin of Species*: A Biography*
by Janet Browne
The author of *Charles Darwin: Voyaging* and *Charles Darwin: The Power of Place* here turns her attention to the *Origin*, providing a brief but scintillating account of its composition and reception. "[T]he *Origins of Species* was clearly a major publishing event that spectacularly altered the nature of discussion on the question of origins," Browne writes in her concluding chapter. "This interplay between one man, one book, and the diverse social, religious, intellectual and national circumstances of his audiences and the broader currents of historical change is what made Darwin's *Origin* such a remarkable phenomenon in its own day and which continues to absorb and instruct modern readers."

On the Origin of Species
by Charles Darwin with an introduction by Ernst Mayr
This facsimile of the first edition of Darwin's epochal work, originally published in 1859, is supplemented with a useful introduction by the great evolutionary biologist Ernst Mayr. "When we go back to the *Origin*, we want the version that stirred up the Western world," Mayr explains. "The first edition represents Darwin in his most revolutionary spirit and this is the edition that stands as so great a monument in man's intellectual history." The publisher, Harvard University Press, proudly — and correctly — says, "For modern reading and for reference, it is the standard edition of Darwin's greatest work."

Darwin's Ghost: The Origin of Species *Updated*
by Steve Jones
It is Steve Jones who is Darwin's ghost: "ghost" as in "ghost writer," as he takes the ideas and concepts from Darwin's *Origin of Species* and presents them in modern English prose, illustrating his points with modern examples drawn from today's science. The London *Sunday Telegraph* describes *Darwin's Ghost* as "a clever book about serious ideas that can be happily read on the beach"; *The New York Times Book Review* contends, "There are few better or more entertaining accounts of the evolutionary process in print today than *Darwin's Ghost*." Jones is Professor of Genetics at University College London; his latest book is *Darwin's Island.*



The Cambridge Companion to the Origin of Species
edited by Robert J Richards and Michael Ruse
From the publisher: "This Companion commemorates the 150th anniversary of the publication of the *Origin of Species* and examines its main arguments. Drawing on the expertise of leading authorities in the field, it also provides the contexts — religious, social, political, literary, and philosophical — in which the *Origin* was composed. Written in a clear and friendly yet authoritative manner, this volume will be essential reading for both scholars and students More broadly, it will appeal to general readers who want to learn more about one of the most important and controversial books of modern times." Coeditor Michael Ruse is a Supporter of NCSE.



NCSE on the Road

A Calendar of Special Events, Presentations, and Lectures

Date March 24, 2009
City San Francisco CA
Presenter Kevin Padian
Title Darwin, Dover, and Intelligent Design
Event Public lectures
Time 12:15 and 6:30 PM
Location California Academy of Sciences
Contact 800-794-7576;
<http://www.calacademy.org/events/>

Date April 14, 2009
City San Diego CA
Presenter Eugenie Scott
Title The Intersections of Science, Faith, and Education
Event American Educational Research Association Conference
Time 12:25 PM
Location San Diego Convention Center
Contact Jay Labov, jlabov@nas.edu

Visit the Grand Canyon with Scott and Gish!

Featuring NCSE's executive director Eugenie C Scott and Alan D Gishlick
Date July 3–10, 2009

Twenty-four lucky people will raft the full length of the Grand Canyon, from Marble Canyon to South Cove, experiencing one of the most beautiful and majestic natural features on the planet.

Of course, as Eugenie C Scott, NCSE's executive director, will inform the rafters, the whole Colorado plateau was laid down by the receding waters of Noah's Flood about 4300 years ago, and the Grand Canyon itself was gouged catastrophically in a matter of days, while geologist Alan "Gish" Gishlick of Gustavus Adolphus College will present the standard geological history of Grand Canyon to the rafters — and they can make up their own minds. NCSE's "Creation/Evolution Grand Canyon Raft Trip"" is a wonderful way to learn about the creationism/evolution controversy in a fabulous natural setting.

The 2008 trip sold out early.
Make reservations now for 2009!
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Check the NCSE web site for updates and details — <http://www.ncseweb.org/meeting.asp>.

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Charles Darwin: Botanist

Sara B Hoot

INTRODUCTION

While Charles Darwin is famous throughout the world for the development of the theory of evolution and natural selection, few appreciate that he was also a preeminent botanist. Darwin's work in botany is extremely varied and includes experiments that are still cited in college-level textbooks because of their elegant experimental design and results. And of course, Darwin's botanical observations, along with his extensive knowledge of many other areas of science (for example, geology and zoology), were involved in shaping his ideas on evolution.

Darwin's botanical interests were broad and eclectic. He published books on such far-ranging topics as domesticated plants (1875), orchid pollination (1877a), heterostyly (1877b), the effects of cross and self pollination (1878), plant movements and tropisms (1881, 1882), and insectivorous plants (1888). In addition to these works, Darwin also published botanical work in journals, was in regular correspondence with many of the outstanding botanists of the time (for example, Joseph Hooker and Asa Gray), and, in later life, worked with his son Francis on botanical research.

Darwin's love of plants appears to have been deeply rooted in his childhood. His parents were both interested in gardening and maintained a varied collection of plants in their conservatory and gardens in Shrewsbury, where Darwin grew up. Indeed, one of the few images of Darwin as a child (age 6) show him kneeling with a potted plant on his thigh. In his autobiographical chapter, Darwin (1887) mentions that "…apparently I was interested at this early age in the variability of plants!" A schoolfellow remembers Darwin's bringing a flower to school and saying that his mother had taught him how to identify the plant by studying the flower.

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Darwin's interest in botany reasserted itself when he attended Cambridge in 1828, where he was greatly influenced by the botanist John S Henslow. In his own words (Darwin 1887: 52): "Before long I became well acquainted with Henslow, and during the latter half of my time at Cambridge took long walks with him on most days; so that I was called by some of the dons 'the man who walks with Henslow;' and in the evening I was very often asked to join his family dinner." Henslow's main research interest during this time was understanding patterns of variation within and between populations, work that is believed to have given Darwin material for his later understanding of variation and speciation (Kohn and others 2005).

Henslow is responsible for arranging Darwin's position as gentleman naturalist on HMS *Beagle*. During the voyage, Darwin displayed great interest in the flora he encountered and collected more than 2000 herbarium specimens. His collections of "all plants in flower" from the Galápagos Islands, were the basis for the first flora of that archipelago and were largely responsible for his understanding of island endemism (Kohn and others 2005).

It would be no trivial task to report here on all of Darwin's botanical work, so instead, I will feature a few examples that represent his use of rigorous scientific methodology, sharp powers of observation, and creative thinking. I will report his work on 1) heterostyly in *Primula* (primroses), 2) plant movements and phototropism, and 3) pollination mechanisms in orchids.

HETEROSTYLY IN *PRIMULA VERIS*, THE ENGLISH COWSLIP

Darwin was first exposed to an extraordinary observation relating to one of Great Britain's most loved wild flowers, the English cowslip, by his mentor John Henslow: that the length of styles and stamens varied among individual plants (Kohn and others 2005). Some plants had flowers with long stamens and short styles — the thrum type; others had flowers with short stamens and long styles — the pin type (Figure 1). This phenomenon is known as heterostyly, and Darwin studied it extensively in the 1850s (Darwin 1877b). He also observed that the two flower types varied in pollen size; pollen produced by pin flowers was noticeably smaller in diameter than that pro-

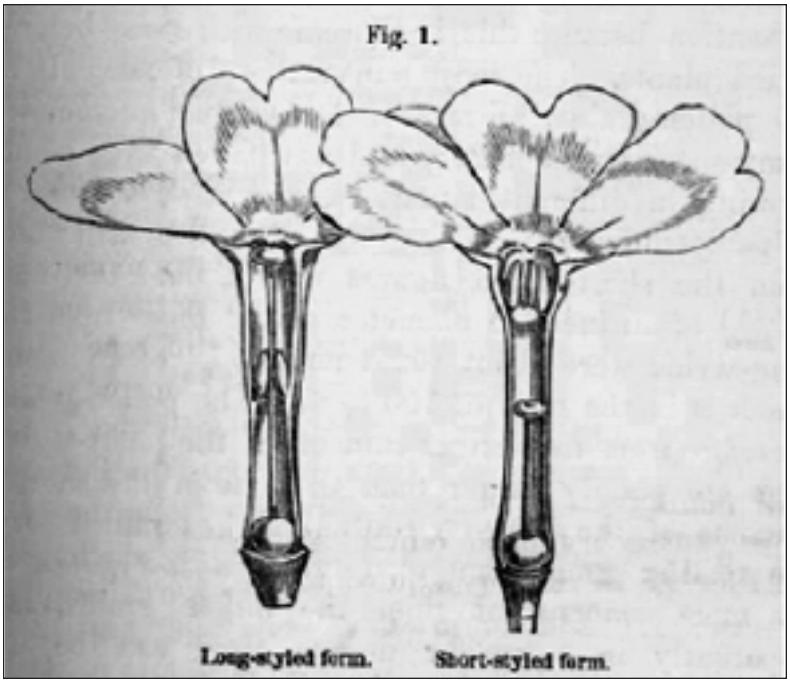

FIGURE 1. *Figure from Darwin's work on heterostyly in* Primula *species (1877) showing the long style and short stamens of the pin flowers and the short style and long stamens of the thrum flowers.*

duced by thrum flowers. What could be the explanation for these phenomena?

His first hypothesis was that *Primulus veris* was tending toward dioecy (where a species has male individuals with only male flowers and female individuals with female flowers). His reasoning behind this was: "Pin plants with their longer carpels, smaller stamens and pollen grains are more feminine; conversely thrum plants are more masculine." If this were true, then, he expected, pin plants should produce more seeds than thrum plants. To test this, he collected seeds from plants growing in different habitats (to negate possible environmental effects), then counted and weighed them. The results? Pin plants produced *less* seed than thrum by a proportion of nearly 3 to 4, suggesting that pin plants were certainly not more "feminine" than thrum.

His next hypothesis was: "The two forms of flowers in *Primula* are related to cross-pollination and prevention of inbreeding." To test this he set up a sophisticated pollination experiment. First, he covered populations of *Primulus* with fine netting to prevent insect pollination. He then hand pollinated the plants in the following combinations: 1) thrum plants pollinated with pin pollen and vice versa, 2) thrum plants pollinated with thrum pollen, and 3) pin plants pollinated with pin pollen. In cases in which he was using pollen from like plants (2 and 3 above), he always took the pollen from a different plant than the one being pollinated to avoid any effects of inbreeding. This alone shows the depths of his knowledge about reproduction and the care he took in his experimental design.

After the plants had set seed, he counted and weighed seeds from both 100 flowers and 100 capsules. He found that by all measures, plants pollinated by the opposite type of flower had markedly greater reproductive success. From this work he concluded: "The benefit of heterostyled dimorphic plants derives from ... the intercrossing of distinct plants" and "the pollen grains from the longer stamens ... become larger in order to allow the development of longer [pollen] tubes."

PLANT MOVEMENTS AND PHOTOTROPISM

Darwin explored plant movements extensively, from the way vines and other plants circumnutate (successive bowing or bending in different directions of the growing tip of the stem) to sleep movements (folding of leaves up or down at night [Darwin 1881]) to movements of insectivorous plants (Darwin 1888). In all his explorations, he performed numerous experiments. For example, in insectivorous plants such as the Venus Flytrap (*Dionaea muscipula*) and Sundews (*Drosera* spp), he explored how food was absorbed by the leaves, what effect various "foodstuffs" had on the plant's ability to react or absorb, and how the impulse to move was transmitted.

The elegant experiments of Darwin and his son Francis on phototropism — the growth of a plant towards a unidirectional source of light — are commonly cited in biology textbooks today (Darwin 1881). In their work on phototropism in Canary grass seedlings (*Phalaris canariensis*), they observed in experiments on seedlings raised in the dark, then exposed to a unidirectional source of light, a marked curvature toward the light. They formed a hypothesis that the tip of the seedling may be responsible for the curvature toward light. To test this hypothesis, they cut the tips off some seedlings while leaving a control group with tips intact. They found that those seedlings with the tips removed did not respond to a unidirectional source of light while the control group with tips intact bent markedly toward the light source.

But the question remained: Did the experimental seedlings remain upright due to their tips not being present to detect light or because they had been damaged? To address this question, they covered some seedling tips with opaque caps and, as controls, covered other tips with transparent caps or placed opaque collars around the base of the seedlings, leaving the tips exposed. They found that the seedlings with opaque caps remained upright, showing no signs of phototropism, while both controls did bend toward the light.

From all of this work, they concluded: "These results seem to imply the presence of some matter in the upper part which is acted on by light, and which transmits its effects to the lower part." We now know that this "matter" is a plant hormone called auxin. Auxin is produced in the apical meristem of plants, is transported down the stem, and accumulates on the shady side of a plant subjected to unidirectional light. This increased concentration of auxin causes the cells on the dark side to enlarge, thus bending the plant toward light. Of course Darwin and his son knew nothing about this mechanism, but their work laid the foundation for subsequent experiments that led to our current understanding of auxins.

Pollination mechanisms in orchids

It is hard to conceive that any botanist worth his weight in chlorophyll would be immune to the charms and foibles of orchids, and Darwin was no exception. He was especially interested in the close relationship between the flowers of an orchid species and their pollinators (Darwin 1877a). There can be little doubt that his work on orchids provided him with ample material for understanding co-evolution.

Darwin made minute observations on pollination in diverse orchids, including the fascinating bee orchids (*Ophrys* species). *Ophrys* excel in the lengths they will go to attract a pollinator. Depending on the species, they mimic female bees, wasps, or beetles. To add to the ruse, they emit pheromones, and these "come hither" smells strongly attract male insects, causing the male to attempt copulation with the orchid flower. As the male pseudocopulates with the orchid flower, packets of pollen called pollinia are attached to his body. And of course, the male is drawn to other individuals of the same orchid species for similar reasons, depositing pollen on the receptive stigma, thus effecting cross-pollination. Darwin spent many hours in painstaking observations and experiments on *Ophrys* and other orchids to understand the mechanics of pollinia and their attachment to pollinators.

Darwin was fascinated by the observation that a bee orchid common to England, *Ophrys apifera*, was apparently "adapted to self-fertilization." His further observations convinced him that these self-pollinating orchids still retained the mechanisms needed for pollination by bees. When he imitated a bee's action using an object, the pollinia reacted as in other *Ophrys*, readily attaching to what would have been the bee's head. He concluded that *Ophrys apifera* must have at one time been commonly pollinated by bees but, due to an insufficiency of pollinators, "became slightly modified so as to fertilise themselves" (Darwin 1877a).

A famous example of co-evolution in orchids that came in for its share of controversy was Darwin's explanation for the pollination of *Angraecum sesquipedale*, an orchid native to Madagascar. This orchid has flowers with very long spurs — about 20–35 cm long! Orchids with spurred flowers usually offer a nectar reward at the base of the spur, to reward the moth pollinator. Darwin hypothesized that *Angraecum* must be pollinated by a moth with a proboscis long enough to reach the nectar and thus effect pollination. This idea was derided and even used as proof of creationism. In 1867, George Campbell published a book in which he argued that the complexity of *A sesquipedale* supports the idea that species were created by a supernatural being. Unfortunately for Campbell, a moth with a proboscis of the required length was found in 1903; it was first named *Xanthopan morganii praedicta* to honor Darwin's correct prediction.

Summary

It is clear, even from the few examples given above, that Darwin's botanical work was important to the development of his ideas on evolution and natural selection. Darwin began thinking about evolution soon after his return from the *Beagle* voyages, starting his notebooks on "transmutation" (evolution) in 1837. He was uniquely situated for the task of developing the theory of evolution, from his early exposure to Lamarckian evolutionary thinking through his grandfather (Erasmus Darwin) and Robert Grant at the University of Edinburgh, his early exposure to the work of Charles Lyell's book on fossils and the botanist Henslow's work on populations and speciation, his travels on the *Beagle*, and his broad knowledge of so many aspects of natural history. This is not to discount other attributes that uniquely placed Darwin to develop the theory: he was hard working and, since independently wealthy, able to spend all of his time on his science. Most importantly, he was able to think logically and creatively ("outside the box" as we say today).

There is no doubt that all the clues and scientific advancements needed to develop the theory of evolution and natural selection were present in the early 19th century. If Darwin had not proposed the theory of evolution, someone else would have. In fact, that is exactly what *did* happen! Because Darwin put off publication of his ideas, Alfred Russel Wallace caught up with him, and the two presented their findings simultaneously in 1858. But I think that Darwin deserves to have the greater part of the credit. He developed his understanding of evolution and natural selection well before Wallace and it was he who took on the enormous task in the *Origin* (1859) and elsewhere of convincing the world that evolution was real.

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Note: all of Charles Darwin's books, papers, and communications are available on-line at <http://darwin-online.org.uk/>.

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Evolution Learning Community Encourages Dialog on Evolution at UNC Wilmington

Dana Fischetti

For the past three years, the Evolution Learning Community (ELC) at the University of North Carolina, Wilmington, has sponsored a variety of speakers, courses and public events related to the study of Darwin and evolution. These activities will culminate in the year-long commemoration in 2009 of the 200th anniversary of Charles Darwin's birth and the 150th anniversary of the publication of *On The Origin of Species*.

After the success of a similar learning community focused on *Brown v Board of Education* in 2004, the campus began to discuss the feasibility of a multiyear, interdisciplinary learning community on the topic of evolution. Developed through a grassroots faculty effort and endorsed by the Faculty Senate, the ELC is dedicated to the study of the theory of evolution and its scientific, social, and moral significance for humanity. The executive council of the ELC is headed by Patricia Kelley, Professor of Geology and long-time NCSE Supporter, Dale McCall, Professor of Anthropology and Genetics, and Thomas Schmid, Professor of Philosophy.

Schmid, one of the founders of the group, said of the ELC: "We were looking for a campus-wide series of events that would be long-lasting and substantial and might generate some curricular change. We've taken a very academic approach. The focus is not to create a debate on evolution but to develop dialogue and educational opportunities for UNCW as well as the larger community."

The group has coordinated educational and cultural events for students, faculty, staff and the community to increase awareness and critical discussion of the role of evolutionary principles in the natural and social sciences and in relation to the philosophical, historical, artistic and literary modes of reflection on life.

Activities have included more than 50 formal ELC-related courses per semester, the Visiting Darwin Scholars lecture series, discussion groups and Honors enrichment seminars, cultural events such as film screenings and an art show, community outreach with public lectures and Continuing Studies courses, faculty professional development and student research opportunities, ELC-related publications, and a faculty and student trip to the Galápagos Islands. Visiting Darwin Scholars have included Richard Leakey, EO Wilson, Stephen J O'Brien, and NCSE Supporters Ken Miller and Niles Eldredge. Details and information about the program and events is available on line at <http://www.uncw.edu/evolution>.

The work of the Evolution Learning Community will culminate with several significant events in 2009. In March, UNCW hosts "Darwin's Legacy: Evolution's Impact on Science and Culture — A Multidisciplinary Student Conference." The conference is open to undergraduate and graduate students in the natural sciences, social sciences, humanities and arts who are conducting research or creative endeavors related to evolution. Faculty members supervising student research are also encouraged to attend. In addition to oral and poster presentations of student research, the conference will also feature keynote speakers David Buss, a leading theorist in evolutionary psychology; Peter Carruthers, a leading theorist in evolution and language; David Mindell, Dean of Science and Research Collections at the California Academy of Sciences; and Kevin Padian, vertebrate paleontologist, witness at the Dover trial, and president of the NCSE board of directors.

"The breadth of programming and strong student involvement has been a key to the success of the ELC," said Kelley, executive administrator of the group and herself a nationally known speaker on evolution and religion. "We have had increased dialog among faculty and between faculty and students as a direct result of the ELC effort. These are important scholarly conversations that would not have happened without this initiative."

Other major events planned for 2009 include Visiting Darwin Scholars Eugenie C Scott, executive director of the National Center for Science Education; Dirk Robert

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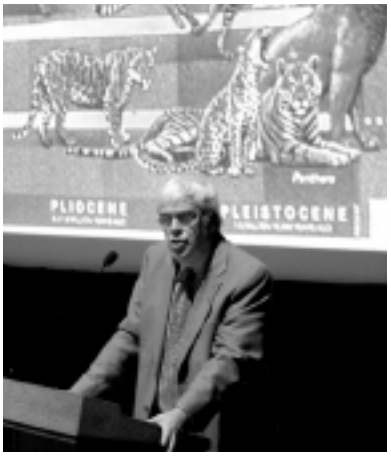
Dana Fischetti is manager of news and media relations at the University of North Carolina, Wilmington. She has worked in the marketing/public relations field in a variety of capacities in both corporate and higher education settings. As part of her current role, she is providing publicity and media relations support to UNC Wilmington's multidisciplinary Evolution Learning Community.

Visiting Darwin Scholars (top, l to r) Ken Miller, Stephen J O'Brien, Richard Leakey; (bottom) students participating in the NSF-funded ELC-related summer program Research Experiences for Undergraduates in Biodiversity Conservation.

Johnson, Associate Professor of Modern Languages at Hampden-Sydney College, whose scholarly work explores the intellectual interaction between Darwin and Nietzsche; Philip Kitcher, John Dewey Professor of Philosophy at Columbia University and NCSE Supporter; and David Quammen, award-winning author of *The Reluctant Mr Darwin*. For academic year 2008-2009, the ELC coordinated a Visiting Darwin Scholars competition to fund visiting scholars. Illustrating the interdisciplinary nature of the ELC, proposals to bring speakers to campus came from the Departments of Anthropology, Art and Art History, Biology and Marine Biology, Chemistry, Creative Writing, English, Foreign Languages and Literatures, Geography and Geology, History, Philosophy and Religion, Psychology and the Watson School of Education.

In addition, *Ecotone*, the university's literary journal edited by David Gessner, Assistant Professor of Creative Writing, will publish a special issue in spring 2009 celebrating the Darwin anniversaries. Through the *Ecotone* Evolution Contest, the journal accepted submissions in poetry, fiction and nonfiction that creatively reflect the subject of evolution. The magazine sought bold interpretations of a theory that has radically altered the experience of being human: What does it mean to share our DNA with other animals? What are the consequences of our diminishing biodiversity? Why have political lines hardened around an issue so rooted in science?

A special issue of the *Journal of Effective Teaching*, an online peer-reviewed journal dedicated to teaching excellence and edited by UNCW faculty member Russell Herman, will be devoted to the teaching of evolution in a university setting. Submissions for the special issue, to be published in fall 2009, will be accepted through May 1.

Throughout all of the activities and events related to evolution, the ELC has maintained one basic premise: no matter how one views the meaning of Darwin's revolutionary work for modern thought, there is no denial that it transformed biological science and the picture our society has of humans in nature. This statement has formed the basis for inquiry and dialog related to evolution, bringing an entire university campus together to consider what it means to be human.

For more information, connect to the Evolution Learning Community web site at <http://www.uncw.edu/evolution>.

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Briscoe Geology Park

Len Eisenberg

A typical fourth grader can rattle off the names of the planets, but does not know the names of the geological chapters of earth history, how old the earth is, when dinosaurs lived, or much else about the history of earth and the life on it. One common excuse for this gap in science education is that these topics are too complicated; but the real reason is the conflict with traditional beliefs — either those of the teacher or of the parents the teacher does not wish to offend. In Ashland, Oregon, the Briscoe Geology Park was built to help students, residents and visitors better understand how our planet and life have changed dramatically through time and how local geology fits into the picture.

In fall 2006, community volunteers proposed to the Ashland School District the construction of a geology park in an unused corner of a closed elementary school. Permission was granted, and with the help of Ashland Parks and Recreation Department, volunteers built the Briscoe Geology Park. The park is designed to operate on multiple levels of ability, such that local university students as well as elementary school students can find it a friendly place to learn a complex subject.

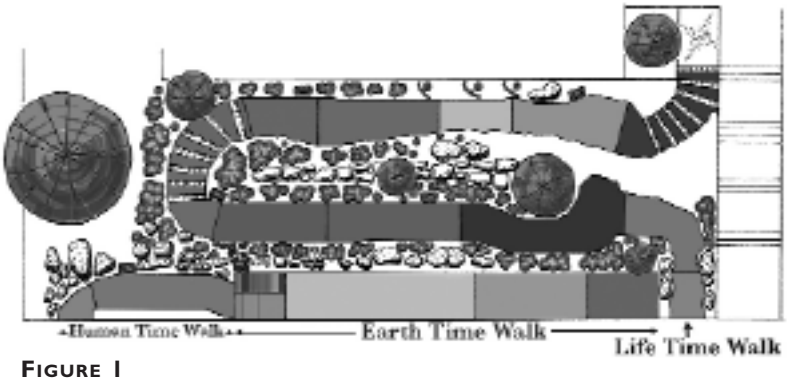

FIGURE 1

Three "time walks" at the park explain how earth and life have changed through time (Figure 1). Each time walk is divided into geologic eons, periods or epochs, as appropriate. The time walks are clearly labeled in tile and of an appropriate length. Hand-made tiles set into the concrete walkways (Figure 2) show animal and plant species representative of each time interval. Other tiles, placed at appropriate points along the time walks, note local geologic events, mass extinctions, ice ages, and human and planetary events. Tracks of trilobites, tetrapods and dinosaurs show how these animals moved (Figure 3), and tile plate tectonic maps depict continental drift through time.

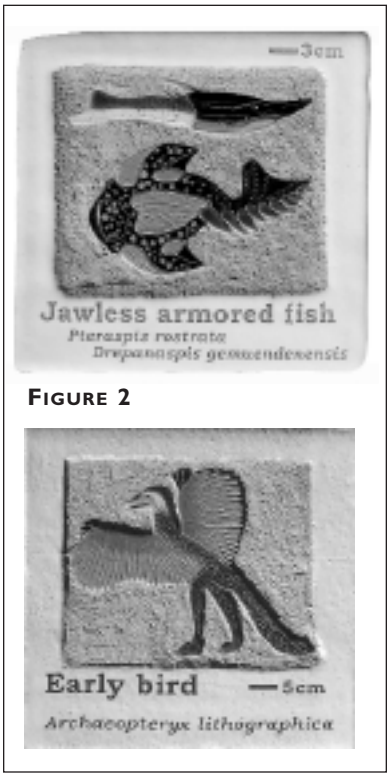

FIGURE 2

The Earth Time Walk describes the entire 4600-million–year history of earth, and one step along this 20-meter–long path covers about 150 million years. The Life Time Walk covers from the start of the Cambrian Period, 542 million years ago, when multicellular life blossomed, to the present, and each step along this 60-meter–long path covers about five million years. The Human Time Walk describes the most recent 50 000 years of earth history, and one step along this 8-meter path covers about 4000 years. An introductory sign and guideposts introduce visitors to geologic time and the features of the park, and help them navigate between the different time scales of each walk. Other signs note plant species used in the landscaping, and provide information on local rock types. There are also four large interpretive signs, one each to explain local geology, mass

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Len Eisenberg is an independent geologist living in Ashland, Oregon, with his wife Karen and daughter Jane. Len's BS and MS degrees are in geology from San Diego State University, and he has spent most of his professional career with Chevron working on petroleum exploration and production projects in Angola, Morocco, Kenya, Somalia, Croatia, Australia, and Papua New Guinea. He now teaches and consults part-time. His current research interest is evidence for giant floods and long-lived lakes in Jurassic eolian sandstones in Utah. He volunteers in Ashland public schools, where he helps teach mathematics, science, and reading.

extinctions, plate tectonics, and evolution (Figure 4).

Landscaping along the Life Time Walk follows the evolution of land plants. Along the Cambrian and Ordovician sections the landscaping is bare rock, because land plants (except perhaps for algae) had not colonized the land at that time. Mosses and liverworts, representing the first land plants, appear along the Silurian part of the walk, followed, at appropriate points, by club mosses, horsetails and ferns, cycads, conifers, ginkgo, flowering plants and grasses. In addition, boulders of local rock types are laid out in stratigraphic order across the park, tilted slabs of rock are placed to mimic outcrops of anticlines and synclines, and fossils and interesting rock types are incorporated into retaining walls.

A 20-page color brochure is available at the park for extra-curious visitors. In it detailed descriptions of major events and interesting organisms are provided for each geologic interval. Extra information on plant evolution, mass extinctions, biological evolution, local geology, and plate tectonics is also included. For students, a two-part educational program has been set up by the North Mountain Park Nature Center. First a docent visits the classroom and explains geologic time and how to use the scale bar on a tile to determine the size of the animal depicted. This is followed by a field trip to the park, during which students use information at the park to discover earth history. Discovery is helped along by multi-page activity sheets that students fill out at the park. There are three sets of activity sheets, one each for elementary, middle and high school grade levels. A 55-page teacher's guide gives educators detailed information on all aspects of the park.

FIGURE 3

Reaction so far has been very positive from the schools and the community. We hear that the artwork of the tiles, the lush landscaping, high quality rock work, and the interpretive signs combine to make the Park a pleasure to visit and the science fun and interesting to learn. Readers are cordially invited to visit Ashland and the Briscoe Geology Park.

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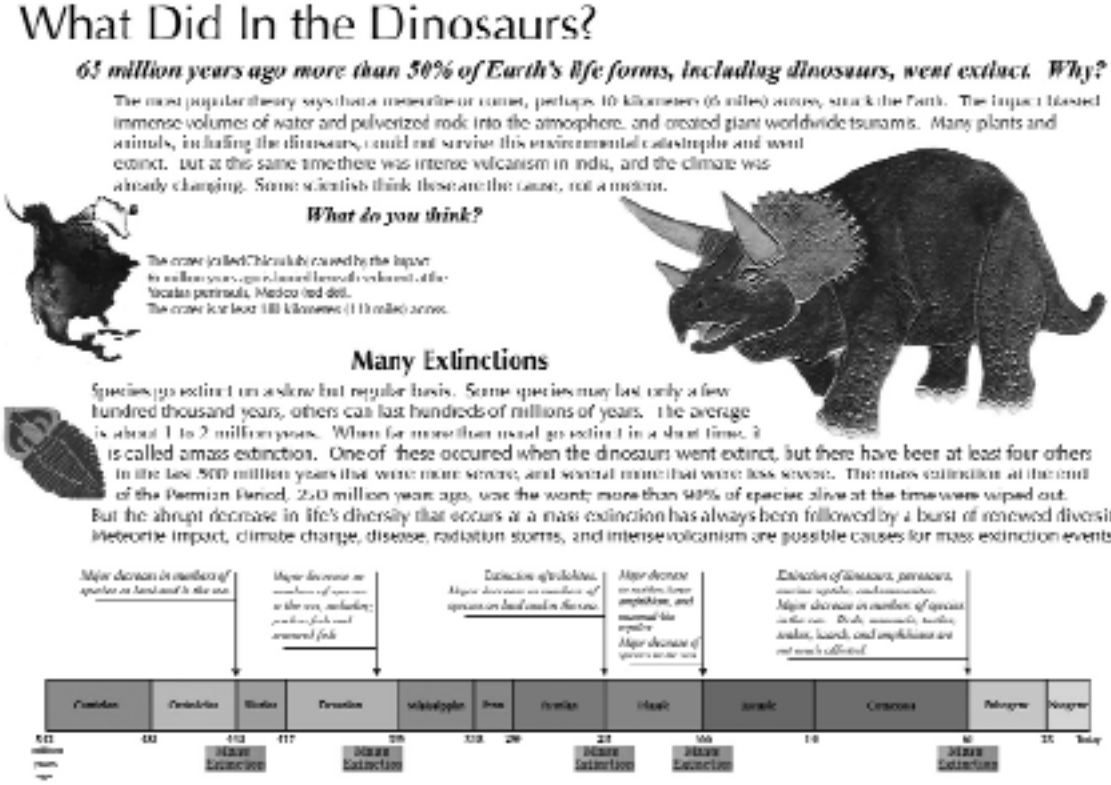

FIGURE 4 *Can you find all five mass extinction tiles on the Life Time Walk?*

Siccar Point

What clearer evidence could we have had of the different formation of these rocks, and of the long interval which separated their formation, had we actually seen then emerging from the deep… The mind seemed to grow giddy by looking so far into the abyss of time. —John Playfair, upon seeing Siccar Point*

Figure 1. Siccar Point is at the base of a steep slope on the Berwickshire coast near Edinburgh, Scotland. For scale, the author is shown in the center of the photograph. (Photo by Randy Moore)

Figure 2. Siccar Point from the North, with the North Sea in the background. Note the horizontal sediments overlying the vertical sediments. (Photo by Randy Moore)

During June 1788, Scottish geologist James Hutton — along with mathematician John Playfair and chemist James Hall — visited Siccar Point, which is arguably the most important geological site in the world (Figure 1). Siccar Point is a rocky promontory "washed bare by the sea" on the Berwickshire coast near Scotland's border with England. Geologically speaking, Siccar Point is an unconformity — a term coined in 1805 by geologist Robert Jameson to describe a surface at which two separate sets of rocks formed at different times come into contact. Sediments at the base of Siccar Point are vertical and, because sediments can only form horizontally, Hutton knew that these sediments had been tilted and raised above land by pressure. Erosion had then worn away the above-ground parts of the vertical sediments, after which they were again submerged and covered by new horizontally deposited sediment (Figures 2 and 3). Charles Lyell, who visited Siccar Point with Hall in 1824, used a sketch of the site as the frontispiece of his *Manual of Elementary Geology* (1855). It is no wonder that Siccar Point is a Scottish National Heritage site.

The vertical sediments at Siccar Point are Silurian greywacke, a gray sedimentary rock formed approximately 425 million years ago when colliding plates created immense pressure that converted the sediment to rock. By about 80 million years later — a period that is more than 10 000 times longer than all of Archbishop Ussher's proposed history of earth — the raised greywacke had eroded and parts were again submerged in the ocean. Erosion of the nearby Caledonian Mountains produced reddish sandstone sediments (Old Red Sandstone of the Devonian) that were deposited horizontally over the vertical greywacke sediments (of the Silurian). When pressure created by moving plates again buckled the sediments, Siccar Point was raised above land for Hutton and others to see. Except for the chiseling by thousands of souvenir-seeking geologists who have visited the site, Siccar Point looks today as it did when it was visited by Hutton and his friends in 1788.

Finding Siccar Point: Although Siccar Point (Coordinate: 55° 55' 55.89" N, 2° 17' 54.74" W) is part of the James Hutton Trail, it is not marked on any of the tourist maps available at Edinburgh hotels. The best way to see Siccar Point is on a tour provided by GeoWalks (<http://www.geowalks.demon.co.uk>), a small geology-education company owned by Edinburgh geologist Angus Miller. Siccar Point is beautiful from above looking out onto the North Sea. If you choose to go down to the unconformity, be prepared to slide down the steep hill and to be quite exhausted by the time you get back to the top. There is a mold of a small part of Siccar Point on display at the American Museum of Natural History.

* *Transactions of the Royal Society of Edinburgh* Vol V, Pt III, 1805.

Figure 3. A close-up of "Hutton's Unconformity" at Siccar Point. (Photo by Randy Moore)

BookReviews

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

by Randy Moore and
Mark D Decker
Westport CT: Greenwood Press,
2008. 415 pages

Reviewed by Glenn Branch

Who replaced John Scopes at Rhea County High School in Dayton, Tennessee? Where was the first evolution course offered anywhere in the world taught? And who was the most controversial figure in the evolution/creationism controversy? Randy Moore and Mark Decker — both biologists at the University of Minnesota; both members of NCSE — know the answers to these questions, and in *More than Darwin*, they share their vast knowledge about (as the subtitle indicates) the people and places of the evolution/creationism controversy. Appropriately as well as alphabetically, they begin with Adam ("the first naturalist," according to Linnaeus), ending with Evelle J Younger, the attorney general of California who in 1975 ruled that the state's educational system could not "balance" its teaching of evolution by teaching creationism as well. Moore and Decker explain in their preface, "we have tried to neither condemn nor praise either 'side' of the controversy, nor have we attempted to reconcile the views of science and religion ... Our only goal has been to present — as best we can — an objective, interesting, accurate, and accessible description of the people and places associated with the controversy" (p xxii). They succeed admirably.

Most of the book's 500 or so entries are short, running about 500 to 1000 words, but a few figures — Charles Darwin, of course, but also William Jennings Bryan, Charles Darrow, Susan Epperson, the Galápagos Islands, James Hutton, Thomas Henry Huxley, Charles Lyell, and Alfred Russel Wallace — receive extended treatments. The entries are generally concise, organized, and accurate, with the exception of the usual crop of typographical errors and a few minor errors of fact. There are a few places where clarity was lamentably sacrificed for brevity: in the entry for the Kansas State Board of Education, for example, it is insufficiently clear that the board was dominated by and reclaimed from anti-evolutionists twice. The usefulness of the book as a reference work is heightened by a four-page bibliography and a competent index that, unusually but helpfully, includes important quoted phrases. (Between the entries for "Buxton Limeworks" and "Byrd, Robert," for example, appears "Buzzword that causes a lot of negative reactions," which was how Kathy Cox, the Georgia state superintendent of schools, described the word "evolution" in 2004.) Scattered throughout are eighty-two useful illustrations, including a number of photographs taken by Moore.

A distinct strength of *More than Darwin* is its coverage of the contentious legal history of the controversy, to which Moore devoted a previous book, *Evolution in the Courtroom* (2001). There are entries for several cases that deserve to be better known: *Bishop v Aronov, Caldwell v Roseville*, *Crowley v Smithsonian Institution*, *Hendren v Campbell*, *Moeller v Schrenko*, and *Pfeifer v City of West Allis*. Practically everyone of significance in the Scopes trial is allotted a separate entry, and a guide (with map) to the sites of the trial is provided. It is regrettable that *McLean v Arkansas* and *Kitzmiller v Dover* were not similarly treated, although a number of people associated with those trials, including Wendell Bird, Stephen Jay Gould, Norman Geisler, John E Jones III, and Kenneth Miller, receive their own entries. It is a minor annoyance that the proper legal citations for the cases — for example, "400 F Supp 2d 707 (MD Pa 2005)" for *Kitzmiller* — are not included. The entry for *Selman v Cobb County* fails to explain the denouement, in which the decision was vacated and the case remanded to the trial court, where a settlement was reached.

With its sturdy binding and exorbitant price ($85.00), *More than Darwin* is clearly intended for the library market. The University of California Press is planning to publish a paperback edition in 2009, however, which is fortunate, since the book is not simply a utilitarian reference work: it is a marvelous trove for the curious browser, who will be constantly tempted to pull the book off the shelf to read a random entry and discover a new fact or two. In addition to scientists and creationists, legislators and litigants, philosophers and poets (well, poet: Tennyson, on the strength of *In Memoriam*'s "Nature, red in tooth and claw"), *More than Darwin* addresses a number of delightfully quirky topics: Carl Akeley, the revolutionary taxidermist whose work is still on display at the American Museum of Natural history; Gertie the Dinosaur, the first animal to star in a cartoon strip; and roadside dinosaurs, such as those displayed at Dinosaur Valley State Park. Moore and Decker evidently enjoyed the chore of researching and writing the book, and their hope, expressed in the preface, that readers will "enjoy learning about the people and places of the evolution–creationism controversy" (p xxiv), is bound to be realized.

And what about those lingering questions? Well, the most controversial figure in the evolution/creationism controversy, Moore and Decker confidently state, was J

Glenn Branch is NCSE's deputy director.

Frank Norris (1877–1952), who "was indicted for a variety of felonies, including perjury, several arsons (including the burning of his own church), and murder. ... As a newspaper editor noted after the [murder] trial, 'In Fort Worth, the 11th Commandment is "Thou shalt not mess with J Frank Norris"'" (p 271). Fans of Norris's modern rival Kent Hovind will be pleased to know that he at least receives his own entry. The first evolution course was offered at Indiana University, at least according to the biologist David Starr Jordan (1851–1931), who taught it. And Scopes's replacement was Raleigh Reece, described in L Sprague de Camp's *The Great Monkey Trial* as "a reporter from Nashville with some teaching experience and an unblemished record of Fundamentalism" (1968: 444). Content to let the irony speak for itself, Moore and Decker add, "When Reece missed the first week of classes in the fall of 1925, his substitute was Darius Darwin" (p 298).

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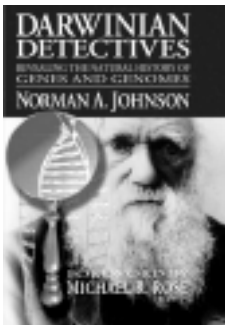
Darwinian Detectives: Revealing the Natural History of Genes and Genomes

by Norman A Johnson
New York: Oxford University Press, 2007. 220 pages

Reviewed by Rebecca L Cann

Just about every topic under the banner "why genetics is important to understand and still amazing to many professional biologists" is covered in this compact book. What a delight to read about some well-chosen examples, glittering in succinct detail and presented in a manner



designed to intrigue and captivate a general audience. After all, where else can you find the forensic details about how a dentist did in an ex-lover with an HIV infection, what the chimpanzee genome project could tell us about differences between the sex lives of all three chimpanzees, the true origins of Akita dogs, or what red-haired singers might have in common with talking Neanderthals? Think of the conversation starters at your next sushi bar encounter, where you can captivate an audience with details about the genomes of smooth versus spiny pufferfish! Then toss off a few comments about the delta 32 mutation in CCR5 and the Black Plague, followed by the link between silaic acids and huge brains, and you are sure to be voted geek of the week. The amazing thing is that Norman Johnson has been able to show the scientific method making sense of the world in all this crazy detail.

A designed biota would not be as messy, as haphazardly assembled, or as truly jerryrigged as the genetic systems cobbled together in the last billion years of random processes and presented here for your total wonderment.

Johnson starts with the general, boxing the math for readers to skip over completely or come back to later, and moves to the specific in well-organized sections. The book starts with a good exposition of the methods scientists use to deduce how genomes are organized and how they got that way, that is, evolution. His discussion on natural selection, both positive and negative, is clear and easy to follow. The focus on how scientists are able to identify cases of positive selection sets the stage for discussions of how populations (simple and complex, marine and terrestrial) have changed over time. In cases where morphological shifts cannot be clearly linked to environments undergoing directional change, he also does a good job of introducing a reader to the idea of balancing selection. If you had an hour to read a chapter a week, covering this book would be like taking a good college biology seminar in a semester with your favorite teacher. You come away with enough background to critically dissect a too facile news story, like the one for a "language gene" or "killer male gene". And if your interest runs to recreational genetics as in ancestry testing, you will learn enough here to know that even a $1000 test fee is going to give you a probability statement, not an identity link.

There is one glaring error on page 160 in the text, easily corrected, but unfortunate because it concerns dogs and how they changed in their domestication from a wolf-like ancestor. Dogs have been bred to diverse body shapes, colors, and personalities, so much so that behavioral geneticists are particularly keen to unlock many secrets about genes contributing to behavioral patterns using the dog genome as a model system. Because many people have close relationships with their pets and may have missed early stages of behavioral development with their own children, this topic is close to a reader's heart and important to get right. So, when Johnson talks about the latest information from large-scale nuclear gene testing of 85 breeds of dogs and suggests that dogs originated from African stock, contradicting previous mitochondrial DNA work, he does so because he misidentifies the basal breeds in the dog tree as African, when in fact they are Asian. Anthropologists can now note that I am finally arguing for an Asian ancestry of one species dear to humans.

Another minor quibble is his failure to include a good discussion of superbugs, or bacteria resistant to multiple antibiotics. Hospital acquired infections are important in an aging population undergoing more intense medical care, and while the latest statistics can be scary for someone spending time in an intensive care unit, it is also clear that school gymnasium facilities and hotel rooms with dirty remote controls or bedspreads can also be a problem. Herd immunity assumed by parents in an attempt to avoid autism risks, where failure to vaccinate has contributed to measles epidemics nationwide, is

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also a public health issue far more immediate than a potential bird flu mutation, yet these topics do not appear. Instead, a final chapter on genome evolution that attempts to give the big picture falls flat, and suffers from both over- and under-simplification, especially in the discussion of transposable elements and gene regulation.

I hope that biology teachers nationwide looking for evidence of evolution to engage their students with take a look at this book. I also hope that physicians who have a shaky understanding of evolutionary processes feel inclined to refresh how their practices can contribute to or detract from the general health of their patients. This slim volume sparked many discussions with airplane seatmates, and clearly covers stories that will resonate with a variety of readers. If a paperback version appears, it would also be a good text for a non-majors biology or an advanced placement high school class. Armed with the right information, these folks may themselves become citizen scientists.

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Negotiating Darwin: The Vatican Confronts Evolution, 1877-1902

by Mariano Artigas,
Thomas F Glick, and
Rafael A Martínez
Baltimore (MD):The Johns Hopkins University Press, 2006.
336 pages

Reviewed by Peter MJ Hess

On both the popular and scholarly levels, the appreciation of the Roman Catholic Church's stance with respect to the theory of biological evolution has been ambiguous. On the one hand, it is sometimes assumed that the Church that had rushed to judgment on heliocentrism in the case of Galileo would not have hesitated to pounce on a theory that both undercut a literal reading of Genesis and reduced human beings to the status of animals. On the other hand, it is well known that Roman Catholicism has not been at the forefront of organized opposition to evolution in the same way as fundamentalist Protestantism has been.

Was the Church fundamentally opposed to Darwin's theory of descent with modification, or was it cautiously open to permitting discussion of the idea? Where along this spectrum should we expect to find the truth? Moreover, by "the Church" do we understand the Vatican and the ecclesiastical hierarchy, or Roman Catholic scholars, or the faithful in the pew? These distinctions are important to make for sorting out the degree of acceptance of evolutionary thinking within Roman Catholicism, since the response by Roman Catholic scholars and churchmen varied according to their region and to their degree of removal from the corridors of Rome. In our collective effort to defend and promote the teaching of evolution in public schools, readers of *RNCSE* will be well served by even a cursory reading of *Negotiating Darwin.* The book offers a nicely detailed elucidation of the delicate position in which the hierarchical Church found itself in the generation after Darwin published *On the Origin of Species* in 1859.

The authors of *Negotiating Darwin* — including the late Mariano Artigas — were among the first to study the archives of both the Congregation of the Holy Office of the Inquisition and of the Congregation of the Index. In principle it was within the jurisdiction of the Holy Office to examine and prohibit a book, with the decision being communicated to the Office of the Index for promulgation. In practice, however, it was the Congregation of the Index that handled both the examination of and the judgment about the books that had been denounced to it by church authorities.The authors examine six cases featuring Roman Catholic thinkers who were suspect of trying in varying degrees to incorporate evolutionary thinking into Roman Catholic doctrine in the generation after Darwin's seminal work appeared. In the case of some, evolution was a relatively unimportant aspect of their thinking; with others it was central to their theological project. The principal objective of *Negotiating Darwin* is "to identify both the ideological and operational stance of the Church with respect to the reception of Darwinism."

The first case studied is that of Rafaello Caverni, whose *New Studies of Philosophy: Lectures to a Young Student* (1877) reconciled divine creation with the active intervention of God by leaving humans out of the process of evolution. Caverni countered the predominant literalist hermeneutic by distinguishing between the divine and human aspects of Scripture. Rejecting an evolutionary theory that denied purpose, he insisted upon a theistic vision of evolution attracting the world forward by final causes. The influential Jesuit magazine *La Civiltà Cattolica* reviewed Caverni's book harshly, leveling the twin objections that evolution is an atheistic and materialistic philosophy explaining matter without reference to God, and that, however much Caverni wanted to exclude humans, materialism would be the inevitable result of the incorporation of humans into the evolutionary scheme. The book was denounced and condemned. The authors note, however, that since Caverni's title did not mention evolution, this indirect condemnation of Darwin's theory was ultimately ineffectual.

The episode of French Dominican Dalmace Leroy offers further evidence that the Church had no official doctrine regarding evolution. Leroy published *The Evolution of Organic Species* in 1887, and critical reviews prompted him to issue an expanded edition under the narrower title *Evolution Limited to Organic Species* (1891), in which he carefully excluded Adam and Eve from consideration in the evolutionary story. The book was denounced to the Index in 1894 and Leroy agreed to retract, but with reservations. He sincerely believed that in its steadfast refusal even to consider the evolutionary

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preparation of the human body for reception of the infused soul, the credibility of the Roman Catholic Church was at stake in an increasingly scientific world. Leroy retracted his book, but the episode shows that there was disagreement about the subject even among the theologians of the Index. Even while forbidding the reprinting of the book, they did not publish the decree of condemnation.

The heart of *Negotiating Darwin* is the extensive treatment of the case of John Zahm (1851–1921). A priest in the Holy Cross Order and Professor of Physics and Chemistry at the University of Notre Dame, Zahm argued in *Evolution and Dogma* (1896) for the harmonization of evolutionary theory with Roman Catholic doctrine. Zahm's grasp of contemporary evolutionary theory was remarkable, particularly in his understanding that Darwinism was not equivalent to evolution but only one of numerous attempts that had been made to explain the *modus operandi* of biological change. Recognizing the paucity of fossil transitional forms, Zahm noted that Darwin himself had acknowledged the current incompleteness of the geological record. Zahm was confident that although the production of variation on which selection works was not yet understood, understanding would eventually arrive. He critically reviewed the controversy about Lamarck's theory of the transmission of acquired characteristics, concluding that a comprehensive theory of evolution was not yet attained.

Zahm was well aware of the baggage Darwinism carried in being associated with atheism, and he was alert to the evolutionary controversies raging in Europe. However, he retained a serene confidence that revealed theology could validly be integrated with progressive science.

The Vatican's attention to Zahm's book must be read in light of Pope Leo XIII's campaign against "Americanism." New World political values were often regarded with suspicion by conservative 19th-century Europeans. American Catholics who had adopted the values of freedom of the press, liberty of conscience, and the spirit of free scientific inquiry were less likely to follow Vatican dictates meekly. The appearance of the French and Italian editions of *Evolution and Dogma* provoked the Congregation of the Index to issue an injunction against further publication and distribution, although apparently this was never enforced. Zahm was a faithful Catholic, and when friends in Rome warned him that the book was about to be placed on the Index, he immediately wrote to the publisher of the Italian edition to slow its distribution. Convinced that the truth for which he had worked would in due time be manifest, he had made his point and was content to follow the orders of the church he loved and served. The decree of condemnation was not published, and Zahm never issued a retraction.

In the remaining three cases examined in this book, evolution played a less direct role. Geremia Bonomelli, Bishop of Cremona, was quite taken with Zahm's book, adding an appendix discussing evolution to his own *Seguiamo la raggione* (*Let Us Follow Reason*, 1898). Bonomelli's enthusiastic endorsement led the Index to examine Zahm's thought more closely, and Bonomelli's book was a casualty. Because he was already controversial for his proposal that the Vatican should recognize the new Italian state, Bonomelli believed that a voluntary retraction of the evolutionary appendix would be in his and the church's best interest. Bishop John Hedley of England came under fire for favorably reviewing Zahm's book, and he issued a letter of retraction in the English Catholic magazine *The Tablet*. Also in England, lay scholar St George Jackson Mivart, author of *The Genesis of Species* (1871), was condemned not for his evolutionary views but for his challenge to traditional doctrines about sin and punishment.

Rome never formulated an explicit condemnation of evolution as a doctrine and seems to have taken a rather pragmatic approach to the issue. The debates internal to the Congregation of the Index reflect a general concern for rejecting evolution when applied to the human body, but the only condemnation ever issued was internal, the decree was not published. None of Darwin's books was placed on the Index, nor were any of Huxley's, Spencer's, or Haeckel's. The six cases under review all involved books written by Roman Catholics who had attracted ecclesiastical attention, presumably because their works had greater potential to disturb the life of the Church. Participants on both sides appear to have remembered the Galileo episode, and the Church was careful not to overstep its bounds.

It is hard to find serious fault with this book, both for the meticulousness of its scholarship and for its engaging style. It might have been useful to pursue the history into the 1930s, but the authors have wisely sacrificed breadth for depth. Historians will enjoy its meticulous scholarship, and even non-historians will find this a useful book, as it offers sound historical perspective on a foundationally important and often misconstrued period in the history of the relationship between ecclesiastical authority and the social osmosis of evolutionary theory.

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Darwin and the Bible: The Cultural Confrontation

edited by Richard H Robbins and Mark N Cohen
Boston: Penguin Academics, 2009.
216 pages.

Reviewed by Andrew J Petto

The main theme of this book is clearly identified in its subtitle. To reflect the cultural conflict theme, the editors have invited authors with a variety of perspectives on the history and diversity of life and how best to account for it. The volume is polyvocal; the editors clearly did not

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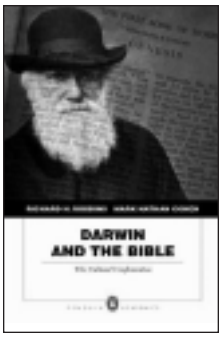
constrain the authors significantly with a particular editorial perspective, even though the editors' perspectives are made quite clear in the introduction and conclusions.

The book is divided into three sections. The first allows proponents of the sciences and of various creationist — including "intelligent design" — models to make affirmative cases for their positions. There is a nice variety of ideas here, though there are some chapters that fall short. For example, though Stephen Jay Gould's NOMA construct is an important perspective, much of the material in the chapter is outdated. And Phillip Johnson's chapter — much abbreviated due to illness — fails to deliver much beyond presenting the basic claims of "intelligent design" (ID) and reads like little more than slogans. Furthermore, the lack of an exposition of a young-earth creationism is a glaring hole. Although young-earth creationists are perhaps not currently in the forefront politically, they are still a significant force on the "Bible" side of the divide.

Still, most of the material here is well presented and worth reading. Cohen's chapter — on the nature of science and the ways in which certain ideas and procedures that make science successful, such as uniformitarianism, have been demonized by opponents — is insightful. He makes clear one important point that is often muddied by ID proponents: even "intelligent" human behavior is still bound by the operation of natural laws. Therefore, it makes a poor analogy to their design arguments, which (despite their disavowals to the contrary) involve the supernatural.

Walter Hearn's chapter provides a voice seldom heard in the "controversy" but which is not an uncommon position: that of the evangelical Christian who accepts the power of natural laws and processes to produce complex biological outcomes. However, this chapter is mostly uninformative — much of it spent in defining and redefining terms, instead of addressing the issues.

Hewlett and Peters clarify the main issues and lay out the terrain that any victor must claim: the nature and definition of science. They clearly characterize the value



of evolutionary theory as "a model that gives directions for scientists to pursue research" rather than an "absolute truth" (p 69). They also decry Darwin*ism* — which they define as the various ideologies that emerge from the scientific theory and *not* intrinsic (or often even related) to the scientific process.

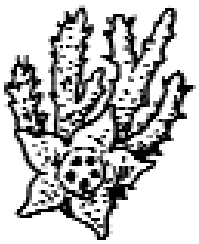
The second section focuses on historical developments. Jonathan Marks provides both a strong historical perspective as well as additional clarification on the nature and meaning of science: "This is not about whether we came from apes, but about how we draw scientific inferences" (p 95). Co-editor Robbins's chapter is a valuable rehabilitation of the reputation of William Jennings Bryan. Robbins points out that Bryan's concern was that Darwinism might lead to inequality, war, and social conflict. His analysis of the state of Darwinism in the 1920s — including Social Darwinism and eugenics — makes Bryan a more sympathetic character than pro-science readers may be accustomed to.

The first of Larson's chapters adds the necessary "post-Darwinian" development of evolutionary science. While anti-evolutionists often invoke Darwin and "Darwinism" in their critiques, this chapter makes clear how much of modern evolutionary science is non-Darwinian. A chapter by the late Ernst Mayr shows why Darwin's original construction still persists and provides the underpinning for modern evolutionary science. By contrast, NCSE's Glenn Branch illustrates the worldwide pattern of how opposition to evolutionary science is maintained and spread.

The final section focuses on issues that arise from evolution in the classroom. Larson's second contribution to this volume explores the conflict between tradition and modernity. It was not evolution itself that was responsible for the conflict, argues Larson, but intellectual and cultural trends that focused on "rational, naturalistic modes of analysis" (p 156) as the basis for understanding and solving the world's problems. This naturalistic focus is, of course, the main irritant that ID proponents want to remove from science, but Larson traces the effects of methodological naturalism on the development of anti-evolutionism throughout the 20th and into the 21st century. His concluding statement is realistic, if pessimistic: "If history is any guide, dark clouds remain on the horizon" (p 165).

Steve Randak adds a perspective that only a high-school biology teacher could provide. Picking up on the idea of "local control" in Larson's first chapter, he shows how it can play out in fervent opposition to evolution, even in a school district with a strong association with a major research university. His chapter perhaps illustrates what Larson meant by his closing remark. Next, one of those students with a strong anti-evolutionary upbringing, Laura Perras, tries to make sense of the scientific theories she is learning in university. This is a valuable voice to add to the conversation, but it is still rather underdeveloped in comparison to the others in the book.

It is in the conclusions that the co-editors' own perspectives become clearest. It is important, they urge, to separate science as the process of inquiry from science as the cultural institution (just as it is important to separate faith as a framework to understand the meaning, value, and purpose in life from faith as embodied in religious denominations). In one sense, this is a restatement and extension of Gould's NOMA construction, and one that recognizes that *both* science and religion are intricately woven into the fabric of our culture. Cohen seems to be calling for science and religion to find that place in contemporary culture where they can join their valuable contributions. And yet, Larson's warning still hangs over this aspiration.



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