REPORTS OF THE NATIONAL CENTER FOR SCIENCE EDUCATION

Volume 17, Number 2

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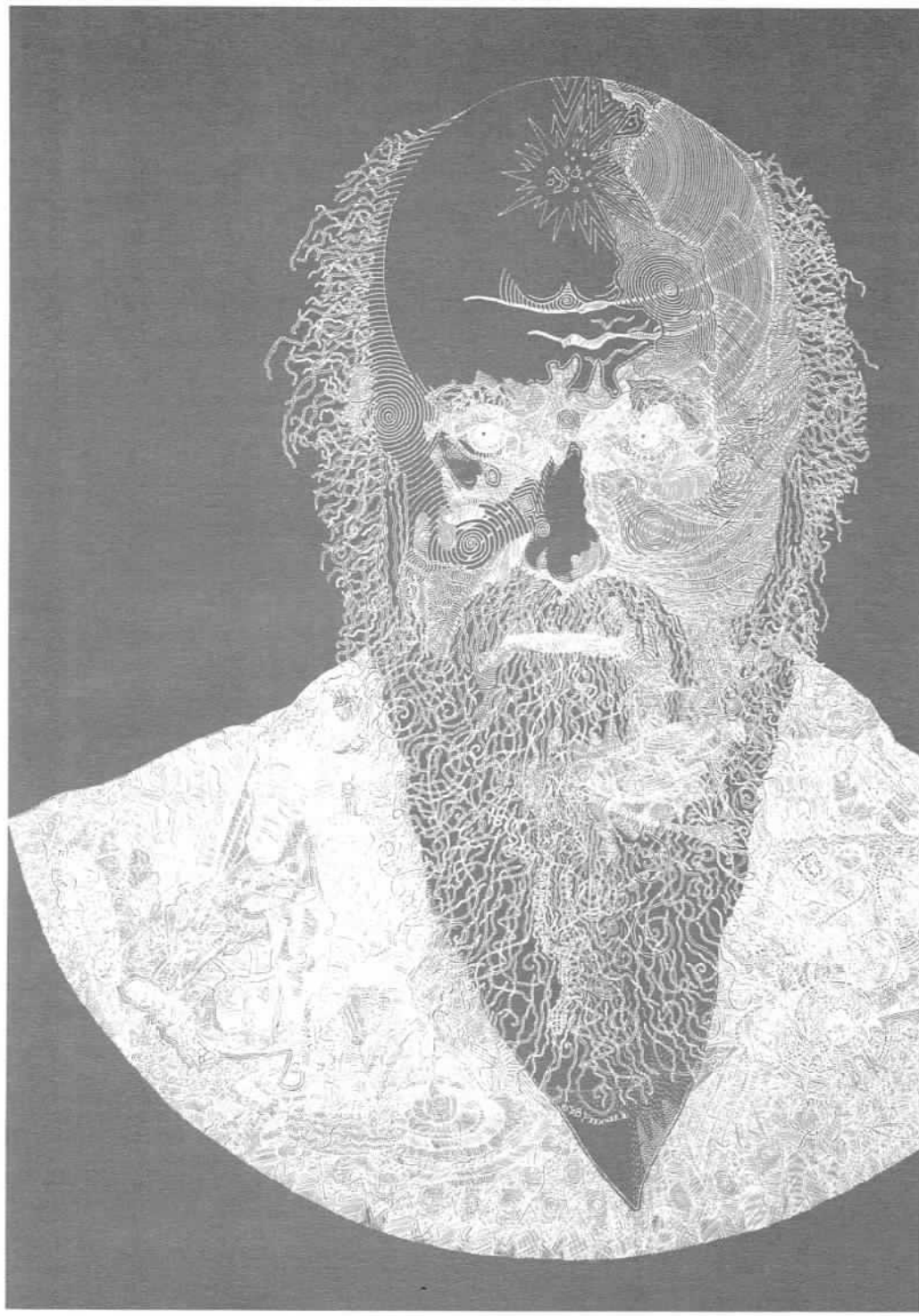

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FROM THE EDITOR'S DESK

With the second issue of Volume 17, we are moving into regular production of *Reports of the National Center for Science Education*. Your response to the first issue has been wonderful — lots of support and suggestions and advice and questions! We have also had more letters than any time since we began sharing the editorial duties in 1995. We wish we had room to print *all* your comments for the rest of the NCSE members to see.

And speaking of the NCSE members, have you completed your membership questionnaire? Our NCSE membership directory is in production, and we hope that you were one of the hundreds who provided our publisher, Bernard C. Harris Co, with up-to-date directory information. Look for the new directory to appear in October.

In case you were wondering why we chose a trilobite for the graphic on the editor's page, wonder no more. It often comes as a shock to our students here in Madison that a *marine* organism should be so prominent here. The trilobite *Calymene celebra* is the official Wisconsin state fossil, and of all the other images associated with the Dairy State, *this* is the one that resonates most with NCSE and its mission.

What's in a Name?

We learned soon after naming the new combined publication that *Reports of the National Center for Science Education* was a mouthful to say and a keyboard-full to write. So, throughout the issue, you will see us abbreviate the title as *RNCSE*. Around here we pronounce it to rhyme with "Quincy". If you see this acronym in the following pages, remember that it is just an affectionate nickname for the newest addition to the NCSE family.

In the News

School board elections and legislative sessions are behind us in many parts of the country. Now the maneuvering and resolutions begin. We have news from around the country on efforts to turn back the clock to the "equal time" or "fairness" doctrines of the 1980s. Some of these are continuing reports of stories that we brought you in previous issues. Others are new instances of recurring problems.

Texas is adopting science textbooks again. For now, it appears as though evolution will be a part of "Texas Essential Knowledge and Skills" (TEKS) proposed by the Texas Board of Education. Evolution is also holding on in New Mexico and North Carolina, after introduction of "alternative theories" language in the New Mexico Board of Education and the North Carolina House. Citizens groups, NCSE members, and the scientific community rallied to overcome creationist challenges in those states.

In Arizona, a member of the Board of Regents called for "alternative theories" in the curriculum as the board was considering becoming the new host for the Institute for Human Origins. There are questions about the board's power to mandate curriculum and also apparently a lack of "takers" in the Arizona State University community interested in developing and presenting this curriculum.

Not all the news is so good! In Tippecanoe Valley, Indiana, the Board of Education is considering a proposal to introduce *creationism* — not creation "*science*" into the public school curriculum. At this point, the board appears to be "stonewalling" all requests from NCSE and the press on the matter. Not to be outdone by its neighbor to the east, Illinois' Department of Education has adopted procedural rules in the consideration of its new academic standards that effectively preclude making adequate resources and protection from creationist pressures in the community available to public school teachers in that state.

Trials and Tribulations

From Down Under we learn that geologist Ian Plimer has lost his legal suit against creationist Allen Roberts and the organization Ark Search. Plimer had argued that Roberts and Ark Search engaged in deceptive trading practices. Plimer's claim was denied because Roberts and Ark Search do not engage in "trade" strictly speaking. The decision was not *all* bad news, however.

John Cole reports that the folks at the Institute for Creation Research (ICR) are worried. They are so worried, in fact, that they have convened a conference on geochronology because they are concerned that their publications on determining the age of the earth from geological data are too simplistic and incomplete to be convincing. In our next issue, John will report on the outcome of the conference.

The Genuine Articles

Since *RNCSE* also continues the contents of *Creation/Evolution*, look for two articles on teaching evolution. Richard Firenze asks why teachers use disclaimers and "apologies" when introducing evolution, but not with other scientific concepts that may challenge religious scripture. Hiram Caton reports on a course that addresses the central issue of the role that understanding evolution plays in support of scientific literacy among students who will probably study very little science. We also carry reviews of 2 CD-ROM resources for teaching and 2 new books.

Resources

Finally, don't forget to check out the resources listed in this issue. Frank Sonleitner combs the pages of numerous publications to give us an outstanding bibliography several times each year. We also receive short "blurbs" about good books and interesting articles from many of you. Don't forget to check out our *centerfold*! Use your member's discount for the great books for sale from NCSE there. And remember, keep in touch with us here at NCSE. By far the greatest resource we have is you — our members.

Anj Petto and Laura McMahon

Correction

In our last issue we incorrectly identified Richard Dawkins as Professor of Zoology at Oxford University. His correct title is Charles Simonyi Professor of the Public Understanding of Science, Oxford University.

In our last issue, the final sentence of Brian Alters' article was incomplete. This sentence should have read, "Given this equality we will teach for understanding and belief of all scientific facts."

NEWS

Tippecanoe and Creationism Too

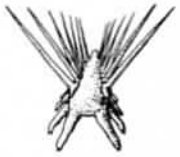
Eugenie C Scott
NCSE Executive Director

In April, 1997, NCSE received word that the central Indiana Tippecanoe, Board of Education had been approached by a member of a group called "Men for Creation", who complained that he thought students should be informed of "both theories" (creationism and evolution) in science class. A committee was appointed to draft a proposal for the inclusion of creationism in the science curriculum. NCSE sent a letter with many enclosures to the chair of the proposal committee informing her of the legal and pedagogical problems of teaching creation science and offering to advise the district on ways to handle this sensitive issue so as to preserve the educational integrity of the district curriculum. The letter was never answered nor acknowledged.

During the summer of 1997, the Tippecanoe Valley schools will consider this proposal, which will affect middle- through high-school students. Copies of the proposed policy were unavailable when requested either by reporters or NCSE, and administrators did not return calls from NCSE. They have also not been forthcoming as to when the policy will be presented to the public. We do not know precisely what the school district is proposing, but school officials who have been quoted in newspaper articles indicate that the plan is to "balance" the teaching of evolution with special creationism.

Yes, creationism — not even creation "science", it appears, but good old, biblical creationism, Adam and Eve and all. One would think that most districts would have figured out that the First Amendment to the Constitution calls for religious neutrality in public institutions such as schools and that presenting special creationism and evolution as equally valid would clearly be advancing not only religion in general, but a specific, sectarian religious view. One would think that most districts would have figured out that if the Supreme Court has declared creation "science" to be unconstitutional, so would biblical creationism. According to a reporter, the district did not consult its legal counsel while drafting the policy, which upon reflection, seems obvious.

NCSE will keep you posted on what happens.



Australian Geologist Plimer Loses Lawsuit

Eugenie C Scott
Executive Director

In 1992, Melbourne University geology professor Ian Plimer initiated legal action against Allen Roberts and the organization Ark Search under Australian laws regarding copyright and fair trades practices. He sued on the grounds that the creationists were engaged in misleading and deceptive conduct while engaged in trade and commerce. On April 7, 1997, the trial began in Sydney.

Australia does not have a statute comparable to the USA's First Amendment calling for religious neutrality in public institutions, thus scientists and others disturbed about inroads creationists are making in Australian schools cannot use the legal approach Americans have relied upon to defend science classes from religiously-based dogma. Plimer's novel legal strategy was to argue that because Roberts and his Ark Search companions claimed scientific evidence of having discovered the final resting place of Noah's Ark in Turkey, he was guilty of scientific fraud and misleading and deceptive conduct. Because Roberts and Ark Search raised money from the public to support their expeditions by selling tickets to lectures, and also sold books, videos, and other materials, Plimer argued that they were engaged in business fraud. Other points raised in the lawsuit were allegations that Roberts/Ark Search plagiarized drawings of the Ark from a book written by an American former "Arkaeologist" David Fasold and that Roberts's claim to be "Dr." Roberts was also false and misleading because his degree came from a Florida diploma mill.

The trial proceeded more quickly than either side had anticipated and was over in seven days. The Australian Skeptics web page offered a running commentary on each day of the trial (<www.skeptics.com.au>). There was considerable interest in the trial in the Australian media, which followed it closely, and there were follow-up stories in the British science journal *Nature* and also in *Science* magazine.

After what seemed like a very long wait, Judge Ronald Sackville issued his decision on June 2. A carefully-worded document of close to 100 pages, the decision clearly attempted to avoid getting caught in the molasses swamp of science versus religion. On the plagiarism issue, Sackville determined that Ark Search had indeed appropriated David Fasold's illustrations, and awarded him A$2500. He ruled against Plimer on the fair trades practices issue, saying that Ark Search and Roberts were not in fact, engaged in business or trade as defined by the relevant statutes.

In support of Plimer's main claim, however, Sackville agreed that Roberts had made false claims about having conducted scientific tests at

the site of the Ark, saying, "these representations were false and, had the Fair Trading Acts applied, would have constituted misleading or deceptive conduct on Dr. Roberts's part".

The judge also expressed reservations about free speech rights, questioning whether even false statements of the sort Roberts had been making might be allowable because of their religious content. The judge wrote:

> "Moreover, in my view, considerable care must be exercised before making orders restraining statements made in the course of public discussion on issues regarded by many people as important to their religious or ideological beliefs, at least where the motivation for making such statements is not primarily commercial in character. Unless caution is exercised, there is a serious risk that the courts will be used as the means of suppressing debate and discussion on issues of general interest to the community."

Free speech was important to both sides, however, as the precipitating events that encouraged Plimer to take a strong stance against Australian creationists occurred when he and other scientific colleagues were thrown out of public auditoria for the audacity of asking questions about geology and other sciences that Roberts could not answer.

Plimer's solicitor, Greg Judd, has told NCSE that they are planning to appeal, arguing that the activities of Roberts and Ark Search do indeed constitute trade or commerce. It is highly significant that the judge agreed with Plimer on the substantive issue of the falsity of the claims about scientific investigation at the Turkish site, validating Plimer's fact claims. Appeals typically take 3-6 months, and are heard before 3 judges.

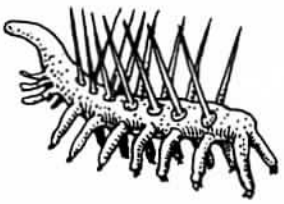
Plimer and his wife had earlier sold their house to finance the lawsuit and under Australian law have had to pay costs up front as the case has progressed. Although he has benefited from a donation of over A$100 000 from an anonymous benefactor and has also received assistance from the Australian Skeptics, Plimer is near bankruptcy. As the loser, Plimer also will be responsible for paying Roberts' costs, estimated at over A$300 000. After the announcement of the judge's decision, Australian Skeptics chair Barry Williams wrote me,

> "My phone hasn't stopped ringing today with people offering support, financial and otherwise, for Ian. ... Included among the support was a subscriber (an electronics technician) who took a whip-around among his work mates and visited me in his lunch hour today to present me with a cheque for A$100. I have had calls from people in Sydney, the Gold Coast, and Perth saying they were sending donations. An Anglican minister rang to ask how he could help raise some money for Ian."

He went on to say,

> "There is no doubt we are winning the PR war hands down. We have never had so many calls in such a short time over any other issue. At last people seem to be waking up to the dangers inherent in letting fundamentalists go unchallenged."

(Those wishing to donate to the Plimer defense fund may contact the Australian Skeptics at their web site, mentioned above, or write to Reverend Brian Nicholls, OAM, 511 Mcgowan St., Broken Hill, New South Wales 2880, Australia.)



Near Miss in North Carolina

Molleen Matsumura
Network Project Director

An "evolution as theory" bill came close to being enacted by the North Carolina state legislature. While the text of bill HB511 omits religious language, it employed terms like "scientific literacy" and the claim that "evolution...is not true science" (see sidebar, House Bill 511). The sponsors made their religious motivations clear. In an opinion piece in the April 1 issue of the *Greensboro News & Record*, Edward Cone quoted the bill's author Russell Capps as saying "'I'd like to see the Bible in the classroom,' hastening to add that his bill simply describes evolution as theory rather than unquestionable fact." Cosponsor Michael Decker also remarked, "We have a lot of young people who are losing their faith. We need to make certain that our schools do not teach something contrary to what young people are taught in their churches and their homes."

NCSE observers report that discussions of the bill in the House Education Committee were dramatic and filled with complex legislative maneuvering. One member, Rep. Hensley, actually contacted Harvard paleontologist Stephen Jay Gould and invited him to testify against the bill. When Gould responded that his schedule would not permit him to visit North Carolina, Hensley sent him a transcript of Capps's critique of evolution and later read Gould's reply to assembled committee members. At one point, Capps actually withdrew the bill, which he felt had been eviscerated by amendments, then re-introduced it.

Capps's bill became a major focus of media interest and public discussion. The North Carolina Academy of Science and the University of North Carolina-based Math-Science Educators' Network officially opposed HB511, and the North Carolina Science Teachers Association, fearing that passage of the legislation would lead to reprisals against science teachers, distributed a letter from NCSE Board member Fred Beyer urging teachers to contact their legislators. One newspaper, criticizing the bill as bad science, offered a "history lesson" invoking the memory of Senator Sam Ervin, known outside the state for his role in the Watergate hearings. Ervin's opposition to an earlier anti-evolution bill had been crucial.

Despite such active opposition, the bill passed on the House floor, as observers had predicted. However, as the legislative session draws to a close, the Senate Education Committee is concentrating on other legisla-

tion, and HB511 is unlikely to be discussed. Beyer and other NCSE activists in the state are breathing a sigh of relief — then taking another deep breath and preparing for the possibility of a new anti-evolution bill in the next legislative session.

[NCSE thanks State Liaison Linda Wolfe, Board member Fred Beyer, and members Denis Dubay, Charles Keeling, R. Byrd Humphreys, and Rob Day for their first-hand accounts as well as reports of media coverage.]

Evolution Too "Controversial" for Illinois Schools

Molleen Matsumura
Network Project Director

A large, industrial Northern state may be about banish the word "evolution" from its science curriculum standards. Acting on a mandate from the state legislature, the Illinois Board of Education has developed new learning standards for a number of subjects, including science. Learning standards are supposed to define appropriate content for meeting a number of goals, including the expectation that students will come to "Understand the fundamental concepts, principles, and interconnections of the life, physical, and earth/space sciences" (State Goal 12). Yet evolution, which has been listed as one of the major unifying concepts organizing the National Science Education Standards issued by the National Academy of Science, is never specifically mentioned in Goal 12 or anywhere else in Illinois' proposed learning standards.

NCSE members who contacted Board of Education staff learned that there had been no mention of evolution in the first public draft of the standards, but revision teams added a reference in response to extensive public comment, as well as the recommendations of expert reviewers. However, according to a letter from the Superintendent of Education that was released with the final "Proposed Learning Standards", members of "an External Review Team consisting of parents, educators, business people, civic leaders, and representatives of family groups 'recommended' that no '*controversial content which was not included in the draft previously disseminated for public review would be included*'" (italics in original). Goal 12, Standard A now reads, "Know and apply concepts that explain how living things function, adapt, and change".

As NCSE member David Bloomberg commented at the June 11 meeting of the board, the vague wording of the standard can refer to individual or short term changes such as "my blood pressure's changing during the day". While "benchmarks" expand-

NC HOUSE BILL 511 MARCH 13, 1997

Sponsors: Representatives Capps, Aldridge, Barbee, Brown, Cansler, Davis, Decker, Eddins, Ellis, Hill, Howard, Kiser, McMahan, Nichols, Nye, Reynolds, Shubert, Starnes, Warner, Weatherly, C. Wilson, and G. Wilson.

A BILL TO BE ENTITLED AN ACT TO AMEND THE PUBLIC SCHOOL LAWS TO ENSURE THAT EVOLUTION IS NOT TAUGHT AS FACT IN NORTH CAROLINA PUBLIC SCHOOLS.

Whereas, understanding science is essential for the survival of a free, democratic society; and

Whereas, the Mission Statement of the North Carolina Teacher Handbook Science K-12 declares that all students become scientifically literate; and

Whereas, modern scientific methods have shown that life is exceedingly complex and there is no present satisfactory scientific explanation for the origin of life from nonlife; and

Whereas, scientific literacy implies that students receive substantial knowledge of concepts and process skills which enable the individual to continue to learn and think logically; and

Whereas, science depends upon the use of proven facts and testable hypotheses; and

Whereas, the theory of evolution is a belief and not true science and should not be taught as fact, nor should student attitudes "be a part of an achievement score"; and

Whereas, there are ample opportunities to teach biological facts that are true, useful, and relevant to the student and useful throughout life; and

Whereas, the teaching of evolution as fact, when it cannot be scientifically proven, requires students to accept the teaching by faith; and

Whereas, the technology used to define evolutionary theory is vague and misleading, and some public school teachers and all presently approved biology textbooks present evolution as fact with many unproven misconceptions and untruths;

Now, therefore, The General Assembly of North Carolina enacts:

Section 1. Chapter 115C of the General Statutes is amended by adding a new section to read:

115C-81.3.

Students shall be taught true science and not belief. The State Board of Education and local boards of education shall ensure that students in North Carolina public schools are not taught evolution as proven fact.

Section 2. This act becomes effective July 1, 1997.

[Thanks to David F Austin, Associate Professor of Philosophy Department of Philosophy and Religion, NCSU, Raleigh for transmitting the text of this bill.]

ing upon the standards refer to evolutionary processes and supporting evidence, the fact is that the "e" word never appears. Teachers who use the most accurate term to describe what they are teaching are given no protection from parental complaints. Worse, the External Review Team's report says only that the state "could provide examples and support materials to assist local districts in deciding when, where, and how to teach these [omitted, "controversial"] subjects. Since evolution is one of the topics omitted from the revised "Draft Standards" before they were submitted as "Proposed Standards", districts that choose to teach it could be forced to rely on limited, local resources.

At press time, the Board of Education is again receiving comments from the public. It is impressive that there had been so much public support for evolution, and if there is more such support, the board could decide to override the Review Team's recommendations. If they do not, it is likely that evolution education will become a local option, and many Illinois students will be denied the opportunity to learn about the major theory unifying biological knowledge.

Fairfax County School Board Rejects Textbook Disclaimer

Molleen Matsumura
Network Project Director

On May 29, the Fairfax County (Virginia) School Board voted 6-4 to reject a plea to add an anti-evolution disclaimer to biology textbooks in use at Thomas Jefferson High School. The original complaint against the textbook was made by Bob and Vicky Carr, parents of a Jefferson High student, who claimed that their religious beliefs had been disparaged (*NCSE Reports* 1996 Fall; 16[3]:16). When the complaint was referred to a standard review procedure, and the parents said they did not have time to attend review committee meetings, William Nowers, president of the local chapter of the American Family Association (AFA), stepped in on their behalf. When a school site committee meeting in February refused either to drop the textbook or add a disclaimer, Nowers promised to appeal to a county committee (*RNCSE* 1997 Jan-Feb; 17[1]: 5).

The text in question, *Biological Science: A Molecular Approach*, had not attacked "creationism" but "*creation 'science'*". After differentiating between science and non-science, the text continues, "These characteristics do not exclude creationism from a place in the school curriculum... [but] strongly suggest that creationism should be taught as a religious belief and not as a *scientific theory*" (p 16).

The controversy drew national attention, and the *Washington Post* published a letter from Joseph D. McInerney, Director of Biological Sciences Curriculum Study (BSCS), the group that authored the textbook, declaring, "[T]here would be no dispute if creationists did not use the oxymoron 'creation science' in an attempt to legitimize scientifically a view of the natural world that is grounded in revealed truth. If, for example, they had stuck with the phrase 'creationism', BSCS would not have to point out that their position has no scientific basis....We will make no changes to the language now included...Any disclaimer, therefore, will come from the school district." Meeting on March 20, the district committee upheld the decision to use the book without any disclaimer, and Nowers appealed to the school board (*Fairfax Journal*, March 31, 1997, p 1).

By the time the school board met on May 29, the proposed text of the disclaimer had changed. An earlier version quoted in the *Washington Times* had read in part, "This book, in treating evolution as an established fact, overlooks the lack of science in the Big Bang... and the leap in logic taking variation within a species to evolution of another completely different species.... The creation belief is dismissed solely because more religious groups believe it..." (May 30, 1997, p 11). The disclaimer proposed in Nowers' letter of appeal read simply:

> FCPS disclaims and regrets the disparagement and ridicule of persons having faith in the Creator of the Bible because this textbook
>
> (a) infers that they do not believe scientific observable microevolution while rejecting the theories of macroevolution;
>
> (b) states that their religious faith in the laws of the created order is "pseudoscience;" and
>
> (c) associates them with astrology and "miracle cures" that the Bible calls witchcraft.

While some board members argued that the issue was one of enforcing a district policy that forbids either disparaging or advocating religion, another commented, "Sorry, this is about creationism....And I hesitate to be lectured to about disparaging religion from an organization that says I'm not part of this nation because this is a Christian nation. This is...a nation for all faiths."

On July 1 the AFA responded to the board's action by filing a lawsuit asking that a label be inserted in the book "that apologizes for the text's characterization of creationism as a pseudoscience". The Carrs are not involved in the suit; plaintiffs are other AFA members with children in Fairfax County schools. One plaintiff, Linda Harth, commented, "[W]e believe in creationism and we are responsible to make sure our children understand Christianity." NCSE will keep members informed of further developments.

[NCSE thanks Douglas McNeil for providing newspaper reports, copies of correspondence, and personal observations. McNeil's commentary on the Fairfax County controversy will be published in our next issue]

Arizona Regent Protests Evolution Institute Move

Eugenie C Scott
NCSE Executive Director

In April 1997, the Institute for Human Origins (IHO), a not-for-profit paleoanthropology research institution located in Berkeley, CA, completed negotiations with Arizona

State University to move to that university in July 1997. NCSE Supporter Donald C Johanson will remain Director of the Institute, and senior staffers William H Kimbel and Kaye Reed will hold dual positions as Institute scientists and members of the ASU Department of Anthropology. Also moving to Arizona with IHO are geochronologist Robert Walker and paleoanthropologist Eric Meikle and support staff.

The move is viewed by both IHO and ASU as being to their mutual advantage: ASU receives a prestigious research institution and IHO receives partial financial stability and the many administrative and scholarly advantages of a university affiliation. Johanson and his staff were looking forward to mentoring graduate students.

Of particular interest to NCSE members, however, is the response of Arizona Regent Kurt Davis when asked to approve the University's association with IHO. Although voting to approve the arrangement, he added an amendment that ASU would "come back with a plan that would implement and examine the use of courses to offer alternative theories, as well." The ASU newspaper reported that, in a memorandum to other regents, Davis expressed concern that "we will expend tax dollars to continue research and create debate from only one perspective" (*State Press*, April 28, 1997). The Board of Regents voted unanimously to approve Davis's motion.

Letters to the editor in local Tempe papers varied from support to criticism of the regents' decision, some assuming it would require the teaching of creation "science" at ASU. As NCSE members know, "alternative theories to evolution" is a popular euphemism for creation science, but the wording of the resolution is vague. Reportedly, both the religious studies program and science departments are uninterested in presenting "alternatives to evolution". Administrators appear to be uncertain as to what to do about Davis's suggestions, which also raises questions regarding Regents' authority to determine curricula.

UPDATES

National: The US Court of Appeals for the 10th Circuit will hear an appeal of a decision by the Federal District Court of Western Oklahoma which upheld a school board policy requiring students to attend school full time. Parents of seventh-grader Annie Swanson wanted to send her to selected classes in the Guthrie Independent School District while continuing home-schooling. The district, which does not receive state aid for part-time students, argued that allowing a student to attend only part-time "work[s] an economic hardship" and might affect their accreditation. The parents, who use home-schooling for religious reasons, argued that the policy violates their rights under the Free Exercise Clause of the First Amendment and under the Religious Freedom Restoration Act (RFRA); they claimed the policy was "based on a bias against Christian home-schoolers".

The Court held that no violation had occurred because the district had not denied the child access to public education. The Court also held that "[parents' right] to direct Annie's education is not absolute.... Nothing in the Constitution, federal or state, grants Plaintiffs the right to control public education on an individual basis." The Circuit Court decision could affect the way school districts respond to religious objections to evolution education. Observers believe that the June 1997 Supreme Court decision over-turning RFRA will weaken the Swansons' case.

Colorado: In February 1997, the Citizens' Project, a Colorado Springs organization "dedicated to upholding the traditional American values of pluralism, freedom of religion and separation of church and state", reported in its newsletter that The Classical Academy, which had applied for a charter in District 20, promised in its recruiting brochure to teach evolution and creationism "side by side" (*Freedom Watch*, February 1997). The Citizens' Project studied the charter proposal and found a strong emphasis on the Bible as well as "creation science", and when the District 20 School Board met in November 1996, both the Citizens' Project and the district's counsel warned of possible legal problems. The charter proposal was rewritten before approval was granted in December 1996. However, according to area attorney Doug Triggs, chair of the Project's Task Force on Science and Creationism: "It's hard to say how closely the school will adhere to the revisions and difficult to monitor the situation because parents and teachers within the school are unlikely to complain. We have to rely on reports from concerned citizens. Anyone who hears about 'creation science's' being taught in The Classical Academy or any public school in Colorado Springs should call us, or call NCSE. Then we can do something about it."

Massachusetts: On April 1, 1997, *The Framingham Tab* reported on a candidates' debate sponsored by the League of Women's Voters. Former State Representative Barbara Gray asked write-in school board candidate John Brown whether he supported prayer in schools and would tell the audience his views on Darwin's theory of evolution. Brown, a clergyman who works with the Framingham Interfaith Clergy Association, briefly drew back, then answered that he wouldn't "force my views on anyone," but that teachers and students should be able to pray if they wished. He also added that he "wasn't very familiar with" the theory of evolution. Brown was defeated in the local election.

New Mexico: In response to controversy about the omission of evolution from the state science curriculum (*NCSE Reports* 1996 Fall; 16[2]:18; *NCSE Reports* 1996 Winter; 16[3]:4-5), two bills were introduced in the state legislature in early 1997. State Sen Pauline Eisenstadt introduced a bill requiring state curriculum to conform with the National Science Education Standards including content standards about evolution, and State Rep Timothy Macko introduced a bill supporting the teaching of "various theories of scientific origins" (*RNCSE* 1997 Jan-Feb; 17[1]:4-5). While Eisenstadt's bill was passed in the Senate, it was tabled in a House committee before the close of the legislative session. Macko's bill was never reported out of committee. The Senate bill did have an impact, however; State Board of Education President Eleanor Ortiz had told a Senate committee that evolution would be restored to the science curriculum.

The Coalition for Excellence in Science Education, a group of scientists and concerned citizens, had submitted proposals that would improve the coverage of evolution in the Stan-

dards, and the board has invited public comment. It is hoped that improvements in content standards will assure that evolution has a place in the performance standards which define what students are expected to learn. While the Board of Education had offered assurances the performance standards would compensate for the short-comings of content standards, proponents of good science education are worried because the performance standards writing committee includes John Baumgardner, an adjunct faculty member at the Institute for Creation Research whose belief in Noah's Flood was featured in the June 16, 1997 issue of *US News and World Report*.

New Mexico, Silver City: In November 1996, in the wake of a State Board of Education decision to permit teaching of multiple "theories of origins", the Silver City School Board adopted a resolution stating simply, "The Board reaffirms its commitment to the teaching of science and the discipline of the scientific method." Dave Thomas, president of New Mexicans for Science and Reason, watched local television coverage of the meeting and reported to NCSE that when board member Gail Stanford was interviewed, she said that while she would wish, for example, for deceased people not to decay in their graves, that is just a wish, and "Wishes shouldn't be taught as science." While dissenting board members felt the policy was too vague, Thomas added, there were others who said it "didn't go far enough".

Ohio, Louisville: On December 9, 1996, a newly-elected school board, which now included "creation science" advocate Andy Aljancic, passed a resolution mandating that whenever evolution is taught, teachers must also teach about "evidences against evolution". Copies of the "intelligent design" textbook *Of Pandas and People* which had been donated to the district by a group headed by Aljancic (*NCSE Reports* 1993 Fall; 13[3]:1,5; *NCSE Reports* 1996 Spring; 16[2]:8) have now been distributed to some school classrooms and libraries, but NCSE members monitoring the district do not yet know exactly where the books are in use. The textbooks had been kept hidden for some time after they were donated, and the ACLU of Ohio had threatened to sue the district. It now seems likely that suit will be filed.

Virginia, Chesapeake: A local parent filed suit against the Chesapeake School Board after it decided not to change the science curriculum in response to her complaints. Beginning with the increasingly common complaint that a seventh-grade science text was presenting evolution "as fact, not as theory", Carol Johnson had gone on to request that evolution education be "balanced" with "creation science" and that the district purchase the creationist text *Of Pandas and People*. Some members of the Board of Education suggested placing a disclaimer in the textbook, but this suggestion was not adopted. Copies of *Of Pandas and People* were purchased for placement in the religion sections of several school libraries, where they will be available for individual use. Administrators assure NCSE that the books are not intended for use in science classrooms or for assigned reading.

[NCSE thanks Andrew Koenigsberg, David Thomas, Kim Johnson, Marshall Berman, Mark Boslough, Steve Edinger, and Douglas McNeil for information used in this article.]

Have The Creationists Already Won? or The Teaching of Faux-Biology

Richard Firenze

In his avant-garde little text, *An Ecological and Evolutionary Ethic*, Daniel Kozlowsky writes that, if fear makes you lock your doors, the thieves have already won. Logic and common sense aside, an apt comparison can be made for the way evolutionary theory is taught in many life science and biology classes in our public schools, that is, apologetically, fearfully, and tentatively — if at all.

Ironically, scientists and science educators seem in virtual agreement about the importance of understanding evolutionary principles as the unifying theme for the appropriation of the origin, history, and diversity of life on earth. At least thirty-two scientific organizations have gone so far as to publish specific statements advocating the use of evolutionary theory in science classrooms as a "megatheme" upon which an understanding of the life sciences must hang. Twenty-nine organizations of science educators, including the National Science Teachers Association, National Association of Biology Teachers, and the Society for College Science Teachers repeatedly publish articles in their respective journals in support of this same concept. Furthermore, at least thirteen religious organizations have produced documents supporting the dialectic, non-combative, nature of creation and evolution (Matsumura 1995).

recent evidence indicates that most students leave our science classrooms at all levels with great and grave misconceptions of ...[evolution].

In the past decade over one hundred texts have been published, many by the world's most eminent scientists, extolling the importance of evolutionary theory in science education. These examples give a flavor of scientists' and educators' views on this topic:

> The modern concept of evolution provides a unifying principle for understanding the history of life on earth, relationships among living things, and the dependence of life on the physical environment (Rutherford and Ahlgreen 1990, p 63).
>
> Evolution is the unifying concept, the commonality that ties all earth's life together (Keown 1988, p 40).
>
> For the science of biology, the theory of evolution provides a unifying framework within which many diverse facts are integrated and explained (Bishop and Anderson 1994, p 415).
>
> Evolution is the warp and woof of biology as the atomic theory is for chemistry. Biology no more makes sense without the unifying conceptual scheme of evolution than the elements could be ordered without an understanding of atomic theory (Mayer 1984, p 423).

Considering these position statements it would appear that educators and scientists alike support the now famous statement of Dobzhansky, "nothing in biology makes sense excepting the light of evolution" (1973, p 125). In fact, the argument for teaching evolution preceded Dobzhansky by some 100 years. The famed German biologist Ernst Haeckel argued for teaching evolution in his classic, but often overlooked, text *Freedom in Science Teaching*, published in 1879.

Despite this compelling cry from our scientific community, recent evidence indicates that most students leave our science classrooms at all levels with great and grave misconceptions of this vital concept (see, for example, Jungwrith 1977; Kargbo, Hobbs and Erickson 1980; Brumby 1984; Clough and Wood-Robinson 1985; Keown 1988; Bishop and Anderson 1990; Demastes, Trowbridge and Cummins 1992; Bizzo 1994). A number of other studies have shown a reluctant and confused public when it comes to a true understanding of evolutionary theory (Christensen

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and Cannon 1978; Bergman 1979; Fuerst 1984; Harold and Eve 1987; Cole 1988, Zimmerman 1986, 1987, 1990, 1991; Stewart 1992). In fact Sheler and Schrof (1991) report that only 9% of all Americans polled believed in the scientific view of evolution, and recent Gallop polls indicate that 47%, including a fourth of the college graduates, reported believing that "God created man [*sic*] pretty much in his [*sic*] present form at one time within the last 10 000 years" (Gallup poll results cited in Numbers 1992, p IX), while 58% of the American public favors teaching creationism in schools (Cole 1996). The National Science Foundation study *Science and Engineering Indicators* reported in May 1996 that only 44% of the respondents agreed with the statement "Human beings, as we know them, developed from earlier species of animals" (Schmidt 1996).

In one school parish in Louisiana, teachers have recently been "instructed" to read a disclaimer prior to any discussion of evolution, while the Alabama State Board of Education approved an insert for all biology texts stating that evolution is "a controversial theory some scientists present as a scientific explanation for the origin of living things" (Holden 1995, p 1305). Tennessee, Ohio, Georgia, and New Hampshire have recently introduced bills into their respective legislatures that would, for all intents and purposes, void the teaching of evolution as a true scientific concept (Schmidt 1996, p 422). So far, none of these bills has passed.

Although science may have tentatively reigned supreme at the state level, the local levels have often fared less well. The *New York Times* recently reported that in Wheat Ridge, Colorado a single student opposing the often-used Nova video "The Miracle of Life" because it depicts evolution as a "fact" has caused the school system to shelve its use until further review. The student argued that the video "went against his fundamentalist Christian beliefs" (*New York Times* 1994 Sep 1, p 1).

Evolution in the Curriculum

My own personal observations, as well as data collected from twenty-six years of teaching introductory biology at the college level, simply reinforce the view that misconceptions are widespread in our educational systems. This is consistent with both Volpe's assessment that "students enter college with vague and naive notions about evolution" (1984, p 435) and Ayala's critique that "we are doing a miserable job in our schools and in educating the public at large" (quoted in Schmidt 1996, p 422). Until recently my experience restricted me to personal observations and data collection primarily from undergraduates. However, a recent opportunity to develop and team teach a graduate workshop at an upstate branch of the State University of New York opened my observational and data collecting horizons. The title of the workshop was "Evolution and the Nature of Scientific Inquiry: Using Evolution as a Central Theme in the Life Sciences". As indicated by the title the general objective of the workshop was to explore mechanisms for the incorporation of evolution as a central theme and to strengthen each participant's academic and pedagogical background in this area.

The participants were 7th-grade life science teachers and 10th-grade biology teachers selected on the basis of a formal application which indicated both excellence in teaching and active involvement in professional development. All the participants came highly recommended by their science supervisors or their principals.

On the surface it all seemed relatively easy. A workshop that includes a host of talented faculty, bright, dedicated participants, and a topic which is being endorsed by virtually all scientists and educators can be nothing but successful; or so it seemed. However, I discovered that several of the participants did not cover the topic of evolution in their classrooms at all. This certainly did not come as a complete surprise, but surely a major disappointment.

I discovered that several of the participants did not cover the topic of evolution in their classroom at all. This certainly did not come as a surprise, but surely a major disappointment.

The true surprise came with the revelation that several of those who "admitted" to teaching a unit on evolution (none used it as a central theme) began their class discussions with what can only be called their own unconscious and cryptic "disclaimers". Certainly not of the magnitude of the Alabama variety, but perhaps serving the same insidious purpose. Many of the teachers professed to beginning the topic of evolution with statements designed to "soften its impact" on the student.

Some typical statements were:

> I know this is a controversial topic, but we need to cover it anyway.
>
> I'm not saying you have to believe this, but its part of the syllabus.
>
> What we are about to discuss is only one way of looking at the origin, history, and diversity of life on earth.

Such disclaimers are tantamount to relegating evolution to the "just a theory" category that creationist diatribe has called for for years.

Eugenie Scott (1996), Director of the National Center for Science Education, has asked "What makes well-meaning people fight so hard to keep children from learning a basic scientific principle?" Now I must ask, why do we, as teachers, feel so compelled to begin a discussion of this basic tenet of science with a host of qualifiers? Do we begin our discussions of the cell with "most scientists agree the data indicate that all living things are made up of cells. I hope this doesn't upset you"? Or initiate our discussion of the solar system with "While it may be somewhat offensive to you, the evidence indicates that the sun is the center of our solar system"? Of course not, nor should we! Granted these "theories" may not require a revision of the student's world view, but they surely required major conceptual changes during their nascent stages of development. Perhaps we just need more time, more evidence, more falsification attempts to fail, in order to feel more comfortable in teaching the concept of evolution as it should be taught.

Perhaps Daniel Dennett (1995) got it right when he said:

"What makes well meaning people fight so hard to keep children from learning a basic scientific principal?"

> In due course the Darwinian revolution will come to occupy a similarly secure and untroubled place in the minds — and hearts — of every educated person on the globe, but today, more than a century after Darwin's death, we still have not come to terms with its mind boggling implications (p 19).

The question is, how long is this "due course" going to take and what shall we do in the meantime?

Surely avoidance of the topic, apologetic approaches, or misrepresentations of the concept of scientific evidence are not the answers. Madeline Grumet (1988) addresses this point when she says that although we should not "substitute" creationism for evolution in those communities who favor a religious rather than a scientific explanation of natural history...[we also should not]...teach evolution to children who are taught to believe in creationism at home without acknowledging and addressing the conflict that they and their families experience as they negotiate these opposing belief systems" (p 176). However, it is one thing to acknowledge conflict and quite another to fear it to the point of misrepresentation. I acknowledge creationist point of view for what it is, simply not science. Perhaps we could call it an art, and while doing so recall what Picasso has said, "Art is a lie that helps us discover the truth." As Craig states, "If [science as a process] can be communicated, kids will be able to see for themselves that 'creation science' isn't science at all" (1996, p 1321).

The most frightening part of this whole thing is that teachers who are "going out on the limb" to teach a basic principle of science — one which should be used to tie together the entire field of biology — may be doing as much harm, if not more, to both the understanding of the process of scientific inquiry and evolutionary theory as those who choose to ignore the topic altogether.

Evolution's Places in Education

From the Huxley/Wilberforce "debate" in 1860 through the Scopes Monkey trial in 1925 to today's call for "balanced treatment" or "intelligent design" legislation, evolution continues to be not only biology's greatest unifying theme and most misunderstood concept, but also the "scientific and educational community's lightning rod for public interest" (Cobern 1994, p 514).

Despite the fact that Mayr calls Darwin's publication of *The Origin of Species* "the most far-reaching of all...intellectual upheavals" (Mayr 1992, p 1), this process did not take place in an atmosphere void of dissent and disbelief. In fact, the debate on "origins" preceded Darwin by some two millennia with the writings of Empedocles and Aristotle in ancient Greece and has been virtually continuous ever since. However, no one can doubt that it was Darwin's work that truly brought the issue to the forefront in both science and society.

Initially Darwin was both cheered and chided by scientists and clergy alike. However, in the five years following the publication of *The Origin of Species*, the idea of organic evolution "had captivated most British and American scientists and was beginning to draw favorable comment from religious leaders on both sides of the Atlantic" (Numbers 1992, p IX). In fact, at the time of Darwin's death some two decades later, much of the scientific community as well as the public seemed to accept his theory. According to Desmond and Moore in Darwin's obituaries "none of the papers saw any religious obstacle to an Abbey Burial.... *The Standard* said, 'true Christians can accept the scientific facts of evolution just as they do Astronomy and Geology.'...While the *Daily News* stated that 'Mr. Darwin's doctrine is quite consistent with a strong religious faith'" (1994, p 670). And there can be little doubt that today most Christians who understand the difference between methodological and philosophical materialism find little difficulty in the acceptance of these two apparently dichotomous concepts.

Preparing Students for Evolution

Cobern (1994) agrees with Mayr (1992) that it is "belief" in an alternative view that prevents our students from accepting the tenets of evolutionary the-

ory. In this regard, one could conclude that the creationist movement has indeed been successful. Cobern continues to argue that curriculum changes in teaching evolution have failed because they failed to recognize that for most students, evolutionary concepts are simply "unbelievable" given their personal world views, which in most cases, include the acceptance of special creation. He feels that in order to get at the root of the problem we must ask ourselves the very basic question, "What is the goal for teaching evolution? [Are we out to] improve understanding or change belief?" (1994, p 584). He posits that we must address the concept of "belief" directly in the classroom if we can ever hope to improve evolution education. But addressing "belief" does not mean that we should teach that all beliefs have scientific support or are equally valid and sound as a basis for scientific inquiry.

Although the acceptance of special creation may, in fact, be at the root of our students' (and perhaps our teachers') rejection of evolutionary theory, many researchers have postulated alternative hypotheses. Lawson and Thompson (1988) take a Piagetian view and argue that evolution is too difficult for elementary, middle, and high school students, who have a tendency to work only at the concrete level and have not yet reached the level of formal operations. Hallden (1988) feels that student difficulties with evolution lie in their inability to understand abstract concepts of genetics and how it relates to natural selection. NCSE Executive Director Eugenie Scott has stated that most "critics of science and evolution criticize from a serious lack of understanding of how science works" (Quoted in Barbero 1994).

Agreeing with Scott, Murray Gell-Mann (1994) feels that it is our general misunderstanding of the term "theory" that lies at the roots of our misconceptions. Rather than considering a theory a "coherent systems of rules and principles, a more or less verified or established explanation accounting for known facts or phenomena, [most people consider it] a speculation, a guess or conjecture" (p 91). Rosen (1989) takes a more simplistic view when he argues that most educators have simply failed to teach evolution at all, or have failed to teach it effectively.

Certainly in these regards the Vygotskian (1978) notion of the "scientific concept" seems highly appropriate. Defined as "a regularity in events or objects designated by labels which requires the formation of theoretical generalizations for its appropriation, [which] cannot be appropriated by empirical abstraction" (Schmittau 1993), it could be argued that students, as well as teachers, simply do not appropriate evolution in this fashion. Perhaps teachers focus their teaching of evolution on the non-essential (phenotypic or everyday) attributes rather than on the essential (genotypic or scientific) attributes which are truly necessary. Davydov (1990) refers to this as emphasizing "external similarities" over "internal kinship" (p 155), and it seems highly likely that such emphasis would indeed lead to misconceptions since the basis for evolution is this "internal kinship". This is surely an area which is in need of further study.

If we agree with Rosen, Scott, and Gell-Mann, that students, as well as the general public, demonstrate a serious misunderstanding of the scientific process in general, and of evolution in particular, then I think we can also agree with Cobern and Vygotsky that this misunderstanding more than likely stems from the way science and evolution are presented in our classrooms. Is science taught as it should be — as a way of knowing (Moore 1993) — or as an accumulation of known facts, simply adding to our already achieved knowledge of ontological reality? Mayr (1984) argues that "we must stop teaching science as packages of facts with which the student can retreat and be assured of truth.... [T]he tentative nature of science needs to be discussed" (p 425).

Is science taught as it should be — as a way of knowing... or as an accumulation of known facts, simply adding to our already achieved knowledge of ontological reality? Mayr... argues that "we must stop teaching science as packages of facts with which the student can retreat and be assured of truth.

Rollins College Provost Robert Marcus argues that we are not letting our students think or act scientifically. He posits that, while in the classroom, we are serving our students "full meals" when we should be inviting them into our kitchens to sort through the "ingredients of science" (Volpe 1983). However, sorting through these ingredients without the basic recipe of evolution can only result in an unpalatable culinary concoction. Smith (1994) warns us that in teaching the scientific basis for evolution we must not design our classes to "make believers lose [their] faith... [but encourage them to] look carefully at the difference between science and non-science" (p 596). Any and all of the preceding arguments seem plausible as explanations for the roots of our misconceptions and certainly all deserve further study.

As scientists and science educators we must identify, assess, discuss, and ameliorate the roots of our misconceptions in light of each of the myriad ideas discussed above, as well other recent developments in constructivist theories of learning and knowledge (Vygotsky 1978; Wheatley 1991; Shapiro 1994; Lerman 1996; Osborn 1996). Using these theories of knowledge we must develop methods and materials to convey effectively to our students the beauty, as well as the limitations, of the scientific process as a reasoned

series of arguments open to continuing refinement; and the elegance and importance of evolutionary theory to both the scientific and educational communities. This approach addresses the need for students to understand the fundamental role of evolution within biology without projecting the arrogance of intellectual certainty.

As Gross and Levitt tell us, "science is, above all else, a reality-driven enterprise" (1995, p 234). And the best way to teach the reality of life science, in the cohesive fashion that is demanded by both the scientific process and epistemological concerns, is through the use of a central theme that ties all the disparate facts together. Those of us in the life sciences are blessed to have perhaps the most obvious of all central threads. Let's use it with no apologies, no qualifiers, no disclaimers. I echo Gross and Levitt's lament when they say "Science courses must teach science. It's as simple as that" (p 253). Indeed, "rather than shying away from teaching about evolution...teachers should use evolution as the ideal opportunity for illustrating the nature of science" (Nickels and others 1996). All else is faux-biology and has no place in the curriculum of our public schools.

Those of us in the life sciences are blessed to have... the most obvious of all central threads. Let's use it with no apologies, no qualifiers, no disclaimers.

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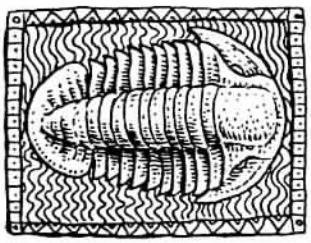

Talk.origins Now a Moderated Forum

John Cole
Contributing Editor

Recently, the owners of the electronic newsgroup talk.origins announced a change to a new moderated format. They emphasize, however, that there will be no change in the charter or discussion topics as indicated in the talk.origins charter.

From the charter of talk.origins:

"The newsgroup talk.origins is meant as a venue for discussion of the scientific, religious, and political issues pertaining to various theories of the origins and development of life and the universe. Within such basic guidelines, wide-ranging discussions over a large number of topics are covered, all relating back to the main purpose of the group."

The talk.origins frequently asked questions (FAQ) files are located at <http://www.talkorigins.org>. They contain a considerable amount of information about topics discussed on the group. A pointer to the FAQ Archive is posted monthly on the newsgroup.

The moderators invite questions about the group's moderation policy at: <talk-origins-request@ediacara.org>.

They're On The Way!

The NCSE Membership Directory project is nearing completion, and the directories will soon be shipped. This comprehensive volume is a compilation of the most current data available on over 3500 NCSE members, which was obtained from the questionnaire mailings and telephone verification.

All members who have reserved a copy should be receiving a directory some time in October. If you have a question about your order, or wish to place a new order, please contact our publisher directly at:

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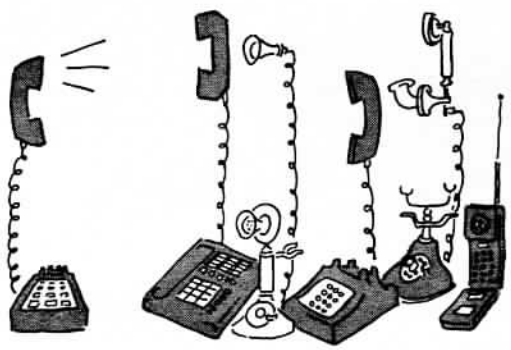
This new directory is an excellent way to communicate and share information with other NCSE members. To those who provided updated information — many thanks for your cooperation; and to those who ordered a copy of the directory — enjoy!



An Open Letter to NCSE Members

I am in the process of reading the book, *The Creation Hypothesis* edited by J.P. Moreland. I became intrigued by the attempts of the editor and other contributors to prove that science does not differ from non-science. I am also intrigued by the arguments and the extent to which the contributors from various disciplines go not only to disprove science, especially evolution, but to demonstrate that the only alternative to naturalism is intelligent design. They further try to demonstrate that the intelligent designer is not just any being or god, but specifically the God of the New Testament.

I am of the opinion that this book has the potential of creating further sociopolitical havoc in public school science curricula and textbooks at a more sophisticated level than that to which we are accustomed. I believe that in developing their major thesis, the contributors took every objection ever raised against intelligent design, or any of its corollaries, and analyzed and tried to refute them. Because of the nature of the arguments, I am of the opinion that the ideas and positions put forth in this book have to be countered.

Therefore, I am writing to request people with expertise in the following areas volunteer to assist in a project to help counter these new and somewhat more sophisticated attacks on science and evolution: astronomy, evolutionary biology, geology, geophysics, linguistics, mathematics, paleontology, physics, physical chemistry, physical biochemistry, philosophy of religion, and philosophy of science.

Anyone with expertise in any of the above areas who is interested in assisting with this project please contact me at Department of Biological Sciences, University of South Alabama, MOBILE AL 36688. Telephone: 334-460-7527; FAX: 334-414-8220; sgottlie@jaguar1.usouthal.edu.

I look forward to hearing from you. Thanks for your cooperation.

Sheldon F Gottlieb PhD

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Hiram Caton
Griffith University

Late in 1995, *Time* published a cover story, "Evolution's Big Bang", that described current work on the explosion of taxa in the course of ten million years of the early Cambrian. Between 543-533 million years ago (MYA; using zircon dating), phyla appeared in sudden profusion. Many were momentary, but the survivors comprise over ninety percent of existing taxa. Multi-cellular micro- and macro-organisms originated then. So did complex ecosystems, complex morphology, the immune system, and the nervous system. For a moment evolution traveled at "supersonic speed", said *Time*. The explosion was unique; nothing quite like it has happened since.

Darwin's contemporaries knew about the challenge that the Cambrian held for gradualistic models of evolutionary change, and Darwin worried how to explain it. More recently the Cambrian stimulated the punctuated equilibrium model of evolution's tempo. "Punc eke" is an oscillation described by nonlinear dynamics. The concluding section of the *Time* essay was devoted to nonlinear approaches to saltations. It is titled "Beyond Darwinism". A leading exponent of chaotic complexity, Stanley Kauffman, said that "these patterns of speciations and extinctions, avalanching across ecosystems and time, are to be found in every chaotic system — human and biological".

The student who showed me the feature article said excitedly "that's what you told us in the Darwinian Revolution course!" Her enthusiasm was catching, and for a moment I congratulated myself on having scooped *Time*, despite the fact that *Time's* science news tends to be on the trailing edge. Still, if such an article could be meaningful to Jenny, it would probably be meaningful to other students; and the graphics aren't bad either. So in deference to the big virtual classroom — the media — I decided to make some color overheads and include the feature in the course materials for "The Darwinian Revolution". We used these materials to illustrate the development of evolutionary thinking and as a way of engaging the students in active learning about the history and complexities of evolutionary theory.

THE SETTING

"The Darwinian Revolution" is a required course in the History and Philosophy of Science major at Griffith University, an institution which enrolls 21 000 students on six campuses. Staff from the science and humanities faculties collaborate in teaching eight core and elective subjects. Enrollments vary between courses, from 25 to 80, although enrollments are stable in each course.

The Darwinian Revolution enrolls 30-35 students, of whom about a third study science or technology; the remainder are humanities students. I share the teaching duties with Richard Yeo, a science historian and author of *Defining Science: William Whewell, Natural Knowledge, and Public Debate in Early Victorian England*. The prerequisite is completion of one year of university study.

Humanities students do not take university science courses, but many have completed high school biology, and most are keen on natural history documentaries. We boost this background by listing titles of documentaries available in video shops and in the library. For some it is easier just to tape television natural history documentaries, and they do. Lectures are illustrated by video clips and by color overheads. The lecture and assessment pedagogy are humanities-based; the controlling discipline is intellectual and social history.

We identify natural history/zoology as the field covered by the course. The identification provides continuity across the two centuries of scientific growth and links competing natural history theories and interpretations. It invites students to plug in their background knowledge of wildlife, conservation, agriculture, or animal husbandry. Finally, we encourage the use of personal narratives, from Darwin's *Autobiography* to Jane Goodall's *In the Shadow of Man*, as learning prompters in the hope that a good yarn from the field may make zoology more attractive. Creation "science" gets no mention because students don't bring it up. They also don't press us to discuss special creation, but we do anyway because it's integral to Darwin's story.

We divide natural history into Linnean and Darwin-

ian types. Linnean natural history is described as static and taxonomic; Darwinian as dynamic and explanatory. Some in-between things, such as Robert Chambers's speculative *Vestiges of Creation* and Linnaeus's own variation-on-archetype scheme, show that the classification is porous. Nevertheless, dichotomizing helps students appreciate the "revolutionary" conceptual transformation incident to any evolutionary natural history. Lamarck, Chambers, Spencer and Darwin are the four evolutionists considered, but extended attention is reserved for Darwin.

I say "appreciate" deliberately. This fuzzy learning category is our response to the lack of prerequisites and to the variation in student knowledge. We "fuzzify" by not requiring mastery of specific bodies of fact — for example, Linnean binomial classification or Cuvier's theory of archetypes. Instead, assessment by essay permits students to select a topic that matches their interests. There fuzziness stops. The essay questions require close attention to specific factual knowledge and relations among concepts, organized by historical inquiry.

A Dynamic Natural History

Since the transition from static to dynamic natural history is accessible through Darwin's intellectual itinerary, we visit his Cambridge years. Paley's *Natural Theology* and Lyell's *Principles of Geology* are highlighted as formative influences prior to the Beagle's voyage. The *Natural Theology* is a tour of natural history, organized by the apologetic intention to demonstrate the perfection of the Creator from the perfection of his creatures. This "God-in-the-details" was much to the youthful Darwin's taste, as was Paley's moral-aesthetic vision of nature as edifying object of admiration. We dwell on the resonances between Paleyan "perfection" and the mature Darwin's "adaptation". However, the mentor of the Beagle's voyage was Lyell, not Paley. Darwin met him shortly before his departure. Volume I of *Principles*, a state of the art geology and paleontology, had just been published.

Lyell's vision was decidedly Linnean. He rejected catastrophes as significant causal factors in earth history. He concluded that the mechanisms of subsidence and elevation observed in his own day sufficed to explain mountain-building as well as the disappearance of land masses in the past. Lyell was also a sharp critic of Lamarckism, which he equated with evolution. (Lyell wasn't brought over to evolution until shortly before publication of *Origin*).

These teachings sunk deep roots that shaped the mature Darwin. He never departed from gradualist geology, with its corollary that nature does not make leaps. (At bottom this is the principle of continuity, which Leibniz propounded in the idiom of rationalist metaphysics). We emphasize that Darwin applied Lyell's gradualism to species evolution when he finally made his own leap to dynamic natural history. Species are in motion, but very slow motion, like mountain-building, occurring by "infinitesimally small" cumulative steps. Gradualism involves the least possible departure from Linnean stasis, yet it changes the central task of natural history from taxonomy to the construction of a grand scheme of metamorphosis.

In the old scheme, natural history does not explain how each species came to be what it is. It is enough to demonstrate that it could not have come to be by chance. Such was the materialist view that Paley sought to confute by describing the complex functional fit of animals and their parts. The description discloses creatures as sublime artifacts. By contemplating their "perfection" (beauty), our finite minds come to know the divine mind. Natural selection, like Paley's God, is also a unitary causal agency (Darwin once styled it "my deity") but it works in a vast multitude of ways. The task of the naturalist is to discover how it works for each species; and this entails phylogenetic reconstruction, or in Darwin's language, tracing "descent with modification". So, the Darwinian naturalist has a new task unknown to the Linnean: explaining the evolution of each species and taxon.

To prevent students' sleep-walking past this earthquake, we rattle some bones. How many species are there anyway? How many taxa? In 1859, Joseph Agassiz published his count of 129 370 animal species. By 1910, over 522 000 animal species had been named. This is an immense biodiversity. And how many phylogenetic trees did Darwin construct? None; though he worked hard to compile the pedigrees of all domesticates back to the original stock, and Thomas Huxley produced his trace of the evolution of the horse. Our other bone-rattling is co-evolution, illustrated by overheads of color- and form-mimicry, plus descriptions of the amazing life cycles of a few common parasites. That usually boggles their minds. Later in the course we follow up this blunt instrument assault with refined samples from the debate on natural selection (Huxley, Agassiz, Richard Owen, St George Mivart).

In elucidating Darwin's key discovery, we safeguard against two distorting influences. The first is the shadow that neodarwinian thinking casts on the historical "Eureka." Students who know some genetics tend to superimpose recombination and mutation on the insight, which is also common in the secondary literature. We deal with the problem by identifying the undertow in Darwin's thought that pulls toward the modern synthesis. It is his study of artificial selection and his attempt to formulate a theory of inheritance. It is easily said that implicitly he "knew" about recombination and mutation, but lacked the language. We argue instead that he lacked the concepts as well. At the time of the "Eureka" (1838), Darwin had no theory of inheritance; the pangenesis theory lay decades

ahead. Even had Darwin thought out pangenesis by 1838, it would have been no help, since it is about as contrary to Mendelian "factors" as it is possible to be. Thus, although Darwin's insight logically requires a correct theory of inheritance, want of one didn't stop him having the insight.

To stouten this fence, we distribute a dozen quotations in which Darwin succinctly describes natural selection. One of the clearest occurs in "Variation of animals and plants under domestication". It begins by recalling a reverie on the Galapagos Archipelago, when Darwin "fancied myself brought near to the very act of creation." Galapagos fauna were variants of mainland species, but it was "inexplicable" how the "modification" occurred. The riddle would have "remained forever unsolved" had he not studied domestication, which gave him "a just idea of the power of Selection. As soon as I had fully realized this idea, I saw, on reading Malthus's *Essay on Population*, that Natural Selection was the inevitable result of the rapid increase of all organic beings; for I was prepared to appreciate the struggle for existence by having long studied the habits of animals" (Porter and Graham 1993, p 264). The thought seems to be this: domestication is near to speciation, but what in nature corresponds to the breeder? Superfecundity and the resulting inevitable struggle for existence form this ubiquitous and inescapable force.

Darwin likened it to "ten thousand sharp wedges packed close together and driven inwards by incessant blows, sometimes one wedge being struck and then another with greater force (Darwin 1968, p 119). To elucidate selection "force", students are challenged to stroll, in imagination, through a botanical garden and find ten wedges pounding away. One class burst into laughter when a student answered triumphantly: "ten gardeners". My alternative is nestling competition among ospreys because I have a stunning video showing how the stronger nestling, with the concurrence of parents, kills its weaker sib in competition for food. Here is nature "red in tooth and claw" sure enough.

Historical and Social Contexts

The next distorting influence arises from stress lines generated by the Internalist versus Externalist interpretation of the insight. Did Darwin know his own mind when he instanced animal "habits" to confirm ubiquitous competition? Or did he bring the capitalist economic vision of social relations to bear on the animal kingdom? And if the latter, is Darwin's theory at bottom ideology? Such questions are warranted in the course pedagogy, which considers Darwin as preserver and innovator in a specific cultural milieu. The milieu includes political economy.

Malthus's *Essay on Population* polemicized against utopian justice as violating the no-free-lunch premise of political economy. His novel knock-out punch was that the nasty law of population growth made resource competition inevitable. To read Malthus is to be exposed to the grim world of political economy, so it's implausible to argue that Darwin didn't have contemporary society in mind in the moment of his creative leap. But in preserving Malthus's insight, Darwin extended it to make differential mortality the force of evolutionary change — something that didn't occur to Malthus. Darwin never wrote a political tract but he did cultivate natural history for the next forty years. Therefore, his theory belongs to natural history, not political advocacy.

This might resolve the matter were it not possible to be an evolutionist without being a naturalist as well. Yet Chambers and Spencer were evolutionists without natural history, and so were the vast majority who accepted evolution in the last century. While Darwin labored to husband his evidence, non-scientists accepted evolution simply as a yarn. Chambers' speculative *Vestiges of Creation* drew scorn from naturalists, but Spencer's prestige was enormous among the learned and among general readers. His evolutionary vision proclaimed the principles of political economy — the "great god of competition" as Daniel Simberloff calls it (Simberloff 1988). Indeed, Spencer's trumpeting of capitalist progress reached its zenith even as natural selection was "eclipsed", as Peter Bowler puts it, by Mendelian genetics and by reconsideration of the natural history evidence (Bowler 1983).

Clearly many wanted to believe in evolution, and the will to believe was as marked among socialists as among liberals. But why? There is no want of answers. We suggest to students that a conceptual tidal wave of this magnitude locks in quite heterogeneous motives, for example, popular enthusiasm for technology, justification for European world dominance, justification for social reform and so on. If there is a common thread, it is probably that evolution provided ostensible scientific validation for the belief in the inevitability of social progress (thus reversing Malthus!). Meanwhile among naturalists, evolutionary progressivism was only a hypothesis and a contentious one at that. Darwin didn't endorse it.

This outcome, circa 1900, completes our elucidation of the difference between science and ideology. Social myth-makers co-opted the ensigns of science because together with nationalism it had emerged as the credible authority rivaling religion. While scientists were not immune to mythologizing — we instance Karl Pearson and Ernst Haeckel as makers of socially opportune evolutionary myths — still TH Morgan's development of chromosome theory in his Columbia University laboratory occupied a completely different cultural milieu — experimental science.

In a course constructed to exclude retrofitting his-

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Gould A La Carte

Stephen Jay Gould's role in developing the model of punctuated equilibria and his monthly column in *Natural History* have made him a popular writer who needs no introduction. NCSE carries many of his books for our members, including:
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Darwin's Dangerous Idea: Evolution and the Meanings of Life
by Daniel Dennett.
This very readable, 1995 National Book Award finalist was greeted with equal enthusiasm by leading scientists and

philosophers. Dennett thoroughly describes evolutionary science, including current controversies, then goes on to spell out its implications for modern philosophy and modern life. To persuade readers that "Darwin's idea is a universal solvent, capable of cutting right to the heart of everything in sight," Dennett avoids "highly technical philosophical arguments" in favor of "tell[ing] a story". 587 pages, paper. *List price $16.00, member price $13.00.*

Addison-Wesley Biology is a textbook sold for use in high schools. I have just been looking at the "new" 1996 version, which is virtually identical to the original 1994 version. In both, evolutionary biology is introduced in Chapter 13, "The History of Life". In both, the material at the end of Chapter 13 includes this "portfolio" exercise:

> 1. There are opponents to the scientific theory of evolution. Conduct library research on the various beliefs and on the evidence for other theories about the origin of life.

What frugality! In only 28 words the Addison-Wesley writers do three of the creationists' favorite numbers. They conflate beliefs with theories; they equate "evolution" with "the origin of life"; and they promote one of the creationists' favorite phrases — "other theories"; Not bad, huh?

[Contributed by Bill Bennetta, The Textbook Letter. *Bill may be reached at 707-778-8429 or <textbook@earthlink.net>.]*

Other Books of Note

Darwin's Dreampond
by Tijs Goldschmidt.

This book discusses the ecological-environmental disruption of Lake Victoria, which is to home to fish that group and speciate like Darwin's Galapagos finches. These species are now being decimated by the Nile perch, a prolific cash-crop fish introduced recently into the lake and called economic "saviors" by the local people. *Cambridge (MA): MIT Press. $24.95.*

Adaptation

edited by Michael Rose and George Lauder.

Adaptation is a new book from Academic Press edited by Michael Rose and George Lauder that will be of interest to many or our readers. It is not about humans, but it addresses the thorny fundamental problems involved in the study of adaptations. There are 14 Chapters, 511 pages, and the cost is $34.95.

Darwin's Black Box Illuminated

There is a wonderful web page by John Catalano all about Michael Behe and his views. It contains not only abridged comments from many sources, but a rich bibliography with links. Connect to <http://www.spacelab.net/~catalj/box/behe.htm>.

[Courtesy of Larry Lerner.]

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tory to today's concerns, how does trendy nonlinear dynamics get in the door? It gets in because we relax the ban on retrofits. It isn't good pedagogy to imply that the Darwinian revolution stopped at 1900. We have an extensive menu of update items: Lynn Margulis on symbiosis, the discovery of the ecosystem, the structure of eusocial cooperation, the emergence of cladism and molecular-based taxonomy; current debates on hominid evolution; jumping genes, somatic hypermutation, the new catastrophism, the new evolutionary timetable, self-organization theory. A different mix of updates is chosen on each passage of the course. The updates are presented as compare-and-contrast exercises that sometimes highlight continuity with Darwin, sometimes discontinuity.

An item that illustrates both the continuity and discontinuity of current evolutionary research is the discovery of somatic selection (sometimes called "evolution in a day") by the Australian scientist Ted Steele (Steele, Gorczynski, and Pollard 1984). Molecular biology is discontinuous with Darwin's natural history, which did not incorporate the cellular biology of his time. Nevertheless, Steele considers himself emphatically a Darwinian selectionist, even though somatic hypermutation is a directional (non-random) mutational process among variable region genes that he and his collaborators contend interprets Lamarckian acquisition of characters, such as acquired immune responses (Steele, Gorczynski, and Pollard 1984).

How can this be? Everyone knows that Lamarck and Darwin are antithetical! Ah, but they aren't! In pangenesis, Darwin acknowledged Lamarckian inheritance as a crucial supplement to natural selection. Absolute separation of the two modes of inheritance is the doctrine of neodarwinism. Steele and his collaborators make much of this historical quirk in contesting neodarwinian "dogmatism". They turn the tables of the "heresy" reproach by claiming to be the true paleodarwinians.

Somatic hypermutation comes with a misconduct option: two priority disputes. The story features David-sized Australian scientists battling in the columns of *Nature* and *Science* with titans at Harvard and Rockefeller Universities. Steele and collaborators were really steamed up. For nearly a decade their discovery was derided as a theoretical impossibility. Then, as its experimental reality came to be recognized (perhaps together with its Nobel potential), those titans rushed into print with claims of a "new" discovery. Steele countered with a plagiarism charge. *Nature* editor John Maddox eventually resolved the dispute by brokering a joint letter in which Steele withdrew the plagiarism charge while the Harvard scientist, John Cairns, acknowledged Steele's prior discovery (Steele and Cairns 1989; Steele 1989).

In the second priority dispute, a Rockefeller University scientist wrote in *Science* a history of the discovery that omitted any reference to Steele and colleagues (Thaler 1994), even though they published the first and the most research in this field. Those who credit that history will not know that there was a dispute about the authenticity of the process and hence will not know that the "Central Dogma" once ruled out somatic hypermutation (Temin 1989). Thus is revolutionary scientific change domesticated to normal science.

The priority dispute is a window on how heresies are sometimes normalized as consensus science. The pattern was ten years of resistance, then sudden expropriation of the contraband evidence under the auspices of "Big Science". A similar thing has occurred with the normalization of catastrophism. Recognition of continental drift and asteroid impacts, together with massive destruction and climatic change that they visited and five mass extinctions apparently correlated with impacts, are conventional wisdom today. Volcanoes are also known to be more destructive than was previously imagined. The flood basalt variety ooze lava for months, centuries, or millennia, creating large land masses (the Daccan Traps) and changing the mix of atmospheric gases. Some scientists promote the concept that flood basalt eruptions correlate with one or more mass extinction.

The normalization of the new catastrophism is very recent. The continental drift controversy, and later the Cretaceous-Tertiary (K-T) mass extinctions controversy, are among the most acrimonious in recent science history (LeGrande 1988). According to David Raup, who survived at the epicenter of the K-T row, it wasn't the scientific issues that got people mad. It was the Old Guard's refusal to give up uniformitarianism. He writes that "even an idle mention of the possibility that something in the history of the earth could be called catastrophic can produce showers of denial and abuse from many geologists" (1986, p 29). He reports a French colleague as saying that French scientists were reluctant to propose new theories in paleontology and evolutionary biology because "they have never gotten over the humiliation of the defeat of Cuvier's catastrophism" (Raup 1986, p 29). It is difficult to fathom that great scientists can cast so long a shadow — unless we remember that uniformitarians were defending a principle that Darwin absorbed from a geology text published 170 years ago!

Revising The Revolution

The course also addresses the retrofit that "synthesizes" Darwin with population genetics and its successor, self-organization theory. The population genetics generated by RA Fisher and Sewall Wright is an elaborate structure that supports an enormous range of "selections" that have slight foundation in Darwin's theory — balancing selection, selectively neutral mutations, random walk, r/K selection, kin selection, linkage disequilibria, and so on. These processes are

inaccessible to those lacking mathematical aptitude, including Darwin himself.

Darwin's blending theory of inheritance could scarcely have been formulated by a mathematician because its basic idea poses an insuperable quantitative difficulty. If parental traits blend in the offspring, parental variation is halved in the first generation, quartered in the second, and so on until the favorable variation is lost. Blending, if it occurred, would quickly reduce all diversity in a population to a monotonic set of traits; there would be nothing for selection to work upon. The muddle compounds when we notice that the theory doesn't account for the persistence of recessive traits that Darwin's own experiments with snapdragons confirmed (Oldroyd 1980, p 143). To extricate himself from this difficulty, Darwin postulated inheritance of acquired characters as the source of new variation. In this scenario, environmental variation induces somatic or behavioral changes, which are assimilated to the germ line.

I suggest to students that pangenesis is a typical muddle due to a qualitative approach to a phenomenon whose order is mathematical. Mendel, whose pea experiments were very similar to Darwin's snapdragon experiments, guessed at the unit character of inheritance and formulated the statistical rules of trait segregation. Although Mendel had read the *Origin of Species*, he did not speculate on how natural selection might operate on his laws of inheritance to generate new species. The probable reason, as we may guess from the criticisms of Darwinism by TH Morgan, August Weissman, Fleeming Jenkin and others, is that new species will not arise from recombination (Bowler 1983). Species genomes are extremely conservative. The velvet worm (*Peripatus onychophoran*), which has remained unchanged for 500 million years, seems to be the champion survivor.

The synthetic theory rescued Darwinism from eclipse by redefining evolution as any change in the frequency of alleles within a gene pool from one generation to the next. Darwin's "infinitesimally small" changes are now precisely defined. His error regarding fitness is corrected. It is not the slight advantage possessed by a few individuals that imparts competitive edge, but the mean value of an adaptation in a population. This "microevolution" is basically a gene pool in equilibrium, and it is not what Darwin imagined to be happening — constant accumulation for change that is driven toward speciation by a continuously applied selection pressure.

At the celebration of the centennial of the *Origin of Species*, there was, according to Ernst Mayr, "complete unanimity" that neodarwinism was "internally consistent and firmly established" (Mayr 1963, p 8). The picture is dramatically changed today. In 1972, Stephen Jay Gould and Niles Eldredge published their classic paper, "Punctuated equilibria: An alternative to phyletic gradualism" which gave direction to a thorough reassessment of paleontology that continues today (Eldredge and Gould 1972). During the same period, the Mendelian theory assumed by Fisher has been revised so far that it continues to be called Mendelian only by courtesy (Milkman 1982; Ho and Saunders 1984).

Mendelian genes are featureless except for the trait they determine. They recombine and occasionally mutate. Today's genes carry out a prodigious number of complex developmental and repair operations. They can split, transpose, amplify, excise, invert, back transcribe, and even hang themselves at the right time (the apoptosis gene). Genes acting on genes and gene products amount to endogenously controlled power of organisms to alter themselves, or to maintain a steady state. In a review of the implications of the molecular evidence for the interpretation for species stability and rates of evolutionary change, Thomas Schopf argued that the ensemble of actual and potential emergent properties of a specific genome organization, its latitude for self-organization, may be a nonselectionist source of evolutionary change (Schopf 1981; see also Thoday 1975).

But the adoption of these concepts were blocked until there was an alternative to Fisher's linear equations. This new non-Darwinian revolution is now running at full steam. I describe the revolution as consisting in the development of a genuine theory of emergence, in contrast to the "building blocks" model of development by serial accumulation of change. This concept is illustrated by videos of computer-generated fractals, cellular automata, and the like. We also refer students to a PBS documentary on the application of self-organizing theory to evolution. So the course concludes on a bright note. The great adventure in understanding the immense diversity and beauty of life has been revised and relaunched into an exciting future.

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Contemplating human origins in North Carolina (see story pages 5-6). Originally published in the Raleigh (NC) *News and Observer*, April 4 1997. Reprinted with permission.

Martian Life Science?

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Web Sites

Edward Babinski, author of *Leaving the Fold* and editor of the *Cretinism or Evilution* newsletter, has written to inform us of two web sites that he maintains which might be of interest to our readers. At <http://www.talkorigins.org/faqs/ce/> readers will find the home page for the newsletter.

At <http://www.infidels.org/mag/sr/1993/1/1brain93.html> Babinski has included excerpts from the Bible that discuss the nature of the human brain.

Emerging in Future Issues

Features

John Cole reports on the outcome of the ICR's "Geochronology" Conference in San Diego.

Scott Goodman brings us up to date on creationist activities in public education in British Columbia.

Andrew Petto reviews the pronouncement in support of evolution by Pope John Paul II and the arguments being raised against it by Answers in Genesis.

Readers respond to Brian Alters's article "Should student belief in evolution be a goal?" and Brian replies.

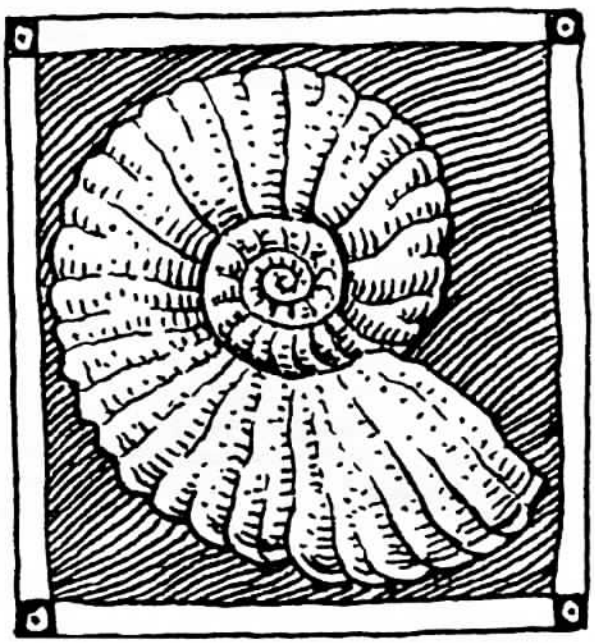
Articles

Lisa Blank and Hans Andersen survey what teachers-in-training think and know about evolution and its place in science teaching and compare their students to others in large midwestern universities. The news is mixed.

Richard Firenze writes more about misconceptions about evolutionary theory that emerged during intensive summer institutes on evolution for teachers. This article focuses on Darwinian and Lamarckian concepts.

John Fletcher gives us a primer on creationism that brings us up to date on strategies. Some of these are old regulars that never cease to amaze. Others are examples of the evolution of creationism.

Glen Kuban explores the reports of the so-called "plesiosaur" netted off the coast of Japan a few years ago. He concludes it is probably a basking shark. Read why.



NOW They Tell Us: Creationists Say Their Geochronology Has Problems

John Cole, Contributing Editor

To quote the Institute for Creation Research's *Acts and Facts* (1997 July 26[7]:5),

> "Numerous young-earth creationists have studied this issue [geochronology and radioisotope dating] and have published their views and results. However, most publications have been somewhat simplistic and have not addressed the problem thoroughly. Even though this issue has been recognized as a major problem for many years, there is no single authoritative document to which people seeking answers in this area can be referred."

"Ten leading young-earth creationists" met in San Diego on July 5th to address this matter, and presumably we will be hearing from them. It is interesting to note that the geochronology conference participants do not include any geochronology specialists or anyone who disagrees with the young Earth premise.

Meanwhile, it is interesting to read the confession that decades of smug pronouncements from the creationist camp — especially the ICR — have been self-admittedly baseless. Their critics have said so all along, of course. One cheer is in order for the effort to try to come up with some sound scientific argument based upon research in "the literature, by theory, and by experiment", although the conference is committed to pre-existing conclusions about the age of the earth and the errors of geochronology. Just possibly they will formulate ideas which can be critiqued and hypotheses which can be tested and falsified, at least by non-coreligionists, although skeptics should not hold their breaths awaiting such a breakthrough. These people know the answer but are going to try harder to prove it, they promise — an attitude which does not epitomize the scientific method which tries quite hard to prove basic tenets wrong and begrudgingly accepts them, the more they stand up to scrutiny.

Creationists like to argue that evolution is simply a "faith". They argue that, at best or worst, evolution and scientific creationism are equally based upon faith. Scientists, however, gain fame by trying to knock holes in accepted "orthodoxy" or commonly accepted ideas, while so-called "scientific creationists" literally sign oaths that they agree with ideas such as "young earthism" and a Noachian "Universal Flood" — and then they commence "research". It would be more impressive if creationists sponsored a conference dedicated to disproving basic "scientific creationist" tenets rather than simply trying to develop a better anti-evolutionist polemic.

Meanwhile, the age of the earth and observed, demonstrable principles of geology and geochronology remain the creationists' Achilles' heel(s), as they themselves seem now to admit. They assiduously avoid debating the topic (I once spent about 6 months trying to maneuver Duane Gish into a debate on this topic with an expert on it!), and now they are trying to shore up their defenses on one of their weakest fronts. We will try to report on their efforts.

CATASTROPHISM REVISITED

John R. Cole
Contributing Editor

Uniformitarianism is a (usually) naturalistic approach to phenomena which requires no miracles or unknown processes. This allows for catastrophes. It simply requires that catastrophes be "normal". For example, asteroid impacts are rare but likely events — especially over the course of time since the formation of the planet. Though they are rare, when they do occur their results are felt globally and are extremely disruptive. Yet the evidence is that the earth has survived such impacts at least a few times in the last few billion years and the organisms and habitats regrouped and recovered after each "hit". In this sense, these "catastrophes" were not really "catastrophic" as creationists and paranormalists would have you believe.

[Reprinted from a post to the talk.origins electronic forum.]

Multidisciplinary NSF Document Supports Evolution

Charles Keeling

It's not that often that you find nice, concise examples of multidisciplinary findings in science supporting evolution, but I've found a recent one that I thought was worth calling to your attention. You can find a one-page summary of recent research at either of two web locations maintained by the National Science Foundation (NSF). Connect to <http:www.nsf.gov/od/lpa/news/press/pr9729.htm> or <http://www.nsf.gov/pubs/1997/pr9729/pr9729.txt>. It's entitled "Evolution of fish antifreeze gene sheds light on climate history", and what's so neat about it is that it represents a *microcosm* of everything that evolution teaches!

- It shows an example of relatively *recent* evolution (within the last 14 million years).
- It provides *genetic* evidence for evolution (as opposed to strictly fossil evidence).
- One gene originated "whole cloth", as opposed to recycling existing genes.
- The dates cross-correlate with and fine-tune data from oceanographic studies
- It shows how *two different* species evolved *different* solutions to the same problem — one in the Arctic, the other in the Antarctic

I like this example not just because of the science it represents, but also because it provides good ammunition as an anticreationism argument:

A. Why would God have created different antifreeze genes for fish at opposite poles? We could easily demonstrate that the two species today don't care which polar ocean they happen to be swimming in — their anti-freeze works just as well in one as in the other!

B. Creationists believe that the early earth was clearly above freezing, so why the genes in the first place? If this is an example of later "variation within kind", then this adaptation must have microevolved within just the last few thousand years. But scientists have found fossils of extinct fish species that show this adaptation! So that means the adaptation in those earlier variations both evolved *and* went extinct all within those few thousand years! And if the *flood* was in fact what caused the first freezing on a global scale as some creationists believe, that happened within the span of only a year or so, which implies a vastly *faster* variation within the fishkind to keep up with such a rapidly-changing environment as these fish faced in the days during and immediately following the great flood!

C. It's odd that anti-freeze genes are found *only* in fish that live at the poles — they are entirely missing from most fish populations — does this suggest that the kinds of fish God created to withstand cold temperatures just "happened" all to migrate to the polar seas where they could take advantage of this unique trait, and not only that, but to the *right* polar sea — all of one species to the Arctic, all of the other species to the Antarctic? Not one fish got confused and migrated to the wrong pole? Or did this happen by miracle? Say, the fish were created in place and, therefore, *always*, had these genes.

D. Evolution predicts that you won't find antifreeze genes if you go back far enough in the fossil record (that is, farther than, say, 20 million years, or deep enough into the strata). This is certainly a testable part of the theory. Furthermore, since science says global cooling occurred simultaneously at both poles, evolution would predict that (a) the two species have never cohabitated (that is, they are a perfect example of species whose fossils have always been geographically isolated, so that their fossil predecessors would never be found together!) and (b) that the earliest examples of both species would show this rare adaptation appearing at roughly the same time in the fossil record. These predictions are all testable.

E. Science — not creationism — has identified the genetic carriers of this adaptation. Analysis of the gene structure of one of the fish species in question demonstrates how they evolved from *digestive* genes at a time that coincides with the global cooling that caused the polar ice caps to form; *and* the similarities with other earlier genes has been quantitatively traced and documented. In other words, we have corroborating evidence for the evolution of this gene in two separate events from genetic analysis, oceanographic studies, and the fossil record.

MEDIAREVIEW

Multi-Media Review

Darwin, 2nd edition.
by Pete Goldie, Lightbinders, Inc., San Francisco, CA.

Evolution.
Clearvue/eav, Inc., Chicago, IL and ZCI Publishing, Inc., Dallas, TX.

Reviewed by Laura L McMahon, Assistant Editor, RNCSE and Science Department, Monona Grove HS, Monona, WI

Students of evolution looking for multimedia reference materials have two new options that facilitate learning from high school through grad school. Clearvue/eav, Inc. has added a CD-ROM entitled, *Evolution*, to their catalogue of curriculum-oriented A-V materials. *Evolution* is a PowerCD aimed at orienting beginning evolution students to the concepts of natural selection, sources of variation, and speciation. More advanced students may find the Lightbinders, Inc. CD-ROM, entitled *Darwin*, 2nd edition, more appropriate. This multimedia CD-ROM includes a DynaText, electronic book technology collection of Darwin's complete works. Students of Darwin will find this CD-ROM an invaluable resource.

DARWIN, 2ND EDITION

Charles Darwin's most famous and most obscure writings are all included on this CD-ROM, from *The Origin of Species* and *The Descent of Man* to *On the Various Contrivances by Which British and Foreign Orchids are Fertilised by Insects*. Darwin's short papers are included as well as his 1200 page monograph on living and fossil barnacles (*Lepardidae* and *Balanidae*). The CD-ROM is rounded out by a bibliography of 1500 primary and secondary sources as well as a biographical dictionary.

The electronic format makes this book collection particularly easy to read, study, and write from. A "journal" feature marks your path as you proceed through the documents so that you can find your way back to previous passages. Annotations that can be left in the text include notes (very much like the sticky notepaper so many of us rely on!), bookmarks, and hyperlinks. Bookmarks are just as they sound — a handy way to mark your place so that you can return to Darwin's 1200-page mollusk monograph without having to scan the entire text. Hyperlinks are cross-references that you can create yourself as you move through Darwin's works.

All of these features make this CD-ROM a particularly valuable tool for exploring Darwin's works. The paper seems to write itself as you conduct your research!

EVOLUTION

The multimedia feature presentation of this CD-ROM is the more formal instruction of the package, taking the student through a multimedia lecture and "slideshow" on a wide variety of topics. At any time, a student can deviate from the presentation to look up words that have been highlighted in the glossary or words that are not highlighted in the 150 000-entry dictionary. For students who want even more information, there is a 24-volume, cross-indexed, concise encyclopedia that encompasses all areas of study.

As students proceed through the presentation, they can access questions that not only test the student's understanding of the program's content, but also spur them to explore related topics. These questions are explained as the students answer them with reference and access to information on other parts of the CD. One can also use the quiz mode to develop a timed quiz over the content material without allowing the student to access the CD's information during the assessment.

The format of this CD-ROM is easy to navigate, and the pictures and sound are very professionally done. The text is understandable for upper-level high school students; beginning high school students may have to spend more time with the vocabulary, referring to the glossary and dictionary, to benefit the most from the program.

The information presented in the program is accurate with the exception of a one-time misuse of the word 'interspecific' instead of 'intraspecific' in the discussion of variation of clines and demes. Otherwise, the depth of the information presented is amazing and very well explained.

Overall, the program is an interesting, engaging presentation of the processes of evolution that would make a splendid tutorial for any beginning evolution student.

BOOKREVIEW

River Out of Eden: A Darwinian View of Life

by Richard Dawkins, 1995, Basic Books, New York. 172 pp.

Reviewed by Daniel G Blackburn, Department of Biology, Life Sciences Center, Trinity College, Hartford, CT 06106

"For nature, heartless witless Nature,
Will neither know nor care."
(AE Housman)

"DNA neither knows nor cares. DNA just is. And we dance to its music."
(R Dawkins).

Richard Dawkins is a professional explainer. His most important contributions to science have lain not in empirical discovery but in recognizing evolutionary implications of work by other biologists and using his powers of explanation to change the way the world thinks. A zoologist by training, Dawkins's early publications were in the areas of ethology, evolutionary theory, and sociobiology. As a faculty member at Oxford University, he secured an international reputation with his 1976 book *The Selfish Gene*, a best-seller with an innovative (and controversial) gene's-eye view of evolution by natural selection. Years later, Richard Dawkins is still explaining, as an eloquent lecturer, iconoclastic debater, and prolific writer. In fact, Dawkins has been appointed to an endowed chair at Oxford as Professor of Public Understanding of Science, a position that supports him in doing what he does best.

River Out of Eden is Dawkins's contribution to Basic Books' "Science Masters Series" — short readable works that are designed to present contemporary scientific ideas to a broad audience as a means of promoting scientific literacy. As such, this book ought not be judged by the same criteria as Dawkins's influential previous works. After all, *The Selfish Gene* and its successors *The Blind Watchmaker* (1986) and *The Extended Phenotype* (1989) were written as much for the working biologist as for the general public. *River Out of Eden* advances the themes from these works and draws on recent findings in biology to present a perspective that is selectionist at its core and broad in its implications. It offers, through a genetic reductionist approach, a view of life in all its manifestations as a consequence of natural selection, and does so with clever examples and an absorbing style.

The "river" of Dawkins's title is a river of DNA that:

> flows through time not space. It is a river of information...of abstract instructions for building bodies, not a river of solid bodies themselves. The information passes through bodies and affects them, but it is not affected by them on its way through. The river is...uninfluenced by the experiences and achievements of the successive bodies through which it flows (p 4).

According to Dawkins's metaphor, this river of information began at the origin of life and with each speciation event forked into tributary rivers which diverged, never to meet (that is, to share their DNA) again. Most of these tributaries gave rise to no rivers that have persisted to the present. After all, the estimated 30 million extant species represent perhaps no more than 1% of the species that have ever lived. Further, Dawkins asserts, the speciation events (or tributaries) that ultimately led to higher taxa were no more momentous than those that gave rise to species that went extinct without leaving descendants.

The key to Dawkins's perspective lies in his view of the bodies of organisms as temporary carriers of genes that make those bodies. "Genes survive down the ages only if they are good at building bodies that are good at living and reproducing in the particular way of life chosen by the species" (p 5). Thus, selection works not on individual organisms nor on groups thereof, not on particular combinations of genes, and certainly not on species, but on genes that maximize reproductive survival. These ideas will not be new to readers familiar with Dawkins's previous work: "We are survival machines, robot vehicles blindly programmed to preserve the selfish molecules known as genes" (*The Selfish Gene*, preface).

The second chapter in Dawkins's book "All Africa and Her Progenies" describes implications and misconceptions of the molecular studies through which the origins and diversity of modern humans are being clarified. Studies of mitochondrial DNA have strongly corroborated a relatively recent common origin for all living humans, probably in Africa. Being of maternal origin, mitochondrial DNA is uncontaminated by sexual recombination with paternal genes. As a result, molecular biologists have been able to trace our matrilineal heritage to a hypothetical common ancestor that has been designated by American biologists, with characteristic cultural chauvinism, "Eve".

Dawkins points out that a strict matrilineal line is one of many ways to trace human ancestry, the others being the innumerable lineages that have passed through a male progenitor. Misconceptions abound, as the author shows. Among these are the mistaken beliefs that mitochondrial Eve represents our most recent common ancestor (she is only the most recent through a strictly matrilineal line); that she was the sole female founder of a new lineage (in fact, her contemporaries and ancestors undoubtedly have numerous descendants as well); that she necessarily coexisted with the most recent male ancestor (in fact, this male individual is probably far more recent than "Eve").

Having read several accounts in the literature, I found Dawkins's

account enlightening in clearing up personal misconceptions on the issues, including some promulgated in popular accounts (Brown 1990). In explaining human origins, Dawkins expresses hope that his narrative will not only prove more interesting, but also more moving than any tribal origin myth (for example, the Garden of Eden story invoked in his title). That he succeeds far less in the latter than in the former regard is understandable, given the powerfully resonating symbolism in Western culture of the mythic tale that he invokes (Pagels 1988).

Other chapters in *River Out of Eden* explore familiar themes with new examples. "Do Good by Stealth" considers a persistent challenge that dates to writings by Mivart (1871) — the question of how natural selection can account for gradual evolution of complex behavior patterns and sensory abilities. Using a variety of behavioral examples involving insects, flowers, and birds, Dawkins demonstrates how such features could evolve incrementally. In the process, he exposes the fallacious assumption that such features must function perfectly from their inception in order to be adaptive.

To the creationist taunt "What good is half an eye?", Dawkins's elegant answer is that it is 1% better than 49% of an eye! Drawing on an analysis by Nilsson and Pelger (1994), he argues that even under conservative assumptions about selective advantages and trait heritability, eyes could have evolved in a small fraction of the geological time available for their evolution. Little wonder that eyes have evolved on multiple occasions in the Kingdom Animalia. Phylogenetic analysis has revealed some forty different origins of light-sensitive structures among animals.

The chapter "God's utility function" draws on a concept from economics; a utility function is "that which is maximized" in a given context. In considering organismal diversity and the appearance of "design" (an unfortunate term that is difficult to avoid), Dawkins raises the question of what is maximized in the natural world. His answer, of course, is DNA survival.

Why, then, is the parental expenditure of resources on male and female offspring commonly equal, when a small number of males could easily impregnate a large number of females? To answer, Dawkins invokes Ronald Fisher (1958), who showed that a 50:50 expenditure of resources between the sexes of offspring maximizes the number of grandchildren that an animal can produce, even in species in which a few males mate with all of the females. In a species where an individual male has much less of a chance of reproducing than does a female, the potential gain to a parent of producing that rare, successful male offspring can be enormous.

If the utility function of a species were to produce the most offspring, then the most efficient situation would be for males to stop competing and to devote themselves to rearing young, regardless of their degree of relatedness. By analogy, from the standpoint of efficiency, it would seem to be most advantageous for forest trees to remain short, rather than to expend energy on growing tall to outcompete others for light. But natural selection acting at the genetic (or even the organismal) level would favor individuals who seek to maximize their own reproduction at the expense of conspecific competitors. Dawkins's ideas and examples date to *The Selfish Gene*, and one is forced to wonder why he has not considered contemporary studies focusing on departures from Fisherian ratios. In addition, his argument could have been strengthened by discussion of species in which sex of the offspring is manipulated by parents according to environmental circumstances, or in which adults change sex to maximize their own reproductive value.

Why have Dawkins's views been controversial, given their broad explanatory power? From a sociopolitical standpoint, the answer may be that Dawkins is explicit in his non-theism (more so than, for example, Stephen Jay Gould usually is) and is unrelenting at presenting life as accidental, amoral, and non-purposive. In his words,

> [n]ature is not cruel, only pitilessly indifferent. This is one of the hardest lessons for humans to learn. We cannot admit that things might be neither good nor evil, neither cruel nor kind, but simply callous — indifferent to all suffering, lacking all purpose" (p 96).

What can be contested biologically is Dawkins's focus on genes as the sole unit of natural selection with such selection resulting in adaptation and design at the organismal level. Over the past fifteen years, the concept of natural selection has been applied with increasing success at a variety of levels, including that of the species and the cell population. Dawkins does mention briefly that asexual animal lineages do not persist for long evolutionarily, perhaps because they do not compete well with those with sexual reproduction. However, he seems not to recognize that such differential survival shifts the level of selection to that of the species itself.

Another issue is how "visible" genes themselves are to natural selection, and therefore how susceptible to selective pressure. The units that differentially survive and reproduce are the organisms themselves — not their parts and only indirectly their genes. Dawkins's mechanism relies on a fairly straightforward relationship between the stored information (genotype) and its outward expression (phenotype). However, translation of a genotype into a phenotype is highly complex, given such phenomena as pleiotropy (multiple effects by genes), genetic linkages, and epistasis (modification of gene action by other genes). Moreover, genes interact with the environments in which they are expressed in complex ways to produce phenotypes; in fact, a major focus of contemporary biological research is on the large impact that environmental conditions can have on phenotypic expression (Blackburn and Schneider 1994). All such factors constrain a close relationship between organismal and genetic selection. Furthermore, much study over the past two decades has focused on departures from optimality, including cases where organisms are not well adapted for particular functions. Such cases can reflect a lack of genetic variation, insufficient evolutionary time, adaptive compromises between disparate functions, and constraints operating at levels ranging from the genetic to the organismal.

Given Dawkins's genetic focus, his work contains several puzzling omissions. One is the overwhelming evidence for neutral mutation — the random fixation of genetic changes that lack significant phenotypic consequences. Another is the existence of multiple copies of unexpressed genes, which requires (in amphibians,

BOOKREVIEW

Dysgenics: Genetic Deterioration in Modern Populations

by Richard Lynn, Westport, CT, Praeger. 1996. 237 pp.

Reviewed by Jonathan Marks, Department of Anthropology, University of California at Berkeley

The good name of evolution is in perpetual need of rescue from its appropriation by cranks and charlatans. The present volume is by a noted hereditarian psychologist, whose ideas formed much of the foundation for *The Bell Curve*. If you believe that one cannot serve both God and Mammon, then the fact that this book thanks The Pioneer Fund for "encouragement and financial support" should give you pause.

Some of you older folks may remember that biology was corrupted in the 1920s by a movement known as "eugenics" which localized the impending decline of civilization to the genes of the lower classes. It advocated state control of reproduction and managed to get involuntary sterilization laws passed in most states and have them upheld in the Supreme Court. Its enthusiasts also managed to curtail the immigration of populations with bad "germ-plasm" — Italians and Jews. The real embarrassment is that nearly every geneticist of note was an advocate of the program, as a casual read of nearly any issue of *The Journal of Heredity* from 1913-1935 will attest.

The movement's earliest opponents were the activist defenders of civil liberties who saw science abused in the biological arguments for the curtailment of human rights. Franz Boas and Walter Lippmann were on record long before any geneticists. Clarence Darrow evolved from biology's champion at the Scopes trial (1925) to its basher a year later with his scathing indictment, *The Eugenics Cult*. Only in 1927 did Raymond Pearl of Johns Hopkins publish the first critique of the movement by a biologist.

With the collapse of the American economy and the accession of the Nazis in Germany — who took their genetics a bit too seriously — the movement fell into eclipse. After the War, however, human genetics attempted to reformulate itself by dis-

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for example) relatively large cells and a slow rate of cell division. Perhaps these cases are omitted because they do not fit neatly into a model where selfish genes yield well-adapted phenotypes. Also not discussed are the implications of developmental (homeobox) genes and epistasis for the tempo of evolutionary change. Because small genetic changes can have large phenotypic effects, the origins of higher taxa need not require the gradual accumulation of micromutations that Dawkins posits.

As interesting as Dawkins's views may be, are they, as he avows, "Darwinian"? Strictly speaking, they are not, since they invoke selection at the genetic level. Not only did Charles Darwin's work long predate even a rudimentary understanding of the genetic basis for evolution, but Darwin (unlike his contemporary Alfred Wallace) saw the individual as the unit of selection. Moreover, Darwin considered that evolution acted not only through selection but via the inheritance of acquired characteristics — a fact that historians as well as biologists tend to overlook. However, Darwin's name has long been invoked by evolutionary biologists (and now philosophers, such as Dennett 1995), on all sides of issues who seek legitimacy for their own views. Given his selectionist perspective, Dawkins is well within the tradition of neodarwinism.

River Out of Eden is entertaining and enlightening, and offers a fine introduction to Dawkins's ideas on implications of evolution by natural selection. Yet, Dawkins's perspective, for all his iconoclastic nature, appears increasingly conservative, not because his views have changed but because they have failed to keep pace with contemporary advances in evolutionary thought. While offering a useful defense against creationism and other forms of ignorance, Dawkins's book is a fine contribution to the public dialogue — a venue where evolutionary ideas are routinely misrepresented and misunderstood.

ACKNOWLEDGMENTS

I thank Craig W. Schneider for reading a draft of this review.

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owning the eugenics movement and redefining the term to refer to a more benign concept — the general improvement of the quality of life through the application of genetic and reproductive technologies.

Richard Lynn's odd thesis in this book is that, even in its old form, eugenics was basically right. There really are too many poor people; they're dumb as bricks; they breed like flies; it's their own fault; and that's the trouble with the world today. Poverty and misery are the results not of human social evil, but of innate personal incompetence. Just as in 1916, when Madison Grant wrote *The Passing of the Great Race*, Lynn's first appeal is to authority; he argues that the best and brightest geneticists have been advocates of eugenics.

To their ignominy, geneticists of the 1920s were indeed advocates of the program. A very few, like Morgan's group at Columbia (who worked in the same building as Franz Boas) never joined up. Others, like LC Dunn, HS Jennings, and Raymond Pearl, became disenchanted in the late 1920s. Lynn cites HJ Muller's *Out of the Night* (1935), which advocated a naive wisdom to govern reproduction, as Muller's first work on eugenics. Somehow Lynn manages to ignore Muller's 1932 address to the International Congress of Eugenics, reprinted the following year in the *Scientific Monthly*, and tellingly called, "The dominance of economics over eugenics." A queer omission, certainly.

More than that, Lynn manages to group together Muller, Francis Crick, Joshua Lederberg, and William Shockley (of Nobel laureate sperm bank fame) as a bulwark of scientific advocates of eugenics, without distinguishing among them. For the record, Lederberg actively opposed Shockley, objected to "the tone of his entire discussion about 'bad heredity'," and deplored "the mischief of a pseudoscientific basis for evading or distorting our social responsibilities" (*Stanford MD* 1966; 5[2]:41).

Lynn even attributes the word "dysgenics" to Shockley. Actually, though, a superficial scrutiny of the classic literature will reveal its prior usage, for example, in the pamphlet called "A Eugenics Catechism", issued by the American Eugenics Society in the early 1920s, which defines "dysgenic" as "harmful to the race". It then asks "Why sterilize?" and answers, "To rid the race of those certain to transmit the same dysgenic tendencies to which they are subject." Then it goes on to specify "criminals, paupers, insane, feebleminded, epileptics, rapists and other defectives".

So there is indeed a link to the past, even if Lynn doesn't quite seem to have his finger on it. What of Lynn's arguments? Are we really going to genetic hell in a proverbial handbasket? Is that where evolution is taking us?

Back when life was "solitary, poore, nasty, brutish, and short" (Hobbes), natural selection weeded out the worst of the human lot. The evolution of culture mitigated the effects of natural selection, argues Lynn, permitting the survival and proliferation in evergrowing numbers of "the less intelligent and those with weak character." So the genes for math and moxie have been progressively diluted in the modern world.

The problem for his thesis arises in Chapter 8, in which Lynn confronts the embarrassing fact that across the developed nations in this century, IQ has been steadily rising at the rate of about a point a year. And Lynn even tells you why: a familiarity with school makes it easier to take tests, prenatal and postnatal nutrition is improving, and so on — in short, the circumstances of life accompanying economic development are driving IQ upward. Hmmm, maybe that means that small differences in IQ are not necessarily the results of constitutional flaws, but of circumstances of life. Nah.

To Lynn, rather, it means that he must draw a distinction between innate potentials and manifested performances, or in an odd construction, "genotypic versus phenotypic intelligence." And thus he maintains that innate potentials are going down even as performances are improving. But performances are all that are accessible to empirical study here, of course. This is ostensibly the world of science, is it not? In the absence of data on his "genotypic intelligence", or on those latent potentialities, this is simply an angels-on-pinheads argument.

Whether the Pleistocene environments selected for IQ and "character" is itself one heck of a gratuitous inference. The reader is free to wonder whether the ability to participate effectively in a bison hunt is adequately examined on pencil-and-paper tests. Or whether the stereotyped upper-class, white Anglo-Saxon temperament is really more biologically ancient than upper-class, white Anglo-Saxons are.

It's also kind of hard to believe that in the post-Jensen generation there would be anyone left who doesn't know that "heritability", as used by geneticists, is not a property of the trait under study, but rather a description of the population in which it appears. Sure, IQ scores have a nonzero heritability; but it doesn't follow that the genes explain why one population scores slightly better on the average than another population. Nevertheless, the book is suffused with that argument.

And finally, with statements like "socioeconomic status is partly determined by intelligence, with which it is correlated at about .5" (p 126), we can see the level of mock science we're dealing with. I suspect even creation "scientists" know about the relationship between correlation and causation.

Lynn suggests that the world would be a better place if the poor, marginalized, and handicapped had never been born. But we simply cannot infer overall genetic quality from lived lives. Sure, some people are more of an inconvenience than others; but history shows that their descendants can be damned fine; and humanitarianism dictates that we should strive to improve peoples' lives and expand the universe of human rights, not restrict it.

Thus, my final impression from this book is to turn Lynn's sentiment around: As the author of a malicious and ignorant work which prostitutes science, invoking it to justify social inequities and man-made evils as natural, the world would probably be better off had he never been born.

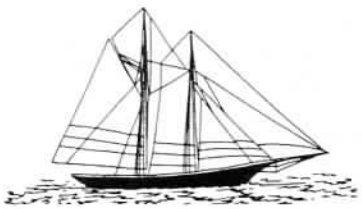
SAY WHAT?

Unfortunately, God doesn't give us all the details. All we can do is begin with what we do know and make reasonable inferences. I can think of several possibilities which are biblically acceptable....Is it possible that this highly intelligent being [Lucifer] performed breeding experiments, or genetic engineering on both mankind and the animals, in his attempt to mock the true Creator/God and usurp His authority? Perhaps even the ancient legends of composite mixtures of beasts and half-men/half-beasts have some basis in fact.

Morris, John D, 1997.

If all animals were created as plant eaters, why do some have sharp teeth?: *Back to Genesis* No. 100, page d. (Published by Institute for Creation Research, El Cajon, CA)

[Contributed by NCSE Supporter G. Brent Dalrymple]



Travel To the Galapagos — Virtually

For those of you unable to join NCSE for its trip of the millennium to the Galapagos Islands, Editorial Board member Leslie Chan sent us this note from Toronto about the Virtual Galapagos web site at: <http://www.terraquest.com/galapagos/intro.html>

I have been following the development of this site the last couple of months and its getting better and better. Highly informative and educational.

Why not take a break and travel to the Galapagos today?

RESOURCES

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Abstract: Natural populations of guppies were subjected to an episode of selection that mimicked natural processes. The resulting rate of evolution of age and size at maturity was similar to rates typically obtained for traits subjected to artificial selection in laboratory settings and up to seven orders of magnitude greater than rates inferred from the paleontological record. Male traits evolved more rapidly than female traits largely because males had more genetic variation upon which natural selection could act. These results are considered in light of the ongoing debate about the importance of natural selection versus other processes in the paleontological record of evolution.

In their conclusions the authors state that this study is "part of a growing body of evidence that the rates and patterns of change attainable through natural selection are sufficient to account for the patterns observed in the fossil record".

Authors' email: <GUPY@ucrac1.ucr.edu>.

[Contributed by James A. Murray <jamurray@ucsd.edu>]

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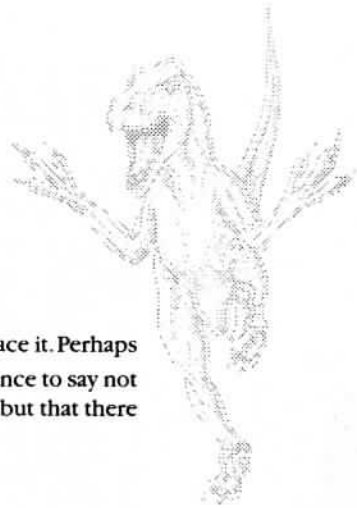
Letters to the Editor



On Dawkins

I enjoyed Richard Dawkins's eloquent essay in *Reports of the NCSE* volume 17, number 1. I wonder what it is that makes some journalists hate and fear science. Are they trained that way or does a certain kind of misfit gravitate to that occupation?

I have a couple of comments on the essay. The first is scientific. Dawkins stated that "Our DNA has proved itself successful, because it is here." This is a tautology; also, it is not true. I strongly object to the idea that we are here because we were the best at facing what life threw at us. Some are here by chance, and some are extinct by chance. There is a lot of chance in the world — ask the large terrestrial animals and marine plankton that lived at the end of the Cretaceous. Or think back to the last time you just avoided an accident by luck. The point is that natural selection is an extremely powerful and subtle force, but not the only one, weeding the garden of life.

I'm intrigued by the comment that Wordsworth looked for a time when science would be a fit subject of poetry. That time is here. Science poetry is a thriving subgenre allied to Science Fiction poetry, and there have been books devoted solely to it. A recent anthology of poetry by the well-known science fiction writer Joe Haldeman included several science poems, and an on-line biomedical journal called *HMS Beagle* publishes science poetry, to mention two examples. Many of the best science poets are also scientists, and science fiction poets as well.

David Kopaska-Merkel

Geological Survey of Alabama

Tuscaloosa AL

On Naturalism

I...was immediately attracted to the essay by Karl D. Fezer (*Creation/Evolution* 1996 Winter; 16[2] nr 39:31-5). Fine essay; I very much appreciate his taking the time to explain all of this. I have thought and tried to explain to my students that just because we say "this happened" that we aren't saying there is no "why" — that's an individual decision, and the province of philosophy and religion. Thanks again to Karl Fezer.

Ann Tattersall

Just a note to say that I just read Robert Pennock's excellent article "Creation and life's meaning" in *Creation/Evolution* (1996 Winter; 16[2] nr 39: 10-30) and enjoyed it immensely. As a paleontologist, I have been quite active locally in fighting efforts of the creationists to introduce their agenda in our public school system (admittedly an "uphill battle" here in Alabama). However, I have been guilty of attacking their claims on a scientific level, which in hindsight probably did very little good and certainly did not change the minds of the more vociferous creationists. It was enlightening to hear the voice of a philosopher on the subject, and you have given me much to think about. Thank you for a job well done!

Mark Puckett

Geological Survey of Alabama

Tuscaloosa, AL

I concur in Robert Pennock's view that it is important to try to understand the motivations that underlie the curious thought patterns of creationists. His excellent article "Naturalism, creationism, and the meaning of life:..." in the final issue of *Creation/Evolution* is a valuable contribution to that effort.

Modern science has replaced the clockwork determinism of classical physics with quantum mechanics. Unlike the former, the latter provides a way for God to intervene in the world without violating the laws of physics — by influencing certain microscopic events in purposeful ways that, as Pennock notes, would still appear random to us. One wonders why, when this was pointed out to Johnson (by me), he did not rush to embrace it. Perhaps

[Johnson] wants science to say not just that there *could* be, but that there *must be* a God.

John Fletcher

Livermore CA

Robert Pennock's recent article "Naturalism, creationism, and the meaning of life:..." is one of the most intelligent articles of its type that I have read. In my opinion, it is head and shoulders above the usual piece on this subject and I think that my saying so is not entirely because I agree with [him]. I will look for [his] new book.

Robert J. O'Donnell

San Rafael CA

I found Robert Pennock's article on creationists' existential angst extremely interesting and useful. So much so, that I sent a copy to my wife's cousin and [cousin's] husband who are both Protestant ministers, thinking the insights into creationists' fears would be valuable to them in their work.

I believe Pennock makes abundantly clear the deplorable quality [often] associated with person's of Phillip Johnson's persuasion: Although perhaps doing so initially in good faith (but mistakenly), such persons willfully continue to employ erroneous arguments — establishing false dichotomies and conflating different philosophical arguments, as Pennock illustrated repeatedly — even *after* those arguments are shown to be in error by others unquestionably more competent in the field.

Blatantly religious charlatans one can accept along with the other crooks of this world, but it is truly deplorable that sincerely religious people should countenance [intellectual] dishonesty in the furtherance of their beliefs.

Kennan Herrick

Oakland CA

EDITORIAL POLICY ON WORLD-WIDE WEB RESOURCES

Andrew J Petto and Laura L McMahon

More and more of the articles and other items submitted to *Reports of the National Center for Science Education (RNCSE)* contain references to sites or pages on the World-Wide Web (WWW). The web is in a constant state of flux, so it is sometimes a challenge to be as confident about the internet locations as we are about print citations in our Resources department. Furthermore, since editorial style manuals are still deciding how to standardize references to internet resources, the formats may be inconsistent at best or confusing at worst.

In order to provide better access to these internet resources for our readers, the editors and the editorial board members have adopted the following policies.

- All WWW locations (universal resource locators or URLs) will be printed inside angle brackets (for example, <http://www.natcensci.org> is the URL for the NCSE home page). Angle brackets are used in the hyptertext mark-up language (HTML) within web pages and as a general convention in electronic media. So, readers can assume that they should enter all the text between the angle brackets to connect to the web page that is being discussed.
- All WWW locations (URLs) will be verified before publication by the editorial staff. We will only print those locations that we have successfully located in these tests. This will assure that they are accurate at the time of publication.
- All URLs cited in any article in an issue will be extracted from the article and included in a table in the Resources section of that issue.

We hope that these policies will improve our readers' abilities to get access to WWW resources. As always, we welcome your suggestions about valuable URLs to visit, and we want to know if and when URLs for the internet resources that are important to our readers change, evolve, or go extinct.

INTERNET LOCATIONS VISITED IN THIS ISSUE

TOPIC: *AAAS EVOLUTION CONFERENCE*
LOCATION HTTP://WWW.AAAS.ORG/SPP/DSPP/DBSR/EPIC.HTM
OWNER: AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
LAST VISIT: JUNE 1997

TOPIC: IAN PLIMER TRIAL
OWNER: AUSTRALIAN SKEPTICS
LOCATION: HTTP://WWW.SKEPTICS.COM.AU
LAST VISIT: MAY 1997

TOPIC: NORTH CAROLINA HB511
OWNER: NORTH CAROLINA GENERAL ASSEMBLY
LOCATION: HTTP://WWW.NCGA.STATE.NC.US/
LAST VISIT: MAY 1997

TOPIC: POLAR FISHES' ANTIFREEZE GENES
OWNER: NATIONAL SCIENCE FOUNDATION
LOCATION: HTTP://WWW.NSF.GOV/OD/LPA/NEWS/PRESS/PR9729.HTM
OR HTTP://WWW.NSF.GOV/PUBS/1997/PR9729/PR9729.TXT
LAST VISIT: MAY 1997

TOPIC: CRETINISM OR EVILUTION NEWSLETTER
OWNER: EDWARD BABINSKI
LOCATION: HTTP://WWW.TALKORIGINS.ORG/FAQS/CE/
LAST VISIT: MAY 1997

TOPIC: BIBLICAL REFERENCES TO THE BRAIN
OWNER: EDWARD BABINSKI
LOCATION: HTTP://WWW.INFIDELS.ORG/MAG/SR/1993/1/1BRAIN93.HTML
LAST VISIT: MAY 1997

TOPIC: MICHAEL BEHE
OWNER: JOHN CATALANO
LOCATION: HTTP://WWW.SPACELAB.NET/~CATALJ/BOX/BEHE.HTML
LAST VISIT: JUNE 1997

TOPIC: VIRTUAL GALAPAGOS TOUR
OWNER: TERRAQUEST
LOCATION: HTTP://WWW.TERRAQUEST.COM/GALAPAGOS/INTRO.HTML
LAST VISIT: MAY 1997

INSTRUCTIONS FOR CONTRIBUTORS

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

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

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

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Kuban GJ. Sea-monster or shark? An analysis of a supposed plesiosaur carcass netted in 1977. 1997; Available from <http://www.ix.netcom.com>. Accessed 1997 Mar 28.

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

Waters IC, Rivers HI, and others. Swept away in a flood of enthusiasm [editorial]. *Reports of the National Center for Science Education* 2995 Jan-Feb; 1015(1):22-9.

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