# REPORTS OF THE NATIONAL CENTER FOR SCIENCE EDUCATION

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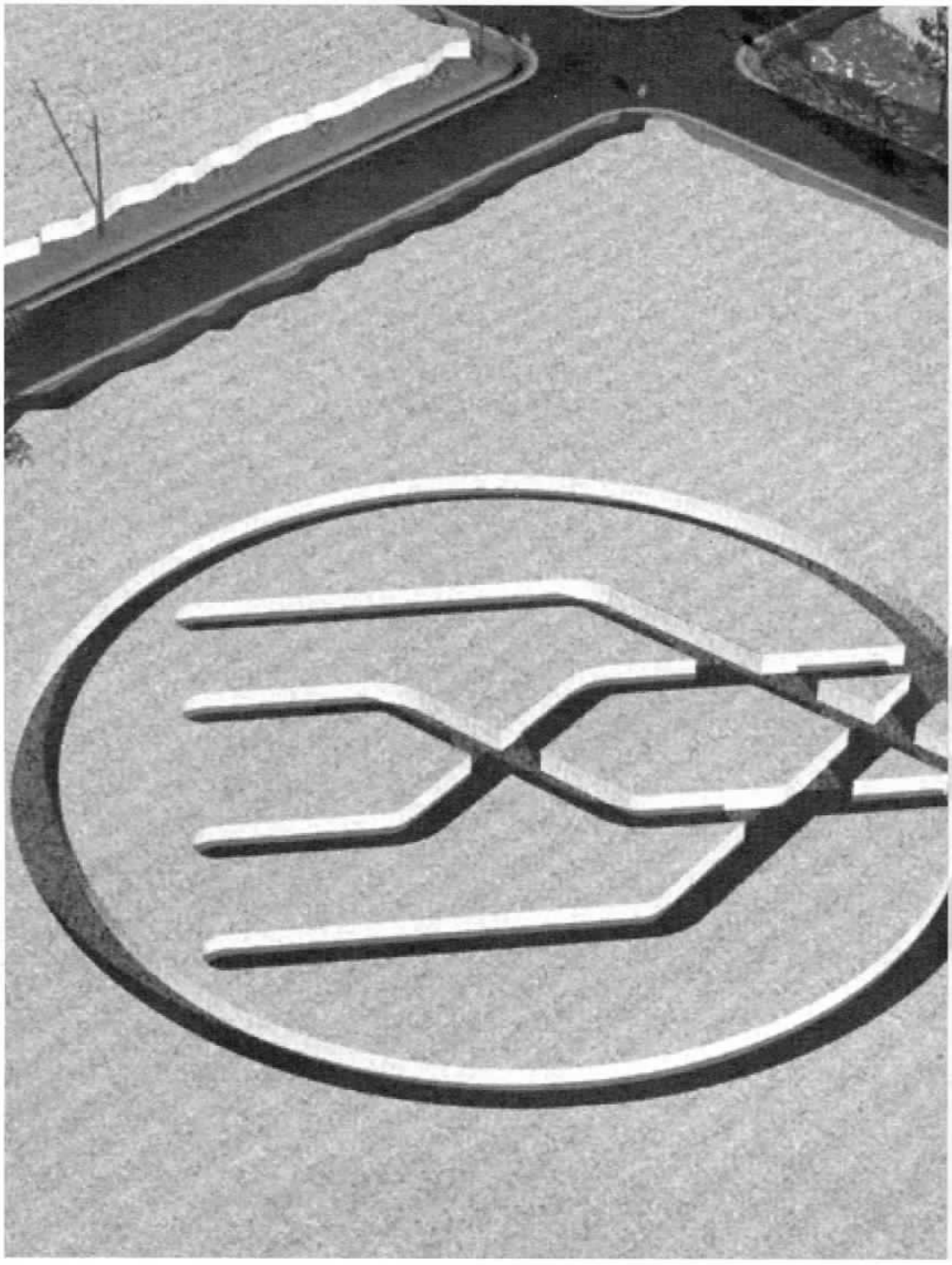

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COVER: NCSE CROP "CIRCLE" COURTESY OF MARK GILBERT.

# FROM THE EDITOR'S DESK

One of the best things that NCSE does for its members, and for anyone interested in scientific literacy, is keep track of actions taken at state and local levels that affect how our children learn science. This, of course, is also the most important thing that our members do for us, because it is due to the awareness and action of members and friends in one state that we can tell those of you in other states what is happening where.

### Standard Disclaimers?

As the dust settles on 1997, we see that a number of states tackled evolution as a component of performance standards for science education. As readers are aware, the news was mixed. We will provide a summary of the year's activity in the final issue of volume 17.

Disclaimers are still making news. In Louisiana the Tangipahoa Parish is appealing the federal court ruling that their disclaimer—similar in concept to the now (in)famous Alabama textbook disclaimer—is unconstitutional. In a milestone for our organization, NCSE has filed a separate "friend of the court" brief that addresses the *scientific* inaccuracies and distortions of scientific theory and practice that form the foundations of these disclaimers. Read all about it in the news on page 4. Not to be outdone, several representatives in the Washington State Legislature introduced a "disclaimer" bill. Debate on the bill was postponed as we went to press with this issue. It now appears as though there will be no action on the bill this year.

### Your Letters

Your letters keep coming in, and we are pleased with the feedback. In the next issue we'll announce some minor changes in layout that should make things easier for readers to find exactly what they are seeking. The one thing that seems still to bug everyone is *punctuation*. We thank you all for your suggestions of appropriate style manuals for our publications, and we assure you that we *do* follow our new style manual closely.

The switch to a new style manual calls for several changes in the way that punctuation is used in the journal. Because *RNCSE* combines news reports and features with analytical or scholarly articles, we needed a style manual that could accommodate both. We chose *Scientific Style and Format* from the Council of Biology Editors because it contains specific standard forms for reporting on scientific issues in the many fields of science that our articles tend to address. Our old manual left most of these up to the editor's judgment or else suggested following standard practice in the relevant field(s). For consistency and accuracy, we chose to follow a manual that requires fewer judgments on issues and topics outside our expertise.

Second, in publishing a journal that contains *both* scientific writing and news reporting, the use of a single manual means that we put on grammatical "cross-trainers" so that we can accommodate all the activities we need to include in each issue. In answer to your frequently asked questions, here is a run down of relevant information.

### Quotes

Punctuation at the ends of quotations is by far the most commonly discussed issue. In our style manual, punctuation in quoted text goes *inside* the quotes if the punctuation mark "belongs to" the quotation, but *outside* the quotes if the punctuation belongs to the sentence containing the quote. This explains the "inconsistency" that many of you have pointed out to us—that punctuation does not always seem to be in the same place in quotations. Of course, there is some room for judgment calls here, and no one is perfect, but consistent application of this format for punctuating quoted text does not provide that the punctuation will *always* be either inside or outside the quotes.

### Commas

Some readers have noticed a dearth of commas—especially after opening prepositional or adverbial clauses, but also at other places where we might expect to see them. The rule for commas is similar to the rule for quotations—usage should follow meaning. If the comma is necessary for clarity, then it must be inserted. If the meaning is clear without the comma, then it can be eliminated.

### Periods

Some readers have noticed that periods are missing from initials, many abbreviations, titles, and a few other places where one might expect them. As with commas, periods are used when not to use them would cause confusion. In most cases, the meaning of these elements is clear without the periods, so the style manual recommends their elimination.

### Final Words

The most important thing about using a style manual is to use it. Whenever there is a question or a difference of opinion, the style manual is the final arbiter. While the recommendations of *Scientific Style and Format* differ from what Mrs Sullivan taught us in grade 5, it represents a streamlined style based on sensible rules without lots of extraneous punctuation. This is important for us part-time, semiprofessional editor-types. It is easier for all the folks who read and edit the materials that we publish to follow basic rules than to memorize long lists of particulars.

Of course, we do err from time to time. Please don't hesitate to let us know when you find something that needs our attention. Our goal is to make this publication useful for *you*.

*Anj Petto*

# NEWS

## Milestone, 1997: NCSE Submits Brief in Creationism Case

In 1984, three years before the Supreme Court ruled in the well-known *Edwards v. Aguillard* decision that "balanced treatment" of evolution and "creation science" is unconstitutional, the Attorney General of Texas put an end to another anti-evolution practice. In answer to an inquiry from a state legislator, the Attorney General gave an official opinion that the Board of Education policy requiring "disclaimers" in biology textbooks violated the First Amendment.

However, disclaimers were never actually tested in court, and in April, 1994, the Board of Education in Tangipahoa, Louisiana, adopted a disclaimer to be read aloud by teachers before they presented any material concerning evolution (*NCSE Reports* 14[2]:8). The Louisiana disclaimer was followed by the Alabama Board of Education's adoption in November 1995 of a statement describing evolution as a "controversial theory"; the Alabama statement, like the Texas disclaimer, has been pasted into biology textbooks (*see NCSE Reports* 15[4]: 10-11). The Alabama disclaimer has been more widely reported and was followed by proposals of similar disclaimers in a number of school districts. However, it is the Louisiana disclaimer that has been challenged in court.

In August 1997, the US District court for Eastern Louisiana found the oral disclaimer unconstitutional. In the first court decision to define "the theory of intelligent design" as another term for "creation science", Judge Marcel Livaudais wrote, "As hard as it tries to, this Court cannot glean any secular purpose to this disclaimer....[T]he school board is endorsing religion by disclaiming evolution" (*NCSE Reports* 1997 17[3]:5). (A summary of court decisions concerning "creation science" and anti-evolution legislation is available from NCSE. Readers may request copies or find this information on the World Wide Web at <http://www.natcenscied.org/courtdec.htm>.

Judge Livaudais' decision is already being cited in opposition to other anti-evolution policies. However, the school district has appealed the decision, insisting that their policy served the *secular* purpose of encouraging critical thinking. The Christian Legal Society (CLS) and Union of Orthodox Jewish Congregations jointly filed a "friend of the Court" brief supporting the school board's policy, arguing that the policy serves still another "secular" purpose—accommodating religious diversity by disclaiming evolutionary "orthodoxy". The brief, written with the assistance of law professor Phillip Johnson, extensively cites claims in his book *Darwin on Trial* that evolution is a "metaphysical world view". (Readers who watched the Firing Line "special debate" on evolution will recall that Johnson took part.)

Briefs supporting the views of the plaintiffs were also filed by the American Jewish Congress and the National Committee for Public Education and Religious Liberty, of which NCSE is a member. However, these briefs concentrated on constitutional issues, and legal advisors believed that it would be important to clarify the scientific issues as well. The Board of Education's defense and the CLS brief rely heavily on the claim that there are *scientific* objections and "alternatives" to the theory of evolution, when in fact there are none.

Against this background, NCSE decided that there should be a separate legal brief, addressing scientific issues exclusively. NCSE is fortunate to be able to call on the services of an attorney who has helped us in the past. Though we have joined other organizations in signing other "friend of the court" briefs, this is the first time in our 15-year history that we have filed a brief independently. It is an important milestone for NCSE and potentially a major contribution to the defense of evolution education.

## NCSE's Newest Board Member Arrives with Sleeves Rolled Up

*Molleen Matsumura*
*Network Project Manager*

NCSE has a fine tradition of a "working board" whose members do far more than lend their names, and our newest Director, Michael McIlwrath, is no exception. Within weeks of joining, McIlwrath went to work on a major project—writing the first legal brief NCSE has independently filed in a case involving an anti-evolution policy.

McIlwrath's enthusiasm is born of long-standing interests in both science and civil liberties issues. When he sent his biography, he commented that he enjoys reading about science, and is currently devouring NCSE Board President Kevin Padian's *Encyclopedia of Dinosaurs*. His fascination with science goes back to his undergraduate years at the University of California, Berkeley, where he took a course in

Underwater Scientific Research; after getting certified, he worked as a volunteer research assistant for a number of graduate and undergraduate students who were doing research off the California coast. After graduating in 1985 with an AB in English, McIlwrath moved to Italy, where he worked in Florence and Palermo as an English teacher and as editor of a European educational magazine. He returned to the United States in 1991 to attend Cornell Law School, where he was a member of the *Law Review* and worked with the Cornell Law School Civil Liberties Clinic. The clinic, led by Prof Gary Simson, has participated in a number of church/state separation cases in state and federal courts and has filed amicus briefs before the Supreme Court. Since graduating from Cornell, McIlwrath has been an associate at the New York law firm Willkie Farr & Gallagher, where he focuses on litigation and on the firm's developing Italian practice, led by former New York Governor Mario M Cuomo.

McIlwrath has continued to be involved in church/state separation matters. He comes to the NCSE through his work on behalf of the National Committee for Public Education and Religious Liberty (PEARL), a civil liberties organization in the vanguard of church/state separation issues with which the NCSE is affiliated. He is the author of "A Summary and Analysis of Leading Supreme Court Decisions" in *Education Vouchers: Handbook for Attorneys* published by PEARL in 1995. For the past two years, McIlwrath, working with the NCSE and PEARL, has represented a public school science teacher in rural Nevada who was sanctioned by his school district for refusing to teaching evolution.

When NCSE learned that litigation concerning an evolution disclaimer would benefit from a brief discussing scientific issues, McIlwrath volunteered his services and literally worked overtime to meet a tight deadline. A long-time admirer of NCSE, he brings skills and good humor that we deeply appreciate. Welcome A-Board, Michael!

## ICR Corrects a Claim

*John R Cole*
*Contributing Editor*

In the November 1997 *Impact* (enclosed in each month's issue of the Institute for Creation Research's *Acts and Facts*), ICR physicist Larry Vardiman wrote, "For example, over twenty scientific societies in the United States have policies in their bylaws denying acceptance of journal articles from creationists." This struck me as dramatic and highly improbable, so I wrote to Professor Vardiman to ask for further information. Was there *any* scientific society with *bylaws* forbidding publication by creationists?

Vardiman replied promptly, noting that he had been mistaken and thanking me for pointing out the error. He said that the next issue would contain a correction. *Voices for Evolution*, he explained, listed "over twenty" organizations with statements critical of creationism, and that was his intended reference. (He referred in his letter to the first edition of the book; in fact, the second edition of *Voices* includes many more than twenty statements from scientific societies endorsing the teaching of evolution in public schools.)

The December *Acts and Facts* arrived with the following note:

> Please replace the last sentence of paragraph 2, page ii, with the following: For example, the governing boards of over 20 scientific societies in the United States have released statements or resolutions expressing their opposition to the teaching of creationism and its identification with science. Such position statements have the effect of blocking acceptance of journal articles from creationists.

The "correction" does not cite either edition of the NCSE book and does not reveal that *Voices* also includes statements from most of the mainstream religious organizations as well as from many educational organizations. The first sentence is confusing, but apparently it refers to the claim that "scientific creationism" is *science* rather than religion. Finally, it is still wrong, because no organization, to my knowledge, ever bothers to determine whether or not a contributor is a creationist; this would be unfair, but it would also be virtually impossible.

A few prominent creationists have in fact published articles in scientific journals, although they have not published papers based on the creationist belief that Genesis has to take precedence over observed scientific data. The peer review process would no doubt find such a conclusion to be unscientific. Letters and commentary items are accepted with considerable frequency by the broad range of scientific journals and magazines listed in the *Science Index*, the *Social Science Index*, *ERIC*, the *Religion Index*, and *The Magazine Index*. According to a statistical study Laurie Godfrey and I published in the book *Cult Archaeology and Creationism*, approximately 20% of the items dealing with the subject came from advocates of creationism. This is far from the censorship and discrimination that the ICR continues to allege.

## At the Front in Tangipahoa Parish

*Barbara Forrest*
*Southeastern Louisiana University*

As for the disclaimer in Tangipahoa Parish, Louisiana, I am sitting in Tangipahoa Parish this minute; my university is right in the middle of it. The disclaimer passed by the school board was the board's response to the failure by one vote to pass a policy to

teach creationism in public schools. One of my departmental colleagues, historian Howard Nichols, was a board member at the time (1994) and succeeded in getting the board to reject the creationism policy.

The policy had been suggested to the board by members of the Christian Coalition and a New Orleans creationist group. Two board members, Jake Bailey and Art Zieske, both religious fundamentalists, brought it before the board. In response to losing the vote Bailey immediately proposed the disclaimer requiring all science teachers to read a disclaimer before teaching evolution. The board's attorney explicitly advised against inserting the reference to the Bible in the disclaimer, but Bailey rejected this advice. The disclaimer is nothing more than Bailey's insistence on having some reference to religion in public school classrooms.

The ACLU, where I served on the Board of Directors, took the school board to court. In August of this year federal Judge Marcel Livaudais declared the disclaimer unconstitutional, after which the board voted to appeal the ruling. The appeal is still pending.

I just received yesterday a copy of an amicus brief entitled "Brief Amicus Curiae of the Christian Legal Society and the Union of Orthodox Jewish Congregations of America, in Support of Appellants". This amicus brief was filed on behalf of the school board by a number of people, the most recognizable of whom is Phillip Johnson. In the list of authoritative sources cited is *Darwin's Black Box*:

> Recently, moreover, leading scientists have challenged on scientific grounds the conjunction of evolution and the general materialistic presuppositions of nineteenth-century philosophy ... and the more specific view that there is no purposeful cause for the universe. For example in *Darwin's Black Box* (1997), Michael Behe, an eminent secular biochemist, views the complexity of biochemical machines as powerful evidence against a nondesign theory of origins.

Several of Johnson's works are also cited; as is a work by John Polkinghorne entitled *Quarks, Chaos and Christianity*. The complete list of cited works is pretty long.

The involvement of the Rutherford Institute in this case—in a small rural parish in a largely rural state—and the involvement of people like Johnson shows that they take this case to be significant. If they can win this case on appeal, the rest of the country had better watch out. So far, creationists have never won in federal court, so our fingers are crossed.

The Institute for First Amendment Studies has a very good article on the Rutherford Institute at <http://www.ifas.org/fw/9406/rutherford.html>.

# UPDATES

**Louisiana**: The Baton Rouge *Advocate* reported on January 7, 1998 that the Tangipahoa Parish School Board must pay $49,444 to plaintiffs who successfully sued against an anti-evolution disclaimer. According to the *Advocate*, "US District Court Judge Marcel Livaudais Jr said that the purpose of awarding legal fees to prevailing plaintiffs in civil rights cases is to allow people to have "effective access to the judicial process." One board member said he feels sure the board will appeal the legal fee issue as well as the original judgment.

**New Mexico, Rio Rancho**: Pressure to teach "alternatives to evolution" has now taken the form of a proposal to use the "intelligent design" textbook *Of Pandas and People*. Working through members in the area, NCSE has provided district administrators with detailed critiques of the text.

**Pennsylvania**: The Moon Township Board of Education is trying to bring "creation science" back into the classroom. A 1994 out-of-court settlement with the ACLU agreed to put an end to school assemblies that teach biblical creationism (*see* NCSE Reports *14[1]:9*). Now, the board is attempting a different approach. Board-initiated changes to the biology curriculum don't mention "creationism", but call for discussion of "intelligent design". They omit references to origin-of-life research on grounds that it is "speculative", and call for showing students the videotape, Mysterious Origins of Mankind—a "documentary" that includes speculations about Atlantis and discusses claims of human footprints appearing by dinosaur tracks without mentioning that these claims have been debunked (*see* NCSE Reports *15[4]:1, 7*). The district, which has not answered letters from NCSE, has also been contacted by ACLU-Pennsylvania.

**Washington**: Legislation calling for all science textbooks (not just biology texts) to include an evolution disclaimer was introduced by the chair of the state Senate's Education Committee (*see text of bill on page 7*). The disclaimer is identical to the one adopted by Alabama's Board of Education in November 1995 (*NCSE Reports* 15 [4]:10-1) NCSE members and allies are actively opposing the legislation. It now appears that there will be no vote on this bill in the current legislative session.

**Wisconsin**: The Burlington Board of Education has been asked to consider a policy "allowing teachers flexibility to teach alternatives to evolution" within the public schools.

[*NCSE thanks Marshall Berman, Scott Brande, Barbara Forrest, Lyle Hubbard, Kim Johnson, Bob Jones, and John Longino for information used in this article.*]

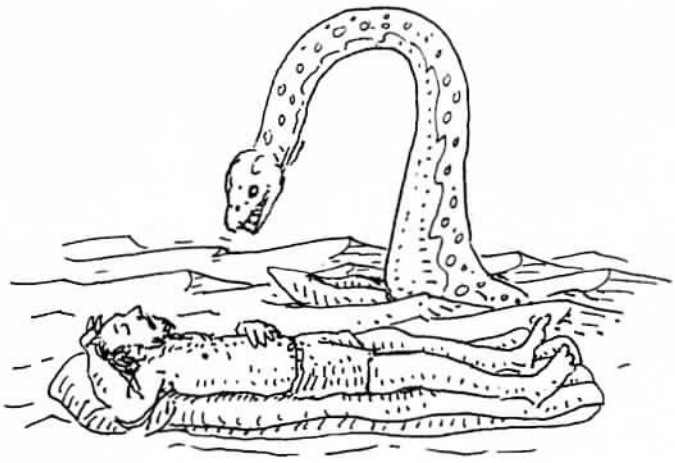
# Lee County (Florida) School Board Settles on Bible Course

In late February 1998, the Lee County School Board settled a costly and divisive federal lawsuit that challenged the board's attempts to teach the Bible as history. Last December, Lee County parents and other concerned citizens filed a lawsuit in federal court to stop the Lee County School Board from teaching a "Bible History" course that uses the Bible as a history textbook. In January, US District Judge Elizabeth Kovachevich issued an injunction against the teaching of the school board's New Testament curriculum. The judge allowed, for the time being, the teaching of the Old Testament portion of the course, but only under strict monitoring, and ordered the two sides to engage in settlement negotiations. The settlement offer submitted to the school board on February 23 on behalf of the plaintiffs was the result of these negotiations.

Under the terms of the settlement, the board will withdraw its previously-adopted Old Testament and New Testament curricula that were challenged in the lawsuit as unconstitutional because they teach the Bible as literal. Instead, the board has agreed to teach a new, objective, and non-sectarian course based upon a textbook entitled *Introduction to the Bible*.

Lisa Versaci, Florida director of the People For the American Way Foundation, said that under the terms of the settlement, the word "history" is no longer in the course title. "The new course will not be a history course, and the board recognizes in the settlement agreement that it cannot lawfully teach that unverifiable aspects of the Bible, such as the miracles and resurrection of Jesus, are historical fact.

[*Source: Press release on February 26, 1998 from People for the American Way*]



# Disclaimer Bill Introduced in Washington Senate

*SENATE BILL 6394*

State of Washington 55th Legislature 1998 Regular Session

By Senators Hochstatter, Stevens, Oke and Swecker

Read first time 01/16/98. Referred to Committee on Education. An ACT Relating to science textbooks; and adding a new section to chapter 28A.150 RCW.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

{+ NEW SECTION. +}Sec. 1. A new section is added to chapter 28A.150 RCW to read as follows: All science textbooks purchased with state moneys must have the following notice placed prominently in them.

A MESSAGE FROM THE WASHINGTON STATE LEGISLATURE

This textbook discusses evolution, a controversial theory some scientists present as a scientific explanation for the origin of living things, such as plants, animals, and humans. No one was present when life first appeared on earth. Therefore, any statement about life's origins should be considered as theory, not fact. The word "evolution" may refer to many types of change. Evolution describes changes that occur within a species. (White moths, for example, may "evolve" into gray moths.) This process is microevolution, which can be observed and described as fact. Evolution may also refer to the change of one living thing to another, such as reptiles into birds. This process, called macroevolution, has never been observed and should be considered a theory. Evolution also refers to the unproven belief that random, undirected forces produced a world of living things. There are many unanswered questions about the origin of life which are not mentioned in your textbook, including

-Why did the major groups of animals suddenly appear in the fossil record (known as the "Cambrian Explosion")?

-Why have no new major groups of living things appeared in the fossil record for a long time?

-Why do major groups of plants and animals have no transitional forms in the fossil record?

-How did you and all living things come to possess such a complete and complex set of "Instructions" for building a living body?

Study hard and keep an open mind. Someday, you may contribute to the theories of how living things appeared on earth."

## Office Biz: How to use the NCSE

*Erik Wheaton*
*NCSE Office Manager*

Here is a guide to the best way for you to use NCSE so we can help you with your concerns related to evolution education.

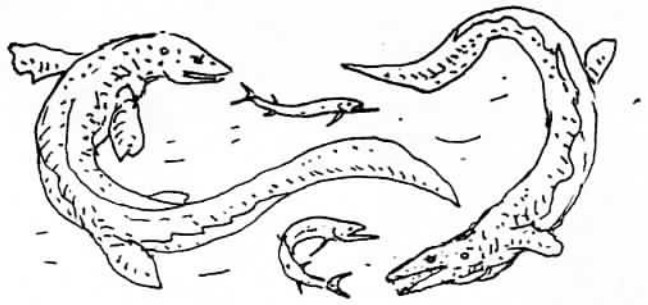
TEACHERS
Write to us for copies of our brochures and fliers. Please include a self-addressed stamped envelope ($0.55 postage please), and we will send them right out to you. You may use them as "masters" to make multiple copies for classroom use.

LETTERS TO THE EDITOR
Readers often send us copies of local newspapers that have printed a creationist letter to the editor with a request that we respond. It is often most effective for the reply to come from a *local* source, so we will gladly send out materials that will help *you* write a response. We even have a flier on how to write responses to creationist claims (written by an NCSE member and working scientist). If need be, we can also contact other NCSE members in your area to help and support you in these efforts.

BOOK REVIEWS
We review books in *Reports of the National Center for Science Education*. Published books will be examined and sent out for review if we feel they are of interest to our members. In general we do not review unpublished, book-length manuscripts. If you have a manuscript you wish to submit please contact us before you send it.

INFORMATION AND REFERRAL
We often hear large, general questions like, "What are the creationist arguments against evolution?" We will help you to identify and locate resources that you can use to develop your own answers. We often get requests for help with term papers or school debates. We will be pleased to send copies of our brochures, fliers, and resource lists. If you have a specific question and you cannot find the answer (for example: what about the creationist argument regarding polonium halos?) we may be able to help. We have files with scientific refutations of creationist arguments. You should also check our website <http://www.natcenscied.org>.

HELPING US HELP YOU
The most important thing *you* can do is keep your membership current and check from time to time for usable office equipment that you might be able to donate to NCSE. Our old friend the ancient QMS PS810 laser printer (same innards as an HP III) is in decline. If you have a good used laser printer (we would prefer HP II or III), we will pay for shipping and give you a tax credit for your donation.



# Speciation in Fast Forward

Africa's Lake Victoria has long attracted biologists to its shores because this evolutionary treasure chest is crowded with hundreds of closely related fish species that can be found nowhere else in the world. But while scientists probed and prodded these cichlid fish, as they are known, in the vast watery expanse of this continent's largest lake, Victoria yet managed to conceal their most magnificent secret.

An international team of researchers, using remote sensing to probe the sediments at the lake's bottom, have found evidence that what is now Lake Victoria was a dry, grassy plain just 12 000 years ago. For evolutionary biologists, the implications are enormous. The discovery means that the 300 unique fish species that have been documented in the lake must have evolved in the unthinkably short interval since the current lake began to form, a geological instant ago.

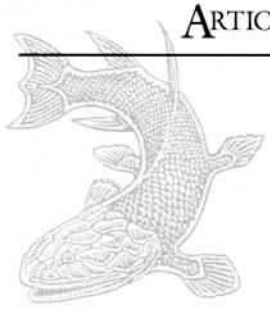
"All these species, this whole universe of cichlid fishes, that all this could have evolved in 12 000 years," said Dr. Ernst Mayr, the Alexander Agassiz Professor Emeritus at Harvard University, "as improbable as it seems—the facts force you to accept it."

Calling the conclusions, reported in the current issue of the journal Science "ironclad," Dr Amy McCune, an evolutionary biologist at Cornell University in Ithaca, NY, said, "It's amazingly exciting. We're talking about rates of speciation that have not even been imagined." She added, "I think everybody is going to be surprised."

But now even more perplexing questions arise, as researchers ponder how so many species could have evolved in such a short period of time and what there is about cichlid fishes that makes them prone to such excesses of evolutionary speed.

"It's a world record, no question," said Dr Axel Meyer, an evolutionary biologist at the State University of New York at Stony Brook, NY. In fact, these cichlids make evolutionary laggards of other groups much celebrated for their speed of evolution, like Darwin's finches on the Galapagos Islands. On those islands, Meyer said, fewer than 20 species of finches have evolved in over four million years.

[*Reported in* Science *Aug 26, 1997*]



# Does the Speed of Light Slow Down Over Time?

*Ronald Ebert*

It seems that old creationist ideas never die. That has been true of the claim that dinosaur tracks and human tracks are found together at the Paluxy River in Texas. Even though the Institute for Creation Research has disavowed this, it is constantly revived as justification for a young earth (see, for example, Kuban 1989). The same is also true of the claim that the speed of light slows over time. Scientists have compelling evidence that the universe is some 10-15 billion years old. In order to reconcile this evidence with the creationist belief that the universe is only 6-7000 years old, creationists have claimed that the speed of light was extremely high, perhaps infinite, in the distant past and has only recently settled down to its currently accepted value (Setterfield 1981). Even though this claim has been rejected by the ICR (Aardsma 1988), it continues to resurface. In one instance in 1996, a creationist on the Internet's Astro listserve mailing list brought this up. But not only is there not a shred of evidence for this idea, scientists are so confident that the speed of light is invariant that today it is used as the standard of length measurement.

### WHAT IS MEANT BY THE TERM, SPEED OF LIGHT?

Unless stated otherwise, the term "speed of light" is understood to mean the speed of light in a vacuum. Light travels more slowly through other media, such as air, glass and water. This happens because light is absorbed and re-radiated by the atoms that make up the medium. And this is true not just of visible light. All electromagnetic radiation—radio, microwave, infrared, light and x-rays—travels at the speed of light.

In fact, the speed of light is a fundamental characteristic of the universe as we know it. So many processes are related to it and dependent on it that if the creationist claims were true, the universe would be far different from how it is now.

*Ron Ebert is a staff member of the University of California at Riverside Physics Department. He is an amateur astronomer and gives talks on astronomy and physics to school groups, astronomy clubs, and audiences of the general public. He also puts on physics demonstration shows for these groups. He is active on the Internet's Astro and Skeptic listserve mailing groups.*

### THE HISTORY OF SPEED OF LIGHT MEASUREMENTS

To see why the confidence in the invariance of the speed of light is so high, we need to look at the history of its measurement, and some of the foundations that led to the development of Albert Einstein's theory of special relativity. The first attempt to measure the speed of light that was successful was made by Olaus Roemer in the late 1600s. He timed the differences in the orbital motions of the moons of Jupiter from when Jupiter and the Earth are relatively close compared to when they are far apart. Based on his measurements, the speed of light was calculated to be 2.3 x $10^8$ meters/second (m/s; Jones and Childers 1990:613)—not bad given the uncertainties about the size of earth's orbit at that time.

**[T]he speed of light is a fundamental characteristic of the universe as we know it. So many processes are related to it and dependent on it that if the creationist claims were true, the universe would be far different from how it is now.**

In 1849, Louis Fizeau performed the first experiment on the earth to measure the speed of light. His apparatus consisted of a toothed wheel, a source of light, and an arrangement of lenses and mirrors. This setup allowed light to move along a path, be reflected from a mirror, and travel through the toothed wheel and back. The toothed wheel was set to rotating, and light's passage through the teeth could be matched to the wheel's speed. Fizeau's calculations yielded a value of 3.15 x $10^8$ m/s for the speed of light (Jones and Childers 1990:613). After Fizeau established this method, others successfully used it or similar methods involving light's reflecting off a rotating mirror to make ever more accurate measurements.

Other methods have also been devised. They include using Kerr Cells which chop up light as does the toothed wheel but are controlled electronically, geodimeters which used modulated light for measuring distances and were mainly used for geologic work, and microwaves and lasers which used measurements based on their frequency, wavelength and phase relationships.

*Table 1*

**EXPERIMENTAL DETERMINATION OF THE SPEED OF LIGHT**

| Date | Experimenter | Method | Speed (m/s) | Uncertainty (± m/s) |
|---|---|---|---|---|
| 1862 | Foucault | Rotating mirror | 298 000 000 | 500 000 |
| 1876 | Cornu | Toothed wheel | 299 990 000 | 200 000 |
| 1880 | Michelson | Rotating mirror | 299 910 000 | 50 000 |
| 1883 | Newcomb | Rotating mirror | 299 860 000 | 30 000 |
| 1883 | Michelson | Rotating mirror | 299 853 000 | 60 000 |
| 1926 | Michelson | Rotating mirror | 299 796 000 | 4000 |
| 1928 | Karolus and Mittelstaedt | Kerr Cell | 299 778 000 | 10 000 |
| 1932 | Michelson and others | Rotating mirror | 299 774 000 | 11 000 |
| 1941 | Anderson | Kerr Cell | 299 776 000 | 14 000 |
| 1950 | Bergstrand | Geodimeter | 299 792 700 | 250 |
| 1950 | Essen | Microwave cavity | 299 792 500 | 3000 |
| 1951 | Aslakson | Shoran radar | 299 794 200 | 1900 |
| 1952 | Froome | Microwave interferometer | 299 792 600 | 700 |
| 1954 | Florman | Microwave interferometer | 299 795 100 | 1900 |
| 1957 | Bergstrand | Geodimeter | 299 792 850 | 160 |
| 1958 | Froome | Microwave interferometer | 299 792 500 | 100 |
| 1965 | Kolibayev | Geodimeter | 299 792 600 | 60 |
| 1967 | Grosse | Geodimeter | 299 792 500 | 50 |
| 1972 | Evenson and others | Laser | 299 792 457.4 | 1.1 |
| 1974 | Blaney and others | Laser | 299 792 459.0 | 0.6 |
| 1976 | Woods and others | Laser | 299 792 458.8 | 0.2 |
| 1977 | Monchalin and others | Laser | 299 792 457.6 | 0.73 |

Table 1 shows some selected measurements made over the years. (Halliday and Resnick 1978:925; Halliday and Resnick 1988:543; Monchalin 1977). These reports show that the measurements became more accurate and precise as time went on.

By the early 1980s the primary limitation on the measurement was the precision with which the length of the meter could be established. This standard of length was determined for many years by a standard meter bar that was kept at the International Bureau of Weights and Measures near Paris. In order to eliminate the need to make secondary standards based on measurement to the standard bar, an atomic standard for the meter, based on the wavelength of light, was adopted in 1960. The meter was redefined to be 1 650 763.73 wavelengths of a particular orange-red light emitted by atoms of krypton-8—something that could be reproduced in any well-equipped laboratory.

### WHY BASE LENGTH ON THE SPEED OF LIGHT?

In 1983 the 17th General Conference on Weights and Measures, the highest international authority on units of measurement, adopted a new definition of the meter, based on the best value for the speed of light: "The meter is the length of path traveled by light in vacuum during a time interval of 1/299 792 458 of a second." Why were the conference participants so confident in the invariance of the speed of light as to base the standard of length upon it? There was more involved than just the quality of the measurements. There was also our modern understanding of light based on modern theories of physics.

In 1865, James Clerk Maxwell provided a unified picture of electricity and magnetism with only four straightforward equations. By using these equations, Maxwell showed that an impressive array of electric and magnetic phenomena could be interpreted and explained—indeed the equations demonstrated that these two are really manifestations of a single electromagnetic phenomenon. The equations correlated experiments in a vast area and made predictions of new results that were later confirmed. They account for such facts as a compass needle's pointing north, the ability to see your image reflected from a quiet lake, drawing sparks when you touch a metal object after walking across a carpet on a dry day, and the ability to pick up your telephone and talk to anyone in the world. These equations give us the basis for the operation of all electromagnetic and optical devices including eyeglasses, microwave ovens, motors, generators, cellular telephones, and telescopes.

### IS LIGHT SPEED CONSTANT?

Maxwell's four equations contain two constants, the permittivity of free space and the permeability of free space—derived from static electrical and magnetic phenomena. When the two constants are combined, a speed emerges which is identical to the speed of light. But this is remarkable! It says that disturbances in electric and magnetic fields travel at the speed of light in free space and strongly implies (as was later shown to be true) that light itself is an electromagnetic phenomenon. However, to produce an accurate measure of its speed, we need a frame of reference—something that *itself* is not moving. But what can this frame of reference be? The surface of the earth? The center of the sun? The center of the Milky Way Galaxy? All of these possible reference frames move with respect to one another.

**[T]he speed of light has never been shown to vary based on the direction from which it was measured—or in any other way.**

Maxwell and his contemporaries didn't really know how to solve this problem, but they revived an idea first proposed by Christian Huygens in 1687—that the speed of light was in reference to an ether, a massless material that pervaded the entire universe. The ether would be both the medium that underlies electromagnetic waves in the same way that water underlies water waves and the absolute frame of reference against which speed could be reliably measured.

This was a great idea, but there was a big prob-

lem with it. Numerous experiments devised to detect and measure some properties of the ether all had failed to find any trace of it. The most famous was the Michelson-Morley experiment in 1887 in which a very sensitive apparatus was designed to compare the speed of light in one direction with the speed of light in a direction perpendicular to the first. They reasoned that, since the earth orbits the sun, it should be moving through the ether and causing an apparent ether wind on the surface of the earth; that in turn would cause a difference in the speed of light in the two directions. But the Michelson-Morley experiment found no trace of an ether wind, nor has any experiment since been able to detect the ether. Furthermore the speed of light has never been shown to vary based on the direction from which it was measured—or in any other way.

The solution to this dilemma was provided by Albert Einstein, who had been thinking about these problems for a number of years and then devised a theory to account for the behavior of light, along with related problems. He published his theory in 1905 and it has since become known as the special theory of relativity. The theory is founded on two principles:

*The laws of physics are invariant in all inertial reference frames.*

This means that the laws of physics apply the same way within all non-accelerating reference frames (to a passenger in a car traveling at a constant speed, the vehicle itself can be such a reference frame for the passengers). This idea is simply an extension of a previously well-established, common sense principle—that Newton's laws of motion apply equally in all inertial frames—to the principle that all laws of physics so apply. Einstein recognized the truth of this from Maxwell's formulation of the laws of electricity and magnetism—laws which have held up under many tests of extraordinary precision.

*It is a law of physics that the speed of light in empty space is the same in all inertial reference frames, independent of the speed of the source or detector of light.*

Einstein pointed out that this meant that the ether could not be detected by any experimental means, and therefore it was a useless concept which should be discarded.

From Einstein's time up to today, special relativity has been subjected to numerous tests and has passed them all with flying colors. It is one of the strongest theories in all of science. It is the confidence in special relativity, backed by all the experimental evidence, that was responsible for the 17th General Conference on Weights and Measures participants' confidence in the invariance of the speed of light.

## What would happen if the creationist claim were true?

The speed of light is a fundamental constant of nature. The word constant, of course, means something that is unchanging. In a sense, the speed of light can be considered to be derived from other constants—most directly from the permittivity and permeability of free space, but these constants, too, are related to other constants such as the charge on an electron, Planck's constant, and the fine structure constant. So if the speed of light were changing, these other constants wouldn't be constant anymore, and the effects of this situation would show up in many kinds of experiments and observations in physics, astronomy, and chemistry—indeed everything—for atoms and molecules would not be as we know them today. If the speed of light were faster in the past, then we should see this in the light spectra produced by distant quasars because the atomic transitions would not be constrained by the same laws. This light is, of course, very old, since it was emitted by these stars ages ago.

**if the speed of light were changing...the effects...would show up in...physics, astronomy, and chemistry—indeed everything—for atoms and molecules would not be as we know them today.**

If the speed of light were changing over the ages, then the observed frequencies in these spectra would have different values based on the electron charge and mass, the speed of light, and Planck's constant compared to their present values on earth. Needless to say, the spectral signature of elements found in the quasars agrees perfectly with those here on the earth today—further proof that the speed of light was not different in the distant past than it is today.


## Acknowledgments

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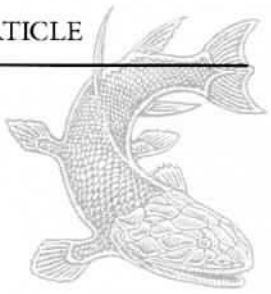

# History Forum Addresses Creation/Evolution Controversy

*John Schweinsberg*

Every year, the University of Alabama in Huntsville (UAH) History Department presents a series of four programs on a topic of current interest such as turmoil in the middle east and the break-up of the Soviet bloc. Recently the creation/evolution controversy was considered to be sufficiently important and interesting to be the central topic. Dr Jack Ellis, professor of history and moderator of the forum, told me that Alabama's 1995 decision to require the insertion of a disclaimer about the validity of evolutionary theory into all high school biology books may well have been the decisive factor in the selection process. The purpose of the forum, which was officially titled "Creationism and Evolution: The History of a Controversy", was to look at the controversy from a historical and sociological, rather than a scientific, point of view. The Honors Program, the Humanities Center, the Phi Kappa Phi Honor Society, and The Student Life Fund joined with the History Department to cosponsor the forum.

## The Evolution of Scientific Creationism

The lead-off speaker was Ronald L Numbers, William Coleman Professor of History of Science and Medicine at the University of Wisconsin and author of *The Creationists* (University of California Press, 1992). Numbers defined the world-wide flood as the leading characteristic which distinguished "scientific creationism" from other forms of creationism and quoted Henry Morris (of the Institute for Creation Research) to that effect. A second characteristic is its claim to be scientific, rather than to use religious reasoning directly from the Bible. "Scientific creationism" is currently the basis of nearly all creationist activity. At the beginning of the century, however, "scientific creationism" had not yet been formulated. At that time all creationist belief was divided into two other camps.

One of the camps, "Day-age" creationism, was championed by G Frederick Wright. Wright was the author of the anti-evolution section in a very influential series of pamphlets, *The Fundamentals*, published from 1910-1915, from which the word "fundamentalism" was eventually derived. Day-age creationism held that the 7 "days" of creation in Genesis were figurative days, rather than literal 24-hour days, thus leaving open the possibility of an ancient earth. Another supporter of Day-age creation was William Jennings Bryan who was much more open-minded to scientific results than the image attributed to him from the play Inherit the Wind. His opposition to evolution was based on the perceived negative social consequences of evolutionary theory. Living in an age when "Social Darwinism" had great following, Bryan was concerned that evolutionary belief was causing loss of religious faith and destroying the foundations of public morality.

The second creationist camp accepted the Gap Theory, championed in the *Scofield Reference Bible* (1909). It also allowed for an ancient earth by maintaining that there was a "gap" between Genesis 1:1, the 7-day creation story, and Genesis 1:2, the Garden of Eden story; that is, the Bible provided no information about the potentially long time period between the initial creation of the earth and the creation of mankind, which was given the traditional date of approximately 4004 BC. Jimmy Swaggert is one of the few major evangelists who supported the Gap Theory in recent times.

The single most influential figure in scientific creationism is George McCready Price, a Seventh Day Adventist. In 1899, he was teaching at a remote village in Nova Scotia. A medical doctor, who wanted to dissuade Price from his creationist beliefs, loaned him geology books which influenced him greatly. Only his prayers and his faith in the visions of the Seventh Day Adventist prophet Ellen White were able to rescue Price from conversion to evolutionism. Price, however, was determined to reconcile his creationist beliefs with the geological record. Price's "rescue" came in the form of a "deceptive conformity".

A deceptive conformity is a geological structure in which relatively young rock is layered directly above much more ancient strata without a layer of intermediate age between them. Overthrusting results in the placement of more ancient rock on top of younger rock—an inversion of the "normal" order. Price interpreted both of these structures as refuting the standard geologic ages. His interpretation was combined with flood geology to explain fossils as the remains of victims of a single great catastrophe. By the end of the twenties, Price was considered a leading fundamentalist authority. Yet, in

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spite of the great impression which he had made, there was very little conversion of adherents from the other two anti-evolutionist camps. This may be due to the association of Price's flood geology with the Seventh Day Adventist Church which was considered an unpopular fringe denomination in fundamentalist circles.

In 1954 Bernard Ramm, an evangelical philosopher and theologian, published *The Christian View of Science and Scripture* which attacked Price's geology. The viciousness of the attack motivated a theology student, John Whitcomb Jr, to write his PhD dissertation in defense of flood geology. To obtain scientific advice, he later teamed with Henry Morris, who possessed a PhD in hydraulic engineering, to co-author *The Genesis Flood*, which appeared in 1961. It was effectively an updated version of Price's geology. Two years later, the Creation Research Society was founded by 10 evangelical scientists. Five of these scientists held PhDs in biology. A sixth, Duane Gish, held a PhD in biochemistry. The society was dedicated to "young-earth creationism" which eventually succeeded in totally co-opting the label "creationism".

Why did flood geology succeed in the second half of the century after its complete failure at the beginning of the century? Numbers believes that there are two major reasons:

1) The launch of the Sputnik satellite by the Soviet Union led to a perceived crisis in American education. In turn, the federal government sponsored the writing of biology texts by the Biological Sciences Curriculum Study. These textbooks became widely used in the seventies and, for the first time, placed strong emphasis on evolution as the basis of modem biology. This created a fundamentalist backlash by the 80s.

2) Fundamentalists were apparently converted from the Day-age and Gap "theories" because the Bible could be interpreted more literally. It was no longer necessary to assume that "day" meant a long time or that the Bible had a major "gap" in its historical account. It was particularly attractive to pre-millenialists who took the entire book literally. Flood geology had now also lost its negative association with the Seventh Day Adventists. Instead, it appeared to give scientific respectability to fundamentalist beliefs about creation.

### Ancient Texts Versus Sedimentary Rocks: Cosmologies in Conflict

The next speaker was Paul K Conklin, Distinguished Professor of History at Vanderbilt University and author of *The Uneasy Center: Reformed Christianity in Antebellum America*. He explained that the first creation account in Genesis, which dates to a period immediately following the Babylonian captivity, is cosmological. A personal creative masculine God named Elohim created the universe in six days. The second creation account is more ancient. A more human-like God named Jehovah makes a garden and creates a man as caretaker. Animals and eventually a woman are created to satisfy the man's loneliness. It is a story about temptation, disloyalty, punishment, and self-consciousness. Due to sin, Adam and Eve's offspring were destroyed by a great flood. Afterwards the earth was less fertile and human longevity was greatly reduced.

These two stories have been extraordinarily influential, being accepted by the Christian, Jewish, and Moslem religions alike. The creation stories had the property of "causality", giving a purpose to existence. Christians specifically believe in creation *ex nihilo*. Mature theism does not require God to have an origin and considers God to be an eternal ground of being who simply created an extension of himself. The creation stories also posses a certain incoherence and "tension" which actually serve to make them more appealing.

Although Christians have always argued about the details of the Genesis accounts, their basic validity was not in doubt until the end of the 18th century when critical biblical scholarship, as well as the growing scientific field of geology, both began to establish questions. It was becoming clear that the earth was older by several orders of magnitude than previously believed. A consistent geologic column was found to exist word-wide, and there was no evidence for a global flood. Genesis was in conflict with the rocks.

**Why did flood geology succeed in the second half of the century after its complete failure at the beginning of the century?**

In the 19th century these tensions had to be faced. Theologians re-interpreted Genesis to allow the creation of new species at the beginning of each geological period. In the 1830s the continuity of geological epochs was not yet obvious. The radiation of species at the beginning of each epoch was explained by re-creation—including the re-creation of species from the preceding epoch who would appear as survivors. This periodic intervention of God preserved agency and purpose in the concept of evolution.

Darwin was able to describe a mechanism for change, based on population theory, which explained the continuity of species without a need for divine intervention. Inherited variations which enhance the probability of survival can accumulate to produce new variations and even new species, resulting in all modem life forms. Its explanation defined general patterns, not the predictable clockwork mechanism of Newton. The greatest threat to Christianity, however, was not evolution per se, but the naturalization of the mind. Darwin's *Descent of Man* gave an evolutionary explanation for self-consciousness. "Mind" and "idea" were no longer necessary causative agents for creation. A naturalistic explanation was sufficient.

The religious concept of cosmology shapes our language. The terminology "big bang" is itself a creationist concept. By personifying nature, the term "natural selection" is also a misnomer. Darwin

writes that natural selection "selects for the good" of each individual and that nature rejects "bad" variations. This is the language of the natural theology which he studied in school. Even today, biologists and physicists talk in terms of causative agents, even though evolution does not "cause" an observed result. The language of evolutionists often resembles that of theists.

Many Christians assimilated evolution by transforming Genesis into a suggestive myth. God is the "ultimate cause" who intervened only at the beginning of creation, and possibly a second time to create human self-consciousness. Conservative Christians, on the other hand, persisted with the Day-age and Gap "theories" through the 1930s, in spite of their mythological aspects. Today, they have returned to a literal interpretation of flood geology in which people coexisted with dinosaurs. They argue that they simply have a different set of suppositions and paradigms than those used by the humanistic scientists. On this basis, they consider their own approach as equally valid scientifically.

**[Bryan] believed that evolutionism would lead to atheism and a breakdown in public morality.**

Today, we live in a tragic age in which all old gods are dying. The Genesis story has become mythological for most people. Feminists cheer the demise of the highly masculine Jehovah. Liberal theologians commit deicide by making a new thunderless god every year. Why did the Lord of Eden warn against eating from the tree of knowledge? Was it really to protect Adam and Eve from knowledge? Knowledge is addictive and will eventually kill all gods. Perhaps God proclaimed the prohibition for reasons of self-preservation.

### The Scopes Trial: A Reappraisal of Science, Religion, and Law in the South

The third speaker was Edward J Larson, Professor of History and Law at the University of Georgia. He is author of the book *Summer for the Gods: The Scopes Trial and the Evolving Concept of Freedom*. Larson maintained that the popular images of the Scopes trial, formed from sources such as Inherit the Wind, are extremely inaccurate. William Jennings Bryan had been a strong hero to common people for a long time. He had been a leading crusader for labor and tax reforms and for women's suffrage. He had been a major candidate for president three times. He had resigned as Secretary of State in opposition to the expected entry of the US into World War I.

Bryan's opposition to evolution was based on sociological considerations. He opposed "social Darwinism" which was popular at the time. He also believed that evolutionism would lead to atheism and a breakdown in public morality. He opposed both religious instruction in schools and teaching that evolution was a fact. When Tennessee passed its law forbidding the teaching of evolution, Bryan was supportive but disagreed with the provision for a $100 fine.

The Tennessee law was supported by the World Christian Fundamentals Association (WCFA) which had been founded three years earlier to promote similar laws. It was opposed by the American Civil Liberties Union (ACLU) which considered the law to be an attack against academic freedom. The ACLU published an ad in a Chattanooga newspaper asking for a volunteer teacher who would be willing to initiate a test case. The offer was taken up by the civic leaders of Dayton, who wanted publicity for their small town. They convinced a local teacher, John Scopes, to cooperate. The WCFA recruited Bryan to represent them. Recognizing the promotional opportunity, Dayton appointed Bryan assistant prosecutor. Arthur Garfield Hayes put together a publicity-conscious defense team which included Dudley Field Malone, a strong supporter of the rights of women, blacks, and reformers, and Clarence Darrow, a non-Christian who doubted the existence of God. Both lawyers were new to the ACLU. Each side was interested in the publicity value for its own program. The trial was covered by hundreds of reporters and was the first to be carried live by radio.

The prosecution attempted to limit the trial to the narrow grounds that the legislature had the authority to control education in the public schools. This was a legally sound argument which would, in practice, suffice to uphold the validity of anti-evolution laws. Expert witnesses to debate the scientific merits of evolution were not desired, since this could only serve to tilt the trial in favor of evolution. In fact, evolution was well accepted by the scientific community, and no expert of adequate scientific credentials could even be found to support the creationist view. The defense was successful in having expert testimony excluded.

The defense argued that the law infringed upon individual freedom. The defense also argued that it was unreasonable and compared it to a law forbidding the Copernican theory. Since the judge had the authority to decide legal issues, these arguments were not heard in the presence of the jury. After the judge upheld the state's control of public education, Darrow argued about interpretation of the statute. He maintained that evolution did not conflict with the Bible and that the Bible could be interpreted to support evolution. He invited Bryan to become an expert witness regarding the Bible. In spite of the legal dangers, Bryan, as a noted religious columnist, felt obligated to accept.

Bryan initially gave evasive answers when asked whether he had ever interpreted the Bible. When asked about Old Testament miracles, such as the sun's standing still, Bryan left the door open to interpretation by admitting that the earth may not have stood still but that the Bible was written in language which common people could understand at the time. Questioning continued about Noah's flood and finally the six days of creation. Bryan admitted that these may not refer to literal 24-hour days. All attempts by the prosecutor to halt the interrogation failed. Darrow maintained that the purpose of the interrogation was to demonstrate that bigotry and ignorance shouldn't control education. Bryan maintained: "I am trying to protect the word of God

against the greatest atheist in the US."

Scopes was found guilty. The ACLU appealed to the Tennessee Supreme Court, making the case an issue of individual freedom vs. state authority over education. The court upheld the law, claiming that Scopes had to obey his employer, the state. However, it overturned the conviction on the technical ground that the judge, rather than the jury, had set the fine. This prevented the ACLU from appealing the case.

The Scopes trial had important but mixed effects on our culture. Newspapers ridiculed the anti-evolutionist position. The ACLU had successfully exposed the ignorance, intolerance, and arrogance of the anti-evolutionists. On the other hand, the anti-evolutionists had won the legal battle. There was little change in the South, and other southern states adopted similar laws. A generation of textbooks was affected.

Today we think of the trial in terms of its media image. The play Inherit the Wind was written in 1955 to reflect on McCarthyism. The play intended to show a parallel from history. Initial reviews criticized the depiction of heroic evolutionists vs. ignorant creationists. The play has now reopened at a time when fundamentalists are taken seriously but McCarthyisrn no longer applies. Northern papers give it good reviews. Secularists see the issue as individual liberty vs. majoritarian democracy.

### Creationism and Evolution: Perspectives for the 1990s

The 4th event in the program was a panel discussion. The panelists were as follows:

Stephen Waring of the UAH history department opened the session by summarizing the development of religion and science. Pre-modern people explained the past through legends and myths. Religion became the basis of knowledge. In the West, where Christianity became the dominant religion, the Bible was understood to be complex but was still accepted as factual history. Genesis was accepted as accurate revealed truth. In the Middle Ages, the investigation of the natural world was considered a means toward better understanding of God. Modern ideas began with the discovery of new information not mentioned in the Bible, such as the heliocentric astronomy and the existence of America. Early scientists rejected the use of supernatural hypotheses since these could not be tested, falsified, or observed. Science and religion were consequently separated into different realms. There remains no easy harmony between science and religion.

Donald Armentrout of the theology department of the University of the South was the second panelist and identified himself as a Christian evolutionist. Armentrout believed that the dispute was about biblical interpretation, since a large portion of Protestantism has mistakenly made the Bible absolute and infallible. The Genesis account should be considered poetry, showing the Creator's transcendence. Literal interpretation of Genesis has caused much mischief. Scientific discoveries simply describe things without affirming or denying God. There is no inherent principle in evolution which requires a non-theistic world view. There is nothing in evolution which precludes divine intervention. There is no need to protect the Bible from science.

John R Christy, Associate Professor of Atmospheric Sciences at UAH, was the third speaker. He identified himself as an evangelical Christian who was formerly a minister and missionary. He remarked that scientific observations show that the earth is very old. He cited the example of ice cores from Greenland which date back 1.2 million years. The cores contain separate layers which can be counted like tree rings and at least 150 000 individual years have been counted. Rocks in Greenland containing fossilized alligators and ferns show evidence of a former tropical climate. Evolution is the best explanation for hundreds of thousands of observations world wide. Christy strongly opposed the anti-science movement and considers science to be an ally of Christianity.

William Gartska of the UAH biology department explained that evolution is a major principle of science. "Creation science" is a strictly American belief which assaults skepticism. The "Equal Time" decision in the Arkansas case (*McLean v. Arkansas Board of Education [1982] 529 F. Supp. 1255, 50 US Law Week 2412* ) defined science and disqualified creationism for its dependence on the supernatural. Creationists would turn science into a belief system by allowing miracles and revelations. To demonstrate that science is not a belief system, Gartska cited the example of Francis Crick's suggestion that life on earth was seeded from space. Even though Crick was a Nobel Prize winner of great authority, his proposal was met with great skepticism and not accepted by the scientific community.

The final and most controversial panelist was Kurt P Wise, Associate Professor of Science and Director of Origins Research at Bryan College in Dayton, Tennessee. Wise gave a different history of creationism than previously heard in the forum. He explained that creationism died in academia at the end of the last century because it had accepted Aristotelian fixity and was unable to adapt to evidence of change. Creationism was unable to resurrect itself because of "scientism" in academia, specifically the rejection of the supernatural as an explanation of events. Wise questioned this doctrine with the rhetorical question: "What if supernaturalism is really true?" In the 20th century, creationism stayed alive in the laity who have now rebelled against scientism. The separation of supernaturalism from science successfully provided new ways of looking at the world but subsequently shackled investigation. Wise strongly criticized the "scientific creationism" movement, particularly its political orientation and its "evolution bashing". He remarked that its "science" was of poor quality, much of it from non-scientific engineers. However, the controversy did cause necessary re-evaluation in academia.

Wise suggested that creationism has been reborn at an academic level. He claimed that the number of trained creationist PhDs is doubling every 10 years. It is also growing in Germany where it is more

research oriented. Creationists are now concentrating on a positive creation model, rather than "evolution bashing". The creation models are undergoing continuous revision due to a process of peer review which was implemented 15 years ago. There are now three peer-reviewed creationist journals. However, Wise believes that standards must be further increased. The new creationism has developed theories which are predictive and explanatory.

Furthermore, mainline science is beginning to move in a creationist direction. In geology, catastrophism is becoming more popular. In biology, the hyper-gradualism of Darwin is being revised. More attention is being given to evidence of discontinuity in the origin of different major groups. Creationists have developed a new method of classification which allows discontinuity. They have also developed a model of plate tectonics which predicts the movement of continents at a more rapid time scale than generally accepted. Wise emphasized that creationism does not represent a monolithic camp. He denied any political agenda and opposed attempts to force the teaching of creation in schools. This must wait until an adequate creation model has been developed. Wise has great respect for science and scientists. Science helps him to know and serve God.

### Ouestion Period

After each panel member made a prepared opening statement, the panel took questions from the audience. Most questions were directed to Wise and Armentrout. When asked about Greenland's ice cores, Wise denied detailed knowledge, but suggested that most layers were fused and couldn't be distinguished. When Christy stated that they could be counted distinctly for hundreds of thousands of years, Wise readily accepted this and admitted that he had no explanation. Questioned whether he accepted any restrictions to supernaturalistic explanations, Wise said that the nature of God is the limit. Supernatural explanations should be viewed very skeptically and be invoked rarely. Personally, he would use supernaturalism only to explain the great flood and creation itself. Asked to explain stars separated by millions of light years, Wise likewise admitted he had no explanation because the creationists do not have any experts in cosmology. When asked whether new evidence would change his conclusions, Wise stated that all scientific theories must be consistent with data, but that the current evolutionary theories are blind to discontinuities.

When asked about the moral implications of evolution, Armentrout stated that evolution has no relevance to the question of morals. When questioned about the interpretation of Genesis as poetry, he insisted that he does indeed take Genesis seriously and believes that Genesis is enhanced by a poetic interpretation. When asked why Protestantism has a problem with evolution, Armentrout stated that Protestantism has a strong tendency to violate the First Commandment by placing the Bible ahead of God.

### Impressions

The lecture series was very well attended, although I think that the university setting and sponsorship may have resulted in a small turnout of active proponents of creationism from the general public. Nevertheless, I believe that it was greatly informative to those who did attend. Personally, I was impressed by the honesty of Kurt Wise. Although he is unscientific in the sense that he uses a preconceived notion and accepts supernatural explanations, he openly admits that he does this. Instead, he questions scientific philosophy on these points, which is his right. This is a refreshing change from politically oriented creationists who talk about the Bible to church audiences but tell school boards that creationism has nothing to do with religion.


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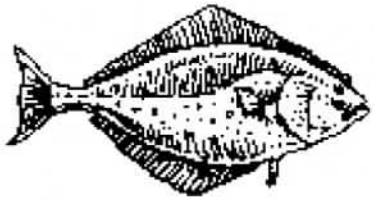
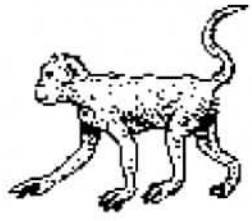


In a recent issue of *Back to Genesis*, former Institute for Creation Research president Henry Morris takes a very pointed look at NCSE! He makes specific remarks and names names! Find the article at <http://www.icr.org/publs/btg/btg-109.htm>.



Human Evolution in Fiction

Jim Foley sent us a note about a web page that he maintains at <http://www.talkorigins.org/faqs/homs/fiction.html>. It contains a list of fictional works relevant to human evolution. A few of them discuss creationism to varying degrees. There's a lot more than *Clan of the Cave Bear* out there!

# The Newer Anti-Evolutionists: Introducing Greg Koukl

*Stephen B Hunter*

There have been a number of articles published recently by the National Center for Science Education which explore "Design Theory" as a replacement for old-style, young-earth creationism as the reigning paradigm of anti-evolution apologetics (see, for example, "Origins & Design: A Journal, not Just a Debate Ploy!" by John Cole in *NCSE Reports* 1996 Winter; 16[4]:4-5 and "Naturalism, Creationism, and The Meaning of Life: The Case of Phillip Johnson Revisited" by Robert Pennock in *Creation/Evolution* 1996 Winter; 16[2], nr 39:10-30).

Under the old paradigm, opponents of evolution were the denizens of the Institute for Creation Research (ICR) and their ilk, whose science is laughable and whose arguments resemble not so much an exchange of ideas but the rhetorical counting of coups. Since young-earth "evidence" collapses under even the most cursory examination, it is only effective when wielded by fast moving riders. And ride they did. Long ago, it became clear that the adversarial debate format favored by young-earthers was not conducive to careful discussions of science. Defenders of evolution, pummeled by coup sticks, learned that, like the punch line from the movie "War Games", the only way to win was not to play. There was some solace in the fact that this hollow coup counting did not fly in the federal courts where it really seemed to matter.

With the shift of paradigm came a certain optimism that we could finally move beyond discussions of the depth of the dust on the moon or those human footprints in the Mesozoic rock of Texas and could finally begin to address issues of substance. That optimism was short-lived as the names changed but the impasse seemed just as intractable.

One name that has not appeared in these articles on "Design Theory" apologists is that of Gregory Koukl. It is my impression that Koukl is an emerging heavyweight in this field and I would like to introduce you to him and his positions and in exploring some of those arguments suggest that the tooth-and-nail conflict between "us and them" is, at base, illusory.

First the stats: Koukl is a licensed Pentecostal minister and founder of Stand to Reason, a Christian apologetic ministry dedicated to promoting "clear thinking Christianity that can compete in the marketplace of ideas." He lectures extensively, teaches at Simon Greenleaf University, has been featured on James Dobson's "Focus on the Family" radio program, sponsors seminars, publishes a bimonthly newsletter (*Solid Ground*) and a quarterly journal (*Clear Thinking*), operates a web site (<http://www.str.org>) and is about to release his first book (*Relativism: Feet Firmly Planted in Thin Air*) with co-author Dr. Francis Beckwith. But his main venue is an 8-year-old, call-in radio program broadcast over KBRT in Avalon CA, KKPZ in Portland OR, and KJSL in St. Louis, MO. He deals in an intelligent and erudite way with a broad range of religious and philosophical issues, but his thoughts on science and evolution are at issue here.

In a radio commentary called "God and Evolution" delivered on February 26, 1995, Koukl said

> If you are an evolutionist, you are not a theist in the sense that your theism has anything to do with the real world. ... Your belief about the real world is evolution, and that means time and chance. If you believe that God has something to do with the real world, then you can't be an evolutionist because evolution is run by chance, not by God, by definition.

Koukl holds that evolution and Christianity are in direct opposition to one another. This is a common, perhaps even universal, position among those at the forefront of this movement as well as among those listening to them. This view has become the linch-pin of the log jam that is preventing honest discussion of the science of evolution (that's not a mixed metaphor, but a compound metaphor). As a committed, thoughtful and sincere Christian, Koukl says that the most important thing in life is his relationship with God. If accepting the reality of evolution means abandoning that relationship with God, no conceivable scientific evidence will move him. That is understandable, even expected. Before we can hope to make progress with Koukl and his numerous allies, we must address the compatibility of their profoundly held religious beliefs with the idea of biological evolution. This is where it gets dicey. We should be arguing evidence. Evolution is a scientific theory, not a philosophy. But that is pointless until we get past this philosophical/religious question.

### Nature and Lawfulness

At the heart of Koukl's position are a couple of unfortunate assertions. One is that in the case of evolution the methodological naturalism necessary to the function of science has become equivalent with philosophical naturalism. Because direct intervention by God contrary to natural law is not included within evolutionary processes, God either does not exist or is at best impotent. This principle is certainly not consistently applied to all scientific theories.

*continued on p 20*

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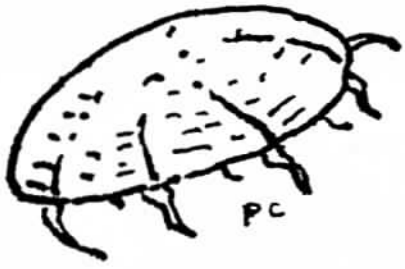


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There are many other scientific theories accepted by Koukl and other old-earth creationists which do not refer to miracles in contravention to natural law. In those cases God is considered to be the author of natural phenomena; therefore violation of natural law is not necessary to infer the hand of God. Evolution is merely an effort to describe life as an ongoing natural phenomenon.

Chance and purpose may be mutually exclusive in all instances save one—the instance of God. If God exists and is the author of the universe, in God's case chance and purpose are one and the same, "by definition". For purposes of discussion let us stipulate that it was that errant bolide that whacked the Yucatan 60-something-million years ago that put the period at the end of the dinosaurian sentence. This freed up all of the choice ecological niches for our mammalian ancestors, which in turn allowed for the development of us. From the point of view of a scientist, no laws of nature have been violated. As fortuitous as it turned out to be, it was a just a natural phenomenon. Impacts happen. But, just perhaps, God arranged from the foundations of the universe for just the proper-sized asteroid to be dislodged from its comfortable orbit and sent on a collision course with our destiny. This is not something that can be explored empirically. Science is in no position to include nor exclude divine motivations behind natural events; our role is only to describe the natural events themselves.

### Science or Scientism?

Another related, but distinct, assertion is that support for evolution is contingent upon "Scientism". Scientism is defined as the contention that the only valid means of understanding the totality of human experience is science. Philosophy and religion may be comforting pursuits, but are ultimately worthless. If science is the only valid means of understanding and science excludes the supernatural, then even when the evidence points to supernatural creation, evolution is adopted by default. Scientism, so defined, is foolishness and constitutes a straw-man argument. (Paradoxically, Koukl's radio commentary from January 15, 1995 is entitled "Science Doesn't Tell Us Anything Important." Would we call this "anti-scientism"?)

Science is a means of investigating natural phenomena. It has proven to be an extremely effective and valuable tool, but only as a means of investigating natural phenomena. Clearly, there is more to life. Is it more important for me to discover how the bluefin tuna came to be warm-blooded or to discover how to relate to my son's decision to become a Buddhist monk and live the monastic life? If I must choose between the two, the fish is on its own—obviously. But why must the two be mutually exclusive? I guess that's a crude way of saying that this is an elaborately constructed false dichotomy.

Koukl has expressed many of the familiar specific objections to evolution that have been expounded by Phillip Johnson, Michael Behe, Michael Denton, Hugh Ross and others. His favorite objection is that there can be no objective morality if evolution is true. Although there are cogent answers to each of his other objections, these answers will continue to fall on deaf ears until this core objection can be addressed.

In his radio commentary "Chance and Dignity" on August 13, 1995, Koukl said

> Science has limited its area of study to the area of natural occurrences. Not only has it limited its search to that area, but it has essentially said that that is the only area that really exits....If only nature exists, then it turns out that we are merely parts of the machinery in the workings of nature, and we are the unwitting victims of the machinery of cause and effect happening over time without any plan. That robs human beings of their dignity. Clearly, if we are the product of chance, then we have no purpose....We are all unwanted pregnancies....Mother nature didn't want us...It just spewed us forth. It just unconsciously squeezed us out. We were the thoughtless conceptus of intercourse of blind natural compulsions with no thought given to us, strangers who accidentally bump into each other in the dark of the universe. We are bastards of the one-night stand if evolution is true.

You cannot dispute that passion by pointing to the postdentary bones of a therapsid reptile and saying, "Look. A transitional form!" If, however, it were possible to convince Koukl and his colleagues that evolution need not threaten their world view, the rest of the conflict would largely evaporate.

Because the thread of evolution is woven into a myriad of areas of scientific inquiry, an understanding of evolution is fundamental to a comprehensive science education. Every time curriculum standards or textbook purchases come up, the issue of creation vs. evolution intrudes. But it is really not the *scientific* issues that are driving the objections. As the example of Greg Koukl points out, we are faced with a deeply-held conviction that evolution inevitably includes the rejection of God and morality, and further greases the slippery slope leading to the ultimate destruction of civilization. If we were able to defuse this line of reasoning without compromising or soft-pedaling evolution, imagine how much would the quality of science education improve when we could devote our efforts to the task at hand? That is one reason why understanding Koukl and folks like him remains a vital issue. Besides, it is insulting to sincere and knowledgeable Christians who accept evolution as a compellingly demonstrated scientific theory to be told they either don't understand evolution or that their faith is faulty.


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# National Science Assessment Shows Need for Improvement

*Molleen Matsumura*
*Network Program Director*

On October 21, 1997, the National Assessment Governing Board (NAGB) announced results of its 1996 tests of science knowledge and skills among the nation's 4th-, 8th-, and 12th-grade students. During the press conference at which test results were released, NAGB Chair Mark D Musick commented, "...[T]hese are part of a very important change.... With these achievement levels NAEP [National Assessment of Educational Progress] is being transformed into a standards-based test, not just a norm-referenced report on comparisons. The Board defines carefully how good is good enough."

For each grade level, tests determined whether students' levels of knowledge were "basic", "proficient", or "advanced". Education Secretary Richard W Riley found good news in the test results: "American education has done a good job in the last decade in improving science education. We aren't where we want to be but...[w]e have raised the level of science education by one grade level.... [T]he NAEP science scores have been going up since 1982.... As this report notes, 67% of our nation's 4th graders are at or above the basic level."

Fred Johnson, president of the National Science Teachers Association, noted sobering facts in the test results and in the state of science education. In comments posted on the NAGB website, he remarked, "[T]he NAEP achievement results show us very clearly that the students of this nation are not where they should be if we expect them to grow into scientifically literate adults.... [I]t is unacceptable that more than 70 percent of the students in each of the three grades demonstrated an understanding of science below the proficient level. Indeed, [over 30% at each grade level tested]...never even reached the basic level. " Johnson cited lack of resources in urban schools, shortages of teachers properly trained in science, and lack of preparation time for teachers as factors contributing to deficiencies in science education. According to a 1996 study released by the US Department of Education, many science courses are taught by "out of field teachers", especially in "high-poverty" schools; for example in 1991, 34% of life-science teachers in "low-poverty" public secondary schools and 46% of life-science teachers in "high-poverty" schools, had no college major or minor in the field.

Problems for science education in general apply to evolution education in particular. Teachers who are not well grounded in science and "live in the world of crowded classrooms, competing demands, ambiguous education goals" may not be prepared for pressures to avoid teaching evolution.

[*NCSE thanks Dr. Barbara Forrest for contributing information used in this story.*]

For more information about the National Assessment Governing Board, its testing procedures and publications, contact:

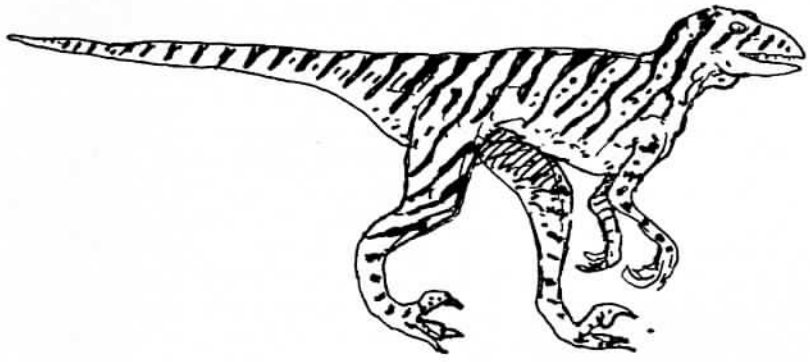
The National Assessment Governing Board
800 North Capitol Street, NW
Suite 825
Washington, DC 20002-4233
(202) 357-6938
email: nagb@erols.com
<http://www.nagb.org>

Comments and responses to the NAGB report made during the October 21, 1997 news conference can be found at the following locations on the World Wide Web:

Johnson F. Responding to the Challenge of the NAEP 1996 Science Performance Results.
<http://www.nagb.org/johnson.html>

Musick MD. Statement on NAEP 1996 Science Performance Standards.
<http://www.nagb.org/musick.html>

Riley RW. Statement on the Release of NAEP Science Standards.
<http://www.nagb.org/riley.html>



# The Naked Truth: The Fallacy of Genetic Adam and Eve

*Greg Laden, Department of Anthropology, University of Minnesota*

Since the mid 1980s, scientists have compared mitochondrial DNA (mtDNA) from several different humans, reconstructing an ancestor of living human mitochondria about 100-200 thousand years ago, which probably lived in Africa (Cann, Stoneking and Wilson 1987). More recently, other researchers reported similar results from a study of human Y-chromosome DNA indicating a common ancestor of a large part of the human Y-chromosome at a similar or more recent time, also in Africa (Hammer, 1995; Hammer, Spurdle and others 1997; Gibbons, 1997). The studies of mtDNA immediately evoked the image of an African "Eve", and now, the Y-chromosome research has evoked a corresponding image of an African "Adam". The metaphorical association between genetic research and the Book of Genesis may have helped sell newspapers, but this metaphor involves a misunderstanding of the meaning of these findings. In both the popular press and scientific journals, we see such statements as "All women/men can trace their ancestry back to a single female/male living in Africa X thousands of years ago." Such statements are misleading, and may obscure more interesting aspects of this important research (see side bar).

**Even if the historical role of Adam and Eve is overstated, there is still reason for excitement about the mtDNA and Y-chromosome studies.**

The genetic code includes units of information that are kept whole when they pass from generation to generation. Genes are passed on as whole units. The DNA in our mitochondria (cell organelles responsible for energy production) are also passed on as whole units, and a large part of the Y-chromosome is, similarly, passed on as a whole unit. Any stretch of genetic code so inherited necessarily has a single common ancestor—called a "coalescence point"—that existed in a particular individual. Furthermore, each of these units of DNA can, and probably does, have a *different* coalescence point. So, if there is a mitochondrial Eve and a Y-chromosome Adam, there is also a hair color Medusa and a melanin Midas.

Even if the historical role of Adam and Eve is overstated, there is still reason for excitement about the mtDNA and Y-chromosome studies. These bits of DNA are passed on in humans through only one parent. Mitochondria replicate asexually within cells. The ovum produced by a woman includes a small number of her mitochondria, which in turn reproduce to supply the mitochondria in all of the cells in her offspring's body. The non-recombining part of the Y-chromosome does not swap genetic material with the X-chromosome to which it is matched, so each human male gets all of these genes from his father. Therefore, it is possible to study genetic echoes that reflect different population histories for humans as a whole, females as a group, and males as a group.

Were we gibbons, who do not migrate far and who are very strictly monogamous, this would be less interesting; our mtDNA, non-recombinant Y, and other genes would show a similar pattern. However, humans are diverse and imaginative in their marriage and mating practices. At the very least, we practice serial monogamy. Polygyny happens. Hypergamy (unidirectional exchange of mates of one sex across a cultural boundary such as class), polyandry, and other varieties of marriage and mating practice are widespread in humans now and in the past. Often, males and females differ in their patterns of residence after marriage (commonly, newlyweds move to a residence near the male's family). These factors shape separate histories for maternal and paternal lineages.

Coalescence is key to understanding this, so let's examine this concept more closely. Coalescence is a property of divergent systems, like genes, rumors, and chain letters. Chain letters come in different flavors—some asking for money, others merely warning of bad luck. For each "species" of chain letter, there is a source to which all copies could be traced. As the letter is duplicated and passed from one person to others, it may be changed by accident or design, so over time there are many minor variants of the first document. A hard-working detective seeking the original version of a chain letter could work backwards through postal records to track down the very first copy written months, years, or decades earlier. A lazy detective might simply examine all of the available chain letters and reconstruct a document that must look much like the original (even if not exactly). Our lazy detective might even take a guess as to how many "generations" have passed since the initial letter was written, by noting the number of typos and alterations, assuming that more changes means more generations. In both cases, the first copy of that chain letter is a "coalescence" point. Our diligent detective has located the *actual* coalescence point, and our lazy detective has estimated or reconstructed it.

To reconstruct genetic coalescence points, scientists use the techniques of our lazy detective, not because they are lazy, but because genetic coalescence points are generally ancient and must be inferred from modern samples. "Mitochondrial Eve" and "Y-chromosome Adam"

are not individuals, but estimates of coalescence points based on modern samples. New data added to the equation could move Adam or Eve (independently) back through time, or even to a new region of the earth.

Mathematical modeling of Y-chromosome and mtDNA data has revealed one or more "bottlenecks" in human population history. These bottlenecks are periods when our ancestors were reduced in number and confined to one or a few groups. Bottlenecks are detectable because they reduce the diversity of genetic material. We should not be surprised that our species has passed through these bottlenecks. Repeated severe "Ice Ages" of the last million years or so reduced the geographical range of many animals and plants, causing many species to go extinct (from the point of view of extinction, a bottleneck is a "near miss"). Eventually, genetic bottlenecks may be matched to these climate changes and to archaeological evidence from those times.

The bottleneck model for human history has led to further confusion about genetic Adam and Eve. Evolutionary change such as the rise of a new species is perhaps more likely when a population is broken up into small, isolated groups. Thus, a bottleneck is a good place to look for a speciation event. Also, the earliest modern *Homo sapiens* fossils date to about the same time as the mtDNA bottleneck. This has led to the idea that the genetic echo from this bottleneck marks the origin of modern *H. sapiens*.

It is important to remember, though, that coalescence points occur for all genetic units, whether there was a bottleneck or not, or a speciation event or not. The identification of a coalescence point is an inevitable outcome of comparing variants of a gene. Perhaps coalescence points will be found to cluster in time near important evolutionary events, but for now there is no evidence that this is the case. Perhaps the life and times of genetic Eve, Adam, Medusa and Midas were quite ordinary.

Not all bottlenecks are genetic; some are informational. The most recent Y-chromosome results are very interesting, and clearly deserving of news coverage. But there have been several studies of human Y-chromosome variability going back several years which have not been as widely reported (see Gibbons and Dorozynski 1991; Shreeve 1991). Low variability in Y-chromosome DNA has been found in several populations. There is a Jewish Adam (Lucotte and David 1992; Lucotte, Smets and Ruffie 1993), a Finnish Adam (Sajantila, Salem and others 1996), and a Native American Adam (Karafet, Zegura and others 1997), for instance. If the geneticists have it right, and this variability is properly calibrated (the Y-chromosome is a badly behaved genetic mess, perhaps not surprisingly), then it would appear that male population histories have more restrictions than do female histories. This accords with what we know about human reproductive patterns. Males vary more than females in their reproductive output. Some males have far more offspring than others, and many males have no offspring. Each female is likely to have a nearer to average number of offspring. This would cause apparent bottlenecks in the male lineage that would not appear in female-only DNA.

Stay tuned. Fifteen years ago, when this sort of research was just getting off the ground, it was difficult, time-consuming and expensive to analyze genetic data. The first studies of mtDNA required human placentas, which are not easy to come by. Now, geneticists extract, isolate, and sequence DNA from many different tissues, more cheaply and more quickly. Until recently, geneticists had all but given up on the Y-chromosome, which appeared to be poorly behaved as a genetic clock. Now somewhat redeemed, the Y-chromosome is starting to yield promising results. Although earlier work in human historical genetics was important, it is also true that the data are only now starting to roll in, and the next few years should be a very exciting time.

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Gibbons A, Dorozynski A. Looking for the father of us all: After finding the controversial "mitochondrial Eve," molecular biologists are hoping that the Y chromosome will lead them to the genetic Adam. *Science* 1991; 251(4992):378-80.

Gibbons A. Y chromosome shows that Adam was an African. *Science*. 1997; 278(5339):804-5.

Hammer MF, Spurdle AB, Karafet T, Bonner MR, Wood ET, Novelletto A,


## In the beginning was the word (on Adam and Eve).

The following quotes are reproduced here to demonstrate a range of conceptions about mitochondrial and Y-chromosome historical genetics. They are taken from articles in the popular press, scientific journals, and web sites. The author has chosen to not provide citations for these phrases, in order to avoid pointing fingers at well meaning writers, and because many of these quotes are subtitles or pullouts that are probably the work of anonymous editors.

*All men can trace their ancestry back to one man who lived 150 000 years ago and whose closest living relatives are a small tribe in South Africa, according to scientists who have spent a decade searching for the original Adam.*

*Scientists have "established...that all humans are descended from a single woman—a prehistoric 'Eve' born some 200 000 years ago in Africa. More recent studies of the male Y chromosome indicate that there was also a corresponding 'Adam' from which all males are descended."*

This source goes on to clarify (sort of)...

*Any comparison to the Adam and Eve of Genesis would be mistaken, however, since the genetic Adam and Eve probably did not live on the same continent or during the same millennia...*

One source reports that...

*modern humans descended from a common male ancestor who lived 188 000 years ago. Although the new report does not say where that ancient man, whom some are calling "Adam," lived, his age is close enough to Eve's for this kind of work.*

To be fair, this source later adds:

*Even though the studies refer to a single man or woman in the past, they do not imply that those people were a couple or even that they were the only parents of all humans.*

Better. But the redemption is quickly mitigated by this follow-up:

*Their (Adam and Eve's) primary significance is in pointing to the time when anatomically modern human beings,* Homo sapiens sapiens, *evolved from a more primitive ancestor, generally thought to be an "archaic" form of* Homo sapiens.

Oops.
A prestigious scientific journal reports that...

*In the beginning, there was mitochondrial Eve—a woman who lived in Africa between 100 000 and 200 000 years ago and was ancestral to all living humans....To test this view of human origins, scientists have been searching ever since for Eve's genetic consort: 'Adam'....Now, after almost a decade of study, two international teams have found the genetic trail leading to Adam, and it points to the same time and place where mitochondrial Eve lived.*

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# NCSE Membership and College Admissions Tests

*Richard A. Nisbett*
*University of Oklahoma Health Sciences Center*

*Kevin M. Kelly*
*The University of Iowa*

In looking over the new 1997 membership directory, we were intrigued by the regional variation. As a first step toward some sort of explanation for this pattern, we decided to see if there were a correlation with state ACT scores. We calculated the number of NCSE members (listed in the directory) per 100 000 population for each state using current census figures. Then, we extracted the 1997 average composite score for each state as compiled by ACT and posted on the ACT website at <http://www.act.org>.

We found the NCSE membership rate had a moderate but significant positive association with the mean ACT score ($p < 0.0003$; Kendall's Tau, B= 0.36126). In general, those states with the highest proportion of NCSE members had the highest ACT scores, while those with the lowest membership rate had the lowest scores. For the top 10 states in NCSE membership, all except one were above the national ACT average (21.0). For the bottom 10 states in membership, all except one were below the national ACT average. Examine these three similarly-sized states in the "Heartland" as examples.

We will resist the temptation to over-interpret our finding. However, we suggest that either: (1) a certain percentage of those members in states with large NCSE memberships should move to states with low membership and disseminate their wisdom and lobbying energies; or (2) states with low scores should bus their children to schools in states with high membership. Alternatively, our NCSE colleagues in those states with low membership could encourage their peers to join NCSE in hopes that a successful membership drive will, ultimately, reach critical mass with a concomitant rise in state ACT scores.

| State | NCSE Members per 100 000 Population | Mean ACT Scores |
|---|---|---|
| Colorado | 4.29 | 21.5 |
| Iowa | 1.54 | 22.1 |
| Oklahoma | 0.60 | 20.6 |

## Course 48: Creation, Evolution or Both? A Multiple Model Approach

Instructor: Craig E Nelson, Indiana University

Date: Apr 15-17, 1998 in Dayton, OH
Registration fee: $40

This course will provide updated content across the entire scope of the controversy and powerful options for classroom discussions. It will provide an overview of the central arguments of the "scientific creationists" and a summary of the current state of science in areas central to the controversy. Participants will examine a resources useful both in preparing for the classroom and for guiding students. The course will also review some recent developments in evolutionary theory with a major focus on the nature of science, decision theory, and modes of critical thinking. Both the overall sequence and the relative emphases will be adjusted in accord with the interests of the participants, though a major emphasis will be on developing selected topics so that participants may utilize them directly in their own teaching.

For college teachers of: all disciplines. Prerequisites: none.

To register or for more information contact George Minor, Physics Dept, University of Dayton./ Dayton OH 45469-2314.

Phone 937-229-2327;
Email:<miner@neelix.udayton.edu>.

Applications will be accepted as long as any places are available.

Craig Nelson is an evolutionary ecologist who has won major awards for his teaching of evolution. He wrote "Creation, Evolution, or Both? A Multiple Model Approach," published by the American Association for the Advancement of Science in *Science and Creation*, edited by RW Hanson, in 1986.

FEATURE

# Creation Science and Free Speech

*Alex Ritchie*
*Australian Skeptics*

As a participant and witness for the scientific side in the recent Plimer/Roberts "Noah's Ark" court case, I have been disturbed by media reports in Australia and overseas suggesting that Justice Sackville's verdict was a victory for free speech. I disagree and would appreciate an opportunity to explain why, based on my own experience. Very important principles are at stake in this matter. This has been reinforced by the news on July 2, 1997 that the Geological Society of London, the oldest geological society in the world, has made Professor Ian Plimer an Honorary Fellow for his "courageous stand" against creationism—international recognition of the fact that he is "a man of enormous courage who has put his money where his mouth is."

In delivering his judgment in the Plimer/Roberts case, Justice Sackville took the opportunity to comment that "there is a serious risk that the courts will be used as a means of suppressing debate and discussion on issues of general interest to the community." Most of your readers would probably agree with His Honor, as I do—but most of them would also be unaware that his judgment was based on only part of the evidence and tells only part of the story. The Plimer/Roberts "Noah's Ark" case was not about free speech, nor was it about creationism. The judge was asked to determine, within the strict confines of the Fair Trading Act, whether Allen Roberts had made misleading statements in a series of public lectures about Noah's Ark "in trade and commerce". Evidence deemed irrelevant to the strict provisions of the Fair Trading Act was therefore rejected as inadmissible before the case began.

However, some of the rejected evidence bears directly on the free-speech issue. It was all the more surprising, therefore, that Justice Sackville, having considered only part of the evidence, chose to speculate publicly about the possible effects of such cases on free speech. It was also ironic that Allen Roberts, despite having been found to be "misleading and deceptive", was able to hail his technical legal win as a victory for "free speech".

In a democratic society, the concept of free speech surely also includes the right to reply, to dissent, to question. I have attended many public meetings organized by so-called "creation scientists" and can confirm, from personal experience, that many creationists have a strange concept of "free speech". The format of the meeting is always tightly controlled. Various tactics and stratagems are employed to ensure that discussion or dissent is minimized or prevented. This is especially true if any scientist present tries to protest about public misrepresentation of science.

"Dr" Allen Roberts's lecture tour provided a good example of how the process works. Before each of Roberts's public lectures on "Noah's Ark", the meeting chairman would announce to the audience that Roberts would *not* respond to questions from the floor. He would only answer written questions dropped in a barrel in the foyer during the interval and left temporarily out of sight when the audience re-entered the hall. Roberts's Ark lectures, heavily dependent on biblical sources, also included many references to supposed scientific evidence supporting his findings. To anyone scientifically literate, these revealed Roberts's limited knowledge of science, and especially of geology.

Professor Ian Plimer, Head of the School of Geology in the University of Melbourne and one of Australia's most experienced and respected geologists, attended Roberts's Ark lecture in Melbourne in April 1992. When he publicly challenged Roberts on his statements about geology and tried to question him, the chairman immediately called on police, apparently waiting ready in the wings, to evict Plimer from the hall.

Later the same week, Plimer flew to Tasmania to attend Roberts's next lecture in Hobart and invited a Channel 9 TV crew to accompany him to record what might happen. Plimer again tried to question Roberts on geological matters and the results were caught on camera. When he rose to ask his question the chairman immediately called on police officers, again conveniently waiting in the wings, to evict him. The bizarre aspect of this eviction was not just that it happened, but *where* it happened. The Hobart meeting was held on the grounds of the University of Tasmania and saw a respected Professor of Geology evicted from university premises for daring to ask a fundamentalist creationist a question on his own specialty—geology! And the officials who evicted him were not campus police, but state police, operating outside their jurisdiction.

Word of these events soon spread through the scientific community. I decided to attend Roberts's lecture on "Noah's Ark" held a month later, in May 1992, in the Wesley Centre in Pitt Street in central Sydney. I took the precaution of inviting some friends, science students and members of Australian Skeptics to accompany me, and approximately thirty of them did so.

Plimer, who was passing through Sydney, was also present. As we entered the hall together, he was handed a writ for defamation, taken out by Roberts, concerning remarks that Plimer had made about Roberts's "scientific" qualifications.

When we entered the hall we saw no sign of police, but something more alarming. The auditorium was patrolled by five burly security guards, the leader ostentatiously wearing a two-foot long wooden club in a sheath on his hip. They circulated the hall trying to identify potential "trouble makers". One security guard occupied the seat immediately behind mine throughout Roberts's lecture, presumably to intimidate me. I had not intended to interject during Roberts's talk, but could not stay quiet during one of his more fatuous references to scientific evidence. My query, about radiocarbon dating, was picked up by another member of the audience who, for his pains, was evicted from the auditorium, together with his wife, by the security guards. He was Dr Colin Murray Wallace, an expert in radiocarbon dating, then with Newcastle University!

**In my long scientific career I have never ever attended a scientific meeting where the organizers felt it necessary to have police waiting in the wings**

In the interval after Roberts's talk, I asked my supporters to form a protective square around myself and Plimer when we went back into the hall for question time. In the naive belief that it is not yet against the law in Australia to ask a speaker a polite question at a public meeting, I intended asking Roberts a simple geological question! During his talk, in referring to the "boat-shaped structure" in Turkey, which he interprets as remains of Noah's Ark, Roberts scathingly said that "some geologists say this is only a geosyncline!" In a newspaper article a week before the Sydney meeting I had been mistakenly reported as describing the structure as a "geosyncline" when in fact I used a quite different term—a syncline. A first-year geology student would know the difference.

During question time, I rose and invited Roberts "to explain to his audience the difference between a syncline and a geosyncline". Pandemonium ensued. The chairman of the meeting leapt to his feet and shouted "Call the police!" At the same time three of the security guards forced their way into the center of our group to confront me, trampling on the feet of my supporters to do so. "Sir, you are causing a disturbance and we are asking you to leave." I had quietly resumed my seat after asking my question, and I declined their invitation to leave until I got an answer to my question. Three of them then proceeded to try to lift me bodily out of my seat to throw me out of the hall. Being of a fairly robust constitution, I was able to remain attached to the seat until they belatedly realized that they had gone too far and withdrew. It was real storm-trooper tactics—but it took place in the center of Sydney in the 1990s

Only later did I discover what might have happened if things had got out of control and turned really nasty! Dr Peter Pockley, a qualified scientist, attended Roberts's Sydney meeting as a science journalist writing for various newspapers and journals. He later informed me that he had seen the security guard leader bring in another three clubs and place them on an empty seat near our group, presumably ready for use.

Roberts made no attempt to answer my simple geological question, or any other questions from the barrel. The meeting closed shortly afterwards, after state police finally arrived, wondering what all the fuss was about. It was a very educational experience, and very illuminating in what creationists mean when they talk about "free speech". In *their* interpretation, "free speech" means they have the right to misquote or misrepresent scientific evidence in public in front of lay audiences of adults and children. And if any scientist in the hall is foolhardy enough to publicly question, or disagree, they believe they have the right to evict them from the hall, by force if necessary. So, when "Dr" Allen Roberts claims that his rights to freedom of speech are being infringed by scientists, I beg to differ. I have many witnesses to confirm what happened when I tried to question "Dr" Roberts on a matter of science. In my long scientific career I have never ever attended a scientific meeting where the organizers felt it necessary to have police waiting in the wings, or to employ baton-wielding security guards, to ensure that no one asked the speaker a question.

The *Canberra Times* recently reported that Senator Kim Carr was concerned about the number and nature of new fundamentalist schools being opened around Australia, many of which receive both state and federal funding, but whose activities were, he said, "shrouded in mystery and completely unaccountable." "We have no mechanisms to check what is going on in these schools" he says, and he is correct. "Dr" Roberts's doctoral thesis, from Freedom University (based at a suburban church in Orlando, Florida) was "On the teaching of absolute Christian values in Australian primary schools". Having experienced what happens when I, a qualified scientist with 40 years' experience in geology and paleontology, tried to question Roberts on scientific matters, I shudder to think what reception a bright pupil might receive in a fundamentalist school if he or she had the temerity to question a creation science teacher's statement that the world was formed in six 24-hour days, 6000 years ago, and that all of the world's rock and fossil record was laid down in the year of Noah's Flood!

No one is attacking, or questioning, creationists' rights to free speech. No scientist is demanding equal rights to teach science as well as creationism from the pulpits of churches. But surely

we have a right and a duty to question the intrusion of religious dogma into science classes of Australian schools, especially those supported by state or federal funding.

We live in a competitive and highly technological world. Our survival as a nation is dependent on encouraging our best and brightest students to develop their skills and compete in an international arena, and that includes the fields of science and technology. If children are not exposed to the scientific method while still at school then it is unlikely that most of them will encounter it after leaving school. Who knows how many bright pupils have been turned off science forever by missionaries masquerading as science teachers in their schools? Mainstream religious organizations may also like to ponder how many students have had their religious beliefs shattered after discovering that they have been systematically lied to by proponents of pseudoscience in the classroom.

Despite the outcome of the Plimer/Roberts case, I suggest that Judge Sackville has clarified the situation by his judgment. He may well also have created a legal precedent for tackling the educational threat to the education system in Australia posed by young-earth, Noah's Flood creationists. His Honor found that, had the Fair Trading Act applied to this case, Roberts's behavior "would have constituted misleading and deceptive conduct on his part." Despite this, Judge Sackville found in Roberts's favor because, technically, he was not "in trade and commerce".

His Honor took into account that Roberts did not receive a salary from his Noah's Ark lecture tour and that his organization was not incorporated at the time of the public lectures and was supported by unpaid volunteers, not by paid staff. Roberts's lecture tour was not "a business carried on for profit". Roberts also did not operate from special premises but from his own home. It should be noted, however, that the main drive to infiltrate creationist teachings into the science classes of Australian schools is spearheaded, not by Roberts, but by an organization called the Creation Science Foundation (CSF).

The CSF has established headquarters in Brisbane and Sydney, and a mobile arm, its Creation Bus, which regularly tours throughout Australia. The CSF is an incorporated organization and much of its income comes from the sale of its own long-established publications (magazines, journals, books), audio and video tapes etc. Although CSF uses volunteers for many of its activities it also employs many permanent staff on salary. I suggest that it is legally "in trade and commerce" and is "a business carried on for profit".

In his judgment on the Plimer/Roberts case, Judge Sackville may thus have inadvertently provided grounds for a follow up court case, if a public-spirited sponsor can be found. I suggest that sufficient grounds exist for a legal class action on behalf of the scientific and educational communities in Australia against the threat to scientific education posed by the Creation Science Foundation.

The aim of such a case would be "to request and require the Creation Science Foundation to remove the word "science" from the name of its organization on the grounds that such usage constitutes "misleading and deceptive conduct". It can hardly be an infringement of their rights merely to require the CSF, in future, to call itself the Creation Foundation, especially since their own Statement of Faith makes it abundantly clear that, in all matters, science is subordinate to religion. Such a test case would provide an opportunity for any qualified scientist (and there are several) employed by CSF to explain publicly why its activities should be classed as scientific rather than religious.

In proposing this it should be made clear that no one is attacking CSF's right to free speech, or to publish or promote its creationist wares and views, only its claim to be using scientific methods and evidence to support such claims. Many scientists, myself included, who are well aware of the misrepresentation of science inherent in fundamentalist creationism, would welcome an opportunity to question, in open court, leading Australian creation scientists on the "science" behind "scientific" creationism. This should not be seen as an attack on religion but as a public defense of science. I suspect that, given the opportunity, most mainstream churches would support the case for a clear demarcation of science and religion as different ways of interpreting the world around us.

**[N]o one is attacking CSF's right to free speech, or to publish or promote its creationist wares and views, only its claim to be using scientific methods and evidence to support such claims.**

The problem, as Ian Plimer recently discovered to his considerable cost, is that no working scientist has the financial resources to mount such a legal test case personally. I invite some public spirited individual or organization with sufficient financial backing to sponsor a class action on behalf of Australian science and education to test the legality of "science" in the "Creation Science Foundation".

**AUTHOR'S ADDRESS**

Alex Ritchie
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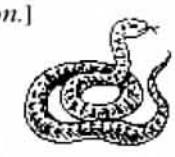
*[Ed. Readers should be aware that the Australian Creation Science Foundation has recently changed its name to Answers in Genesis, which is the name used by Australian-born creationist Ken Ham for his US-based organization.]*



# The More Things Change

*John R. Cole*
*Contributing Editor*

Anti-evolutionists have evolved over the decades from demanding that biblical creation be taught in schools to demanding equal time for "scientific" creationism to arguing that evolution classes give a sort of equal time to the weaknesses of evolution. Like peppered moths, they change as pressures and resistance change, and they often revert back to earlier guises when circumstances are ripe. Tactics and tangents apparently long-dead or defeated can reappear and flourish when time or other distance leaves an opening. Some examples include out-of-place fossil claims, Piltdown Man, the 2nd Law of Thermodynamics, the "lost Peking Man fossils", misunderstandings of probability statistics—and the granddaddy of them all, "Design Theory".

**Much of the design is just "good enough" to get the job done, not the perfection one would expect**

Paley postulated in 1699 that the appearance of order in the universe was similar to the appearance of order in a clock—a watch suggests there is a watchmaker, and an orderly Universe also suggests there is a Creator or Designer. A brilliant maneuver in biblical apologetics at the time (at the dawn of the scientific age), the "argument from design" fell into disfavor over the years for a number of reasons. One reason was that alternate explanations of why natural things had specific forms shrank the number and scope of situations in which a designer seemed necessary. Chemistry, physics and mathematics demonstrated that there were sound natural reasons for physical forms and easily understood naturalistic explanations of changes in form. Ice "organizes" water without divine intervention, crystals self-organize, chemicals react in predictable ways to form compounds. It became reasonable to assume that there were natural and naturalistic explanations of some or most phenomena which remained as yet unexplained.

The situation was similar to the theological bent often termed "gap theory" in which what we understand is considered the realm of science, leaving God in charge of the gaps in knowledge or the unexplained phenomena. But the gaps kept shrinking, and theologians by and large realized that their efforts to propose a God who acted only when the lights were out, figuratively, was a limited God and one being further limited daily as scientific knowledge grew. Many theologians decided they should not limit their Deity by such narrow human rules, and the "God of the Gaps" faded from debate. God the Watchmaker was similarly downplayed, in due course.

The advent of Darwin's theory of natural selection set in motion what seemed to be the end of this narrow theology, even more decisively than of "gap theory". Natural selection seemed to provide plausible explanations and naturalistic ways to derive complex organisms. In addition, it became increasingly obvious that nature was awe-inspiring but, alas, incredibly jerry-rigged in design. Much of the design is just "good enough" to get the job done, not the perfection one would expect of a perfect Creator who would not seem to have to cobble things together with quite as many sub-optimum birth canals, fragile foot bones, backaches, and pandas' thumbs.

Today we see the single biggest comeback story in the revived "Intelligent Design Theory". The theory is rather rickety and impoverished, compared with the robust, active God on the Sistine Chapel ceiling, performing clear miracles rather than working behind a curtain at a drafting table developing subtle ways to fool human observers with ever-so-slight miracles, at most. This seems like a conscious "design" by some creationists attempting to come up with a sort of "Creator Lite" who cannot easily be challenged because so little is in fact being claimed for this Creator. At least one of these nouveau anti-Darwinists, law professor Phillip Johnson, seems content just to cast doubt on what he considers to be naturalistic explanations of life and behavior, since he offers no alternative scenario or suggestions, let alone any testable theory. Biochemist Michael Behe, author of *Darwin's Black Box*, has a similar approach. Although he, unlike Johnson, understands the scientific issues involved, he too seems simply uncomfortable with where they lead and proposes a rather tepid theory of "irreducible complexity" as a sort of "opening" for God to exist.

Most of the same "scientific" creationists are involved in the "intelligent design" movement, to one degree or another, in that they happily quote these supposedly new ideas, although the leading lights of the new movement are not drawn from these same old faces. Some, like Johnson and Behe, are not even young-earth creationists. However, they are trying to advance the same old idea—get rid of evolution. Like their predecessors, they do not have an alternative theory to offer, although they are loath to admit this, still. At least the older-style creationists have a model, of sorts, which they prefer!

# Why Teach Evolution?

*Bruce Miller*

*[Recently, a student in Bruce Miller's biology class brought him a video tape of Rev Todd Cook's sermon against evolution (and other science) delivered at Hoffmantown Church on August 4, 1997. The sermon began with the grim admonition that if any of his audience accepted any part of the evolutionary scheme, then it must logically follow that there is no God, Heaven, Hell or even any purpose in life.*

*At first, the student asked if an "alternative assignment" could be arranged for her, because of her feelings about evolution. Bruce considered having her withdraw from his biology class and take a physical science course instead. However, she insisted on the alternative assignment. Bruce discussed the issue with the girl's parents, and with his principal and counselors. Ultimately, the girl decided to stay in class. She agreed that it is better to learn about an issue before taking a stand against it—a very mature decision!*

*With his permission, we have reprinted Bruce's response to the videotape and the student's request.]*

I am writing this letter in response to your recent request that I show the videotape of the Hoffmantown Baptist Church presentation on the creationism/evolution topic to my Biology I classes. I wanted to try to explain to you as clearly and as completely as possible why I have decided not to show this tape. As you may appreciate, for many people this is a tremendously emotional issue, when in fact, it should not be at all. In light of this emotional atmosphere, I hope to make you aware of the fact that my objections to showing the tape are based on rational thought and the desire to promote science.

My first, and perhaps greatest, area of concern is how the gentleman making the presentation gave his listeners a very grim set of consequences arising from making a choice between the two sets of ideas. I very strongly disagree with him that if one finds the ideas of evolution and natural selection acceptable, then it must follow that there is no God, no Heaven and no Hell. According to the speaker, acceptance of the ideas of biological evolution must ultimately lead one to conclude that life itself has no purpose! I find this effort to arouse fear in others completely unreasonable and even patently unfair. To start a presentation that purports to be objective with such an emotional outburst plays on the fears of people in an unacceptable and even cruel manner.

I have been teaching the basic tenets of evolutionary thought for twenty two years now, and I would *never* consider starting this unit with a statement demanding a choice be made between the two points of view on the basis of unreasonable fear! Demanding such a choice is diametrically opposed to the basic nature of science, which implores us to continually seek out evidence related to natural phenomena as a means of being able to explain these phenomena rationally.

My second area of deep concern regarding this presentation is that, along with presenting a fearful and agonizing choice to his audience, the speaker also dispenses gross misinformation. I will give the speaker the benefit of the doubt that these mistakes came from simple errors as he conducted his "research" on evolution in preparation for this presentation. I also believe that if he had a more thorough foundation in the biological sciences, these errors would likely not have been made at all.

One of the first errors is found in the speaker's account of the big bang theory. He mentions that a large quantity of dust and chemicals came together and formed a big bang. In fact, the events of the big bang actually formed the matter after the initial explosion. The speaker has mistakenly reversed the sequence of the events. Curtis and Barnes, in the fifth edition of *An Introduction to Biology*, write on page 19 "Our universe began, according to current theory, with the 'big bang', a tremendous explosion that filled all space. Prior to this, all of the energy and matter of the present universe is thought to have existed in the form of pure energy, compressed into an infinitesimally small point. This energy was released by the 'big bang' and every particle of matter formed from the energy was hurled away from every other particle." The text goes on to explain how protons and neutrons were then formed as the temperatures cooled.

The speaker next talks about how the accretion of this matter into gas clouds which formed galaxies, planets and solar systems was all due to random chance. In fact, the laws of physics predict such an accumulation of matter, even accounting for the complex orbital and celestial mechanics of these systems!

The speaker then goes on to discuss how he has no problems with the evolutionary tenet of microevolution, which he presents as the biological mechanisms that enable a single animal or plant to change or adapt. Again, he is wrong. In their textbook, *Biology, The Science of Life*, Wallace, Sanders and Ferl state that microevolution, "is evolutionary change below the species level, including changes in gene frequencies, brought about by natural selection and random drift." The speaker also is in error when he states that a single organism is able to adapt. In fact, adaptation occurs at the level of the population and usually requires a great deal of time in which to occur.

The speaker also presents an interesting system to explain why mules are sterile. He states that God, in an effort to insure that organisms only breed within their "kind", has made the mule, the progeny of a horse and donkey mating, sterile. This idea simply has no basis in bio-

*Bruce Miller teaches high school biology in New Mexico.*

logical fact. In fact, Wallace, Sanders and Ferl state that a mule, "is unable to reproduce successfully because abnormal meiosis in the hybrid produces abnormal gametes."

There are many more inaccuracies and inconsistencies in the presentation, such as the speaker's assertion that every major form of animal, such as elephants, has appeared in the fossil record quite suddenly. This is simply not based on any real evidence. In fact, there is a great deal of hard fossil evidence to the contrary.

Finally, when the speaker begins to cite the Second Law of Thermodynamics to refute the theory of evolution, I began to realize his "research" likely included only literature supplied to him by various creationist groups. I have long heard the arguments from creationists stating that all of the universe is running down, which of course, is quite true. The universe, ever since the "big bang", has been growing more and more random, or increasing in entropy. However, the laws of thermodynamics describe the behavior of matter and energy in what are referred to as "isolated systems", which are theoretical constructs developed by physicists. Isolated systems—those in which matter or energy cannot enter or leave—do not really exist, but are contrived as models by scientists who wish to test their ideas under hypothetical conditions that can be limited and controlled. In other words, isolated systems are closed systems, where there is no input or output of energy or matter. The living world, in contrast, exists in an open system, where there is a constant input of energy, ultimately from the sun. The result is that life is able to use vast quantities of energy through such mechanisms as photosynthesis to slow entropy, while your house, unless it is radically different in composition from mine, is not able to trap energy for its routine maintenance and upkeep!

The introduction of the Laws of Thermodynamics into the presentation of course led to the very dramatic and yet somehow sad demonstration where the speaker smashed an alarm clock to pieces and then facetiously waited for it to reassemble itself. Of course, without the ability to capture energy from the environment, the result was a permanently compartmentalized alarm clock! I wish the speaker could have seen a similar demonstration I saw in my Invertebrate Zoology class at the University of New Mexico! Here, the professor took a small section of a live sponge and put it into a blender. He then pressed the button for a few seconds so that the sponge was reduced to a "puree". He then set the mixture aside until the next class meeting a few days later. When we came in, the sponge had reassembled itself! The difference, of course, is that the living sponge is able to take in energy to power this re-assembly.

There is a great deal of highly emotional dialog currently going on about teaching what are referred to as "alternative theories of evolution or creation" in science classes. I think that at some point teachers should be given credit for having some intelligence and sensitivity in this matter. They should be given credit for having enough intelligence and knowledge of subject matter in their teaching fields to be able to teach mainstream ideas in the limited time at their disposal. With the call from some quarters that alternative ideas about the origin of life be taught in high school biology classrooms, I am waiting for demands from these same individuals or others that geography teachers also teach the old flat earth theory. I am also expecting that chemistry teachers will soon be required to teach the outdated phlogiston theory to their students. Will physics teachers next be required to present alternatives to the laws of gravity?

At some point in this conflict, I believe biology teachers must state clearly and calmly that what they are teaching are ideas that have been carefully developed and expanded over many years of rigorous scientific endeavor. We are *not* attempting to warp young minds. What we are attempting to do is simply present an elegant construct of how life began on this planet and how it has come to be present in such bewildering and majestic abundance and diversity. I always make it a point to tell my students that the theory of evolution is a theory. To those ungrounded in the vocabulary of science, the term "theory" implies a largely untested set of ideas. In fact, Curtis and Barnes describe a theory as "a generalization based on many observations and experiments; a verified hypothesis". The mechanisms of evolution, such as natural selection are regarded as scientific law. As we discuss the status of the theory of evolution, my students always want to know how I feel about the matter. At this point, I tell them that I personally and professionally regard the tenets of evolution as fact. However, I make it very clear that this is my own opinion and that they should listen to the ideas presented in class before they reach their own conclusions.

In conclusion, I do not plan to show this video tape to my Biology I students because it only offers emotional, irrational and erroneous attacks on an elegant and vibrant explanation for the marvelous complexity and diversity of life on this planet. People who insist on attacking evolutionary thought in this manner do so with an insulting air of ridicule and derision, with no hard evidence or facts of their own to offer. Our students deserve much better.

## Robert Pennock Wins Templeton Prize for *C/E* Article

Robert Pennock wrote to us from Austin to tell us that his paper in the final issue of *Creation/Evolution*—Naturalism, Creationism and the Meaning of Life: The Case of Phillip Johnson Revisted—was awarded the Templeton Foundation Prize for Exemplary Paper in Humility Theology for 1997 in the category of Theology and the Natural Sciences. Pennock is also the author of *Tower of Babel* on Phillip Johnson and the new creationists to be published by the MIT Press-Bradford Books in the Fall of 1998. More information is available on the Templeton Foundation web site <http://www.templeton.org>.

# Spiritually homeless in the cosmos

*Chet Raymo*
*Department of Physics, Norton College*

I was recently at Grinnell College in Iowa talking with a group of talented young nature writers. They had read a couple of my books, and generally approved of the way I tried to relate science to human values. However, they took me to task for what they perceived as condescension towards astrology, crystal therapy, parapsychology, and other New Age superstitions. I had called these things "baloney." Don't be so cocksure, they said. Remember, that even Galileo was a victim of close-mindedness. Their point is well taken.

There is more to the world than meets the eye and it behooves us not to dismiss anything too quickly. However, I do not dismiss these pseudosciences quickly; I have studied the evidence and it is unconvincing. But I will try to be more sympathetic with young believers.

The students are looking for spiritual meaning in their lives. They value the scientific way of knowing, and some of them have turned away from traditional religious faiths that they perceive to be in conflict with science. But they have not found much in science that answers their need to feel at home in the universe.

What they are looking for, it seems to me, is a sense of stewardship for the earth. They want to feel part of an organic system in which their individual existences make a difference. So they turn to the "Movement," a collective New Age openness to forces and possibilities that flicker about the margins of science. They align themselves with powers and spirits that they perceive to be consistent with science, but which escape the grim calculus of the reductionists.

Their quest is sincere, but I wish they could find something better to latch onto than pseudoscience. Science has unfolded a creation story that is infinitely more majestic and meaningful than any mishmash of New Age enthusiasms.

But we have not yet learned how to connect the scientific creation story to our search for spiritual fulfillment. That's not the students' fault, nor is it the fault of scientists. We have been failed by our philosophers, theologians and spiritual leaders.

Cultural historian and Roman Catholic priest Thomas Berry is one of the few scholars to address the problem head-on. He roots the difficulties we face today in the plague of the late Middle Ages.

The Plague that began in Constantinople in 1334 killed off one-third to one-half of the population of Europe within 20 years. Subsequent visitations likewise decimated the population. It is difficult for us to grasp today the horrible dimensions of the dying.

There were two responses to this trauma, says Berry: One part of the community sought to enlist the intervention of supernatural forces in a world that seemed increasingly hostile to man; another part sought to remedy earthly terror by understanding earthly process. The first response led to forms of religious faith that emphasize redemption rather than creation; the second led to science. The first sees the material world as the enemy; the second sees matter as an amoral matrix upon which we can impose our will.

We have not yet resolved this split in our culture, says Berry. We have a new scientific creation story, but we have not integrated the story into our lives as believers and seekers. An integral story of creation and redemption has not emerged, he says, and no community can exist without a community story. If Berry is right, the Grinnell students are struggling with a problem that should concern all of us.

There are two communities in America today. One rejects the scientific creation story in favor of an obsolete story that at least had the virtue of working in its time. The other community buys into the scientific story but languishes without a collective means for expressing worship and praise.

The antagonisms between the two communities are deeper than they appear to be, says Berry: "This is precisely why communication between these two is so unsatisfying. No sustaining values have emerged. The problems of the human are not resolved. The human adventure is not dynamized."

In conversations with the students, I sensed a dissatisfaction with the partial answers of both communities and a determination to do something about it. Their preoccupation with pseudosciences will pass. Behind it is something deeper and truer: A commitment to the earth that is integral, organic, and grounded in scientific knowledge; and a conviction that every being on the planet has its own self, value and mystery.

Only when we see ourselves as integral and worthy parts of creation, with a profound sense of stewardship, will creation and redemption come together. If we are to save the earth (ourselves included), science must provide the knowledge and spirituality the motivation. It had better happen soon, or there won't be much left to save. My visit to Grinnell gave me hope that the current generation of educated young people, faced with a biospheric cataclysm comparable to the plague, will not settle for the half-way answers of their parents.

[*Chet Raymo's columns are a regular feature in the* Boston Globe. *This column ran on page 38 on 03/25/96.*]

# Letters to the Editor

### Pseudoscience

Molleen Matsumura's lucid, detailed analysis of the *US News & World Report* article on John Baumgardner's claims for his *Terra* program is *exactly* what I look for from the NCSE. As a scientist I am often confronted by "what about..." questions from those who are believers in or at least uncertain about various pseudoscience claims. When the area is out of my limited expertise, I need the sort of help that the NCSE provides.

Thanks

Jon A Kapecki
Rochester NY

**Correction** — We recently published a letter to the editor from Kennan Herrick (*RNCSE* 17[2]), and we apparently liked it so much that we published it a second time (*RNCSE* 17[3]). However, both times we also apparently made editorial changes that altered the writer's intent. The original statement read, "Blatant religious charlatans one can accept along with the other crooks of the world. But it is truly deplorable that sincerely religious people should countenance dishonesty in the furtherance of their beliefs."

### Puff the Magic Plesiosaur

I want to congratulate Glen J Kuban for his thorough article analyzing the 1977 Zuiyo-maru "plesiosaur". Because of the powerful "gee whiz" aspect of this widely-told sea story, such a refutation has been long overdue. During my 1987 debate at Buffalo City Honors High School with Canadian creationist Ian Taylor (cited by Kuban), the students audibly gasped in awe when he flashed the Michihiko Yano drooping carcass photo on the screen. Interestingly, this was Taylor's most impressive moment in a debate which, overall, left these high school students astounded that anyone could actually believe the universe was created all at once out of nothing only a few thousand years ago. But then, Taylor had been refreshingly candid throughout the debate about his young universe creation model. Taylor also showed a slide of a Japanese postage stamp commemorating plesiosaurs, strongly implying that this philatelic issue by the Japanese government was in direct response to the amazing carcass find. Though some pretty silly things have been dignified with a stamp, I still can't believe that rotting shark remains dredged up off the coast of New Zealand would be among them!

Fred Edwords
Editor, *The Humanist*
Amherst NY

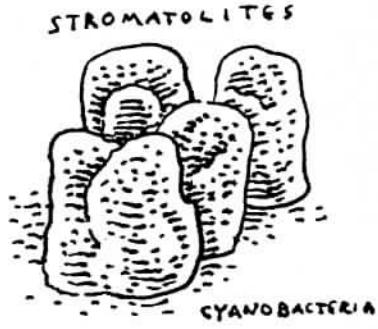
### Literature Searches for Intelligence

Here's a little tale to let you know your hard work *is* appreciated and that the information [NCSE] provide[s] can be very critical and timely.

A local reporter was in the wrap-up stages of a big article on evolution in the classroom, intelligent design, *Pandas and People*, etc. So, when I got the issue of *RNCSE* with the article by [George] Gilchrist on literature searches for [research into] intelligent design, I thought it might be good background for the reporter. I faxed [it] to him late [one] afternoon. I guess he used the information; by the time I called him about 6 pm to check if he'd got the fax, he had already tracked down and interviewed Gilchrist.

Thanks and best regards,

Dave Thomas
Peralta NM



# BOOKREVIEW

*Metaphysics and the Origin of Species*

**by: Michael T Ghiselin, 1997. Albany: State University of New York Press. 377 p.**

*Reviewed by Danny Yee, Department of Anatomy and Histology, University of Sydney, Sydney Australia, danny@cs.usyd.edu.au*

Ghiselin is best known for arguing that species are logical individuals rather than classes, most notably in a 1974 paper "A radical solution to the species problem". This individuality thesis is apparently simple, but it has surprisingly broad implications. In *Metaphysics and the Origin of Species* Ghiselin explores these implications, in the process resolving some of the philosophical confusions that have beset evolutionary biology and laying metaphysical foundations for the discipline.

*Metaphysics and the Origin of Species* begins with nothing less than the construction of a natural system of ontological categories, following Aristotle and Kant. This is used as a basis for elucidating various philosophical concepts, most importantly the properties of individuals (and, against them, classes): individuals are concrete (while classes admit abstraction); individuals lack defining properties and they are spatio-temporally restricted (while classes are not) individuals participate in processes (which classes cannot); they are ontologically autonomous; and they don't appear in laws of nature.

This sounds rather abstruse, and much of *Metaphysics and the Origin of Species* will be heavy going for those without a background in philosophy. But it is not just abstract speculation. Ghiselin connects his philosophical analyses and explanations to biological "applications" and provides effective non-biological analogies and examples. His philosophy also reflects familiarity with everyday scientific practice, not just knowledge of the theory.

After a chapter on definitions and proper names (and their relationship to essentialism), Ghiselin moves on to the key concept of "species". He presents an extended discussion of different definitions, arguing for the biological species concept and against alternatives. He examines, and dismisses, some of the alternatives to the individuality thesis which have been suggested—that species are neither individuals nor classes, or are both, for example. And he also explores some of the more suggestive analogies for species—languages and firms—and addresses the question of why species exist and what they do.

Turning to *systematics*, Ghiselin considers the differences between objective and subjective classification systems, and between natural and artificial ones. He sees systematics as afflicted by naive inductionism; phenetics was tainted with phenomenalism, but evolutionary and cladistic systematists have inherited some of its metaphysical (and epistemological) confusions.

Ghiselin also considers definitions of characters and the concepts of homology and analogy. Homologues are parts of individuals, related by specifically shared, historically causal influences (for example, lineal descent from a common ancestor). Analogues result from convergent evolution on which there is no such spatio-temporal restriction.

A later chapter on the "artifactual basis of macroevolution" highlights the artificiality of higher taxonomic classifications—particularly in the choice of rank for taxa. This is illustrated with a survey of the Metazoan phyla. Ghiselin also explores pseudoextinctions and other artifacts of the fossil record.

Ghiselin argues convincingly that biology does have laws, but that they must refer to kinds of species, not to particular species. He presents some hypotheses about hermaphroditism, sexual selection, and sex ratios as examples. He then goes on to consider the principles of historical inference, drawing on the earth sciences as a model.

Distinguishing laws of nature from historical facts and contingencies can be difficult: as an illustration of this Ghiselin sur-

veys the history of embryology and relationships between ontogeny and phylogeny. In his final chapter, after a digression on definitions of "fitness" and "function", Ghiselin places the study of life among the other sciences. He argues that the goal of evolutionary biology is the synthesis of the nomothetic—laws of nature—and the idiographic—contingent facts. He envisions the endeavor as the production of a historical narrative which relates sequences of events to laws of nature.

*Metaphysics and the Origin of Species* jumps from topic to topic in slightly haphazard fashion. There is, however, help in the form of an appendix which includes a kind of glossary with the terms arranged conceptually. This addition provides a very effective summary of the volume.

It is most unlikely anyone will agree with Ghiselin on everything; on the other hand, it is also most unlikely that anyone interested in philosophy will fail to find something worth chewing on in the almost profligate smorgasbord of ideas he has laid out. There is no other work which treats this material so comprehensively. *Metaphysics and the Origin of Species* brings a cobweb-clearing broom to the philosophy of biology and a welcome freshness to metaphysics—it has convinced me that "applied metaphysics" isn't an oxymoron!

*[This review was originally posted at <http://www.anatomy.usyd.edu.au/danny/book-reviews/h/Metaphysics_Species.html> and is used with permission.]*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**Topic:** Reports on 1996 Tests of Science Skills and Knowledge
**Location:** http://www.nagb.org/musick.html (NAGB Chair Mark Musick)
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**Owner:** National Assessment Governing Board
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**Topic:** *Metaphysics and the Origin of Species* Book Review
**Location:** http://www.anatomy.su.oz.au/danny/book-reviews/h/Metaphysics_species.html
**Owner:** Danny Yee
**Last Visit:** Jan 1998

# SAY WHAT?

Ellen Craswell, last year's GOP nominee for governor of Washington: "...I do not agree with the sentiment that evolution was the origin of man." She also said God should control school curricula (through parents).

Family Research Council (FRC): "We are impressed with the work of the ICR. FRC supports the teaching of creationism in the schools. Creationism should not be considered unfit for the classroom simply because it has religious connections." (A reply to a query about their position.)

Charles Colson has been peddling a pamphlet *Darwin Denied* and has been supporting Phillip Johnson via Colson's Prison Fellowship Ministries.

Toward Tradition, a Jewish organization, says they take no official position on "creation vs. evolution, although our sympathies are certainly with the 'creationist' side. And we certainly believe the creationist side deserves a fair hearing." Their founder, Rabbi Daniel Lapin, praised David Berlinski's *Commentary Magazine* article.

Then there is the book I found in a motel emblazoned with the title: "The Holy Bible with Additional Material by Bill Bright and the Campus Crusade for Christ."

*[Gleaned by John R Cole.]*

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*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 present organizations, other reports of information related to our primary concerns of promoting good science in education and public life, and, of course, humor related to creation/evolution issues.

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

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

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

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

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

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