

REPORTS

OF THE
NATIONAL CENTER FOR SCIENCE EDUCATION



Volume 18, Number 5

SEP/OCT, 1998



CONTINUES
NCSE REPORTS &
CREATION/EVOLUTION

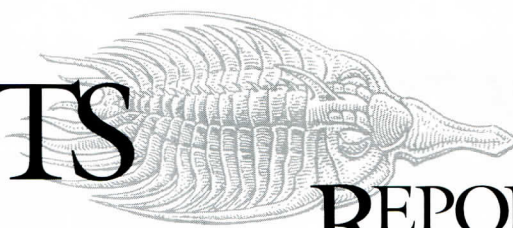
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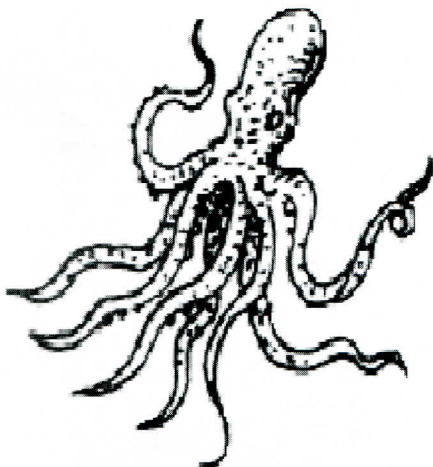
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[NCSE thanks Barbara Forrest and Chris Toumey for information used in this report.]



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Erik Wheaton
Circulation Manager

TRACKING YOUR SUBSCRIPTION

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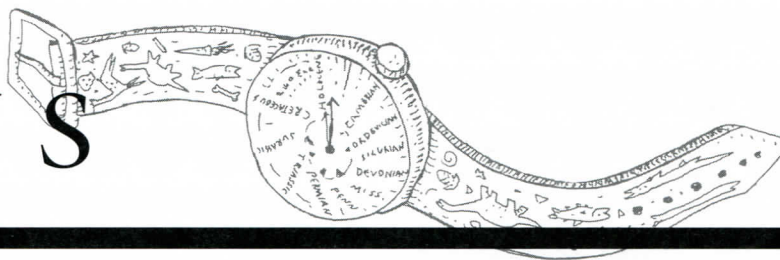
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Earth Science Week: Momentum for the Future

Julie Jackson
Program Director of Earth Science Week for the American Geological Institute

"A roaring success" is how American Geological Institute (AGI) Past President Susan Landon described the first Earth Science Week. From Oct 11 to 17, 1998, activities took place in every state and in Australia, Canada, Germany, and India. Publicly recognizing the importance of the earth sciences, 39 state governors and at least 3 city mayors signed Earth Science Week proclamations. Oregon Sen Ron Wyden read an Earth Science Week resolution into the Congressional Record in July; and on Oct 9, President Clinton issued a message urging every citizen to participate in Earth Science Week. In several states, these endorsements were presented at signing ceremonies and public events, bringing local media coverage and attention to the earth sciences.

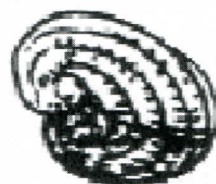
Week-long celebrations of Earth Science Week included open houses, lecture series, film festivals, demonstrations, and exhibits. By promoting Earth Science Week, many AGI member societies, state geological surveys, geoscience organizations, and various publications contributed to its successful launching. *Science Scope*, the National Science Teachers Association journal read by about 20 000 middle-school teachers, featured an earth-science issue in October. Many teachers are still using the Earth Science Week *Ideas and Activities* booklet in their classrooms.

NEW PARTNERSHIPS

Perhaps the most significant byproduct of Earth Science Week is

that it has fostered so many new partnerships and communication links. These links unite geoscience organizations, industries and communities, scientists and teachers, and youth leaders and scientists. These and other partnerships will flourish as communities organize to celebrate Earth Science Week every year. In fact, many organizations and individuals are already planning Earth Science Week 1999, Oct 10-16.

[Reprinted with permission from GeoSpectrum Nov/Dec 1998: 2.]



Lee County FL Voters Rebuke Creationists

John Cole
Contributing Editor

In the September 1st (1998) school board election, voters in Lee County, Florida, resoundingly defeated the effort by conservative religious groups to include history courses based on the Bible in the public school curriculum. The two courses, one on each testament of the Christian Bible, were already blocked by court rulings which have held that they were designed to *promote* a specific religion, not to teach *about* religion.

Douglas Santini, the school board chair who supported the curriculum, was defeated by challenger Terri Wampler by a margin of 69% - 31%. Katherine Boren won re-election by a 60% - 40% margin over another candidate who supported the curriculum. Incumbent Bill Gross, another supporter of the Bible curriculum, garnered only 32% of the vote and must compete in a runoff election. Thus the margin will have

shifted from 3-2 in favor of the curriculum to either 3-2 or 4-1 against. The Lee County Bible Curriculum was once hailed as the next step or tactic in the nationwide fundamentalist effort to dictate public school curricula. Court rulings and voter opposition may have relegated it to a footnote instead.



Updates

Kansas, election news: In the November 1998 elections, a candidate who included opposition to evolution as a minor part of his campaign was elected to the state board of education from the northeast district. With his election, 3 of the 10 board members have publicly opposed teaching evolution (*Kansas Board of Education members are listed at the state web site* <<http://www.ksbe.state.ks.us.commiss.board.html>>).

Kentucky, Boone County: In late November, Answers in Genesis (AIG) appealed to the Boone Circuit Court the decision of the county's Fiscal Court to deny a zoning variance for AIG to build headquarters and a museum (*RNCSE* 18[3]:6). According to the *Kentucky Post*, AIG is raising constitutional issues in its suit claiming that "the decisions by the Fiscal Court and the Planning Commission amount to a violation of the ministry's rights of free exercise of religion and protected speech, as well as an illegal taking of land and a violation of due process." The Fiscal Court's public documents expressed concerns about sewage disposal and similar issues, and opponents of "creation science" who had once opposed AIG's plans for another site did not attempt to influence the recent decision (*Cincinnati Post*, October 1998:86). The text of the *Kentucky Post*

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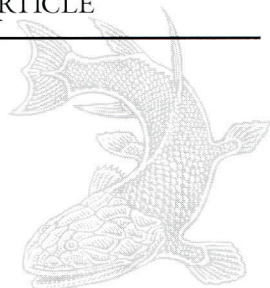
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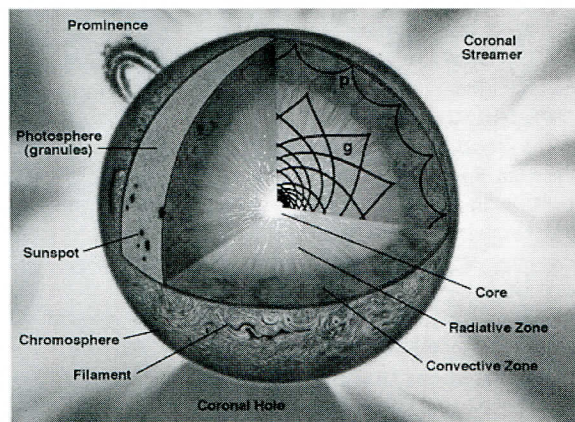


Long-Term Solar Oscillations and the Age of the Sun

Kevin L O'Brien

In the June 1996 edition of the *Acts & Facts* series published by the Institute for Creation Research (ICR), Keith Davies, a retired administrator of the Scarborough (Ontario) Christian Academy, argues that the sun is homogeneous in structure and derives its energy from gravitational contraction. Therefore, he concludes, our sun is "an exceedingly young" star (Davies 1996). He focuses his argument on three lines of evidence: 1) a long-term solar oscillation of 160 minutes; 2) the solar neutrino problem; and 3) the observed abundances of lithium and beryllium in the sun. It is worth examining Davies' argument to see whether his claims are supported by the facts, because if he is correct, then this would have profound implications for the age of the solar system, stellar evolution, and possibly even cosmology as a whole.

Of the evidence Davies presents, the strongest is the long-term solar oscillation. The other two are minor, and they lose their strength if the oscillation evidence is false. Therefore, this essay will focus primarily on a careful examination of the 160-minute oscillation. Since the validity of Davies' argument depends to a large degree on the quality of the evidence, the fact that his evidence was already 20 years old when he published his essay in 1996 means that, even if he had presented it properly, more up-to-date data could have superseded it by then. I will describe some of these new data at the end of my discussion, but I will also show that Davies in fact misused his sources by presenting distorted information to sup-



A cut-away diagram of major features of the sun. Courtesy of the SOHO/MDI consortium. SOHO is a project of international cooperation between ESA and NASA.

port his thesis.

SOLAR OSCILLATIONS

Prior to the 1970s, if anyone had suggested that the sun could vibrate like a sphere of gelatin, the vast majority of astrophysicists would have strenuously disagreed. The main reason was that no one could conceive of a force that could start such oscillations, much less keep them going. A few researchers had suggested they might exist and that they might be observable, but no one verified their existence until 1973 (Moore and Hunt 1983:72). Since then it has been deduced that solar oscillations are caused by interactions between the plasma that makes up the sun, and changes in gravity and pressure.

There are three types (or modes) of oscillations. *Pressure* modes are sound waves trapped in the temperature gradient. A crude analogy would be an echo bouncing around inside a cavern. *Fundamental* modes are caused by gravitational interactions with the sun's surface and resemble ocean waves. One type of fundamental mode is called a *radial* mode, because it changes the observed radius of the sun. *Gravity* modes are not completely understood, but they are believed to be the result of buoyancy effects. All the known pressure and fundamental modes (some 10 million)

It is worth examining Davies' argument, because if it is true, then it would have profound implications for the age of the solar system.

Kevin L. O'Brien has a Master of Science in Biochemistry, specializes in protein chemistry, enzymology and mitochondria, and works as a research scientist. He is an evolutionist, but he is also a Christian and a creationist, in that he sincerely believes that "In the Beginning, God created the Heavens and the Earth." The rest is open for debate. He lives in Fort Collins with his two cats. He may be contacted by e-mail at klob@lamar.colostate.edu.

have oscillation periods of less than 18 minutes, and most are around 5 minutes. The gravity modes are not known conclusively to exist, but they are predicted to have periods of 40 minutes or longer. [Readers who wish to learn more are encouraged to read a series of articles in *Science* 1996 May 31; 272.]

Davies claims that if the sun had a large and massive core as predicted by the standard models of solar structure and evolution, then this core "would have a substantial effect on any global oscillations." He explains that "such a large core would mean that the Sun's global oscillations would range up to a maximum fundamental radial mode of oscillation of around one hour." He then adds that fundamental "[o]scillations greater than one hour would involve such enormous amounts of energy that they would result in the complete disruption of any large core that might be present in the Sun." In contrast, however, he states that for "a very young homogeneous star that has not yet developed a large central core...its spectrum of global oscillations have been calculated" to be as high as 167 minutes. In fact, he claims that this is "a key distinguishing feature of a young homogeneous star."

He then cites two 20-year-old papers (Brookes and others 1976; Severny and others 1976) whose authors independently report detecting a 160-minute oscillation that both research groups believed was a fundamental radial-mode oscillation. Both groups also concluded that, if this oscillation was real, it would be nearly consistent with a homogeneous model of the sun. Davies concludes by cit-



A cut-away view of the sun revealing bands of differing rotational speeds as measured by the MDI instrument on the SOHO satellite. Courtesy of the SOHO/MDI consortium. SOHO is a project of international cooperation between European Space Agency (ESA) and NASA.

ing 3 other astronomers to deliver the *coup de grace*. He quotes Iain Nicholson (Moore and Hunt 1983:72) as saying that if this oscillation "was a true fundamental period, then the 'standard model could not be correct.'" Davies also cites another report of a 160-minute oscillation (Christensen-Dalsgaard and Gough 1976): "in order to account for the [160-minute] observation it is 'evident that a very drastic change in the solar model would be necessary' and 'it is unlikely that any such model can be found.'"

To summarize Davies' argument, if the sun is homogeneous, it cannot have a dense core; if it cannot have a dense core, it cannot obtain its energy from nuclear reactions; if it cannot obtain its energy from nuclear reactions, it must obtain it from gravitational contraction. And astronomers generally believe that young stars are homogeneous and obtain their energy from gravitational contraction.

For Davies, the conclusion was obvious: "The fundamental oscillation of the Sun matches the model for a young star."

THE EVIDENCE

The major problem with Davies' evidence is that it is over 2 decades old. In and of itself, this is not a fatal problem, because even old evidence is valid if nothing new has been learned. However, these data are obsolete because much more has been learned, especially in the last 10 years. And obsolete data are always invalid, no matter how much they support a favorite hypothesis.

Furthermore, Davies did not treat his sources fairly. He commits three indiscretions that no careful or experienced scholar should. The first is misinterpretation. Part of Davies' argument is that a star with a massive central core cannot support fundamental oscillations with periods greater than 1 hour, because such vibrational modes would disrupt the core. (Keep in mind that whenever Davies refers to global oscillations in general or the 160-minute oscillation in particular he is referring to fundamental mode oscillations.) The source for this information is Nicholson (cited in Moore and Hunt 1983:72), but Davies' claim is based on an incorrect interpretation of Nicholson's work:

[I]t has been pointed out that if the [fundamental mode] oscillations arise in the deep interior, then—because of damping mechanisms—the oscillations seen at the surface should be weaker than those in the interior. Attempts to calculate the oscillation magnitudes...required to match the [surface] observations appear to indicate that they would become of such great amplitude that they would disrupt the solar interior.

Nicholson is referring to *observed* oscillations, not theoretical ones, and remember that all known oscillations have periods shorter than 1 hour. As such, Nicholson is saying that *any* of the observed fundamental oscillations would be powerful enough to disrupt the core. Why this does not happen he did not explain, but contrary to Davies' claim, solar researchers expect that if the sun can tolerate millions of short-term oscillations with little or no core disruption, then it should be able to tolerate at least one long-term oscillation as well.

The second indiscretion is selective quotation and, in at least one case, outright misquotation. For example in the same source that Davies quotes as evidence of Nicholson's admission that 160-minute

[Davies argues] if the sun is homogeneous, it cannot have a dense core; if it cannot have a dense core, it cannot obtain its energy from nuclear reactions; if ... its energy [is not] from nuclear reactions, it must [come] from gravitational contraction.

oscillations cannot be explained by the standard model, Nicholson writes, "the observed results seem roughly consistent with the way the Sun's interior is believed to be constructed" (Moore and Hunt 1983:72). In reference to the 160-minute oscillation, Nicholson adds: "It seems certain there is some periodic effect to explain, but whether the oscillation is a true global oscillation or a surface effect, or a 'gravity wave' like waves in the ocean, remains a matter of debate." He then concludes: "No-one [*sic*] seriously doubts that the Sun shines by means of thermonuclear reactions converting hydrogen to helium, but the precise mechanism is open to doubt" (Moore and Hunt 1983:73).

In other words, while Nicholson agrees that a 160-minute *fundamental* oscillation would contradict the standard model, he states that the long-term oscillation may not be fundamental at all, especially if all the other known oscillations confirm the standard model. Since none of these statements can

even remotely be considered an endorsement of Davies' thesis, there is perhaps no mystery as to why he fails to mention them. Even so, it is dishonest for a scholar to quote a source in support of his thesis while at the same time ignoring statements showing that the source in fact comes to the opposite conclusion.

The one case of misquotation involves the quote from Christensen-Dalsgaard and Gough. Davies' statement implies that the authors believed it was impossible for the standard model to explain the long-term oscillation under *any* circumstances. What they actually say, however, is this:

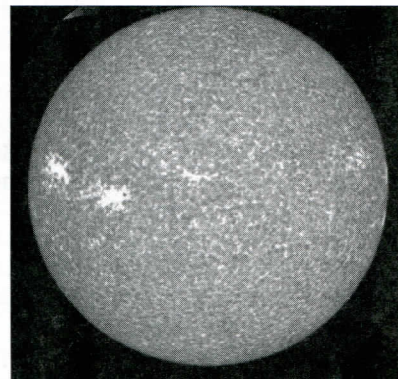
It is also evident that a very drastic change in the solar model would be necessary to enable the 2 h 40 min oscillation to be interpreted as the fundamental radial mode, as Severny et al and Brookes et al suggest. Indeed it is unlikely that any such model can be found *that can generate the observed photon luminosity by thermonuclear reactions* [emphasis added] (Christensen-Dalsgaard and Gough 1976:90).

In other words, the authors are saying that drastic changes would be necessary *only* if the long-term oscillation is a fundamental mode oscillation, and that only under such circumstances would it be impossible to construct a model that relies on stellar fusion. As I hope to demonstrate later, Christensen-Dalsgaard and Gough did not believe that the long-term oscillation was a fundamental mode oscillation.

Davies' refusal to discuss alternative explanations is his third indiscretion. Such explanations should be discussed if for no other reason than the fact that the very sources he cites mention them. Though both of the 20-year-old papers clearly interpret their

results based on a homogeneous model, both discuss other interpretations as well. In the conclusion of Severny and others (1976:89), the authors "...investigated two possible solutions...." The first is that "nuclear...reactions are not responsible for energy generation in the Sun," which Davies seizes upon to support his claim that the sun is young. The second possible solution, however, allows them "...to adopt the current model of solar structure with [nuclear] reactions and assume that [they] really observe not pure radial pulsations but some gravity g mode...oscillation." They go on to say that "g modes...can yield long-period oscillations," and

A Ca II K emission line image of the sun showing sunspots. Courtesy of the National Solar Observatory at Sacramento Peak in Sunspot, New Mexico, NASA and NSSDC.



admit that one mode in particular, the g_{11} mode, is "in perfect agreement" with their observed period, though they did question the dominance of a gravity mode over a fundamental mode. However, they also admit that their method of observation does not allow them to "distinguish pure radial pulsations from [gravity] oscillations." As such, while they maintain that a homogeneous model is the "best" interpretation, they do allow for the possibility that other explanations are possible. Davies conveniently omits this *caveat*.

In Brookes and others (1976), the authors do not mention nuclear reactions, though Davies claims that they, too, reject the idea that the sun is powered by fusion reactions. However, they also admit that their observations could be explained by gravity modes. This suggests that they are willing to accept the possibility of gravity mode oscillations, even though they found it difficult to do so. Once again, however, Davies ignores this alternative explanation.

Christensen-Dalsgaard and Gough also suggest an alternative to abandoning nuclear fusion. In fact, the entire section leading up to the statement which Davies misquotes is an attempt to determine whether they could assume the standard model and still explain the observed long-term oscillation. They calculate periods for various pressure and gravity modes using the standard model, and confirm that the Soviet and British observations could be explained as a gravity mode oscillation (Christensen-Dalsgaard and Gough 1976:91). At that time 20 years ago the authors cautioned that their calculations are not "sufficiently reliable", but they were nonetheless reasonably confident of their results that they suggested that the observed 160-minute oscillation was due to a gravity wave rather than to a fundamental mode or pressure wave oscillation (Christensen-Dalsgaard and Gough 1976:90;

It is dishonest for a scholar to quote a source in support of his thesis while at the same time ignoring statements showing that the source in fact comes to the opposite conclusion.

Weiss 1976:78).

Even Nicholson suggests an alternative explanation (Moore and Hunt 1983:73). He begins by stating that "[m]ore recent analyses of the 2h 40m oscillation suggest that it could be accounted for by reducing the core temperature by about 10 percent." He notes that this cannot account for the current solar luminosity, but he gets around this problem by suggesting that "the output of energy from the core fluctuates over long periods of time." In this way, since photons take 10 million years to reach the surface of the sun, he suggests that the current luminosity could be the result of a more energetic past. Though few astrophysicists are willing to entertain the idea of core variability, it remains a viable, if unlikely, explanation. Besides, it is dishonest for a scholar to ignore alternative explanations discussed by his sources, even if he believes they are not valid. [Newer data acquired from the SOHO satellite suggest that the core may indeed be cooler than originally thought, so core variability may not be so fantastic after all (Cowen 1998:279).]

HELIOSEISMOLOGY

Today, astronomers acknowledge that there are mysteries surrounding the sun that could have profound implications for our models of solar structure and activity (Lang 1996a, 1996b); solar oscillations are among these. However, the knowledge of these very same oscillations is being used to fine-tune the standard model by measuring how their speeds change as they pass through the sun's various layers (Lang 1996b). This powerful tool is known as *helioseismology*, and it is capable of directly probing nearly the entire volume of the solar interior in a way that no other observational method can. Davies himself admits that helioseismology can "provide important information on the structure of the Sun." It is in fact one of the great success stories of modern astronomy, because each of the thousands of known oscillations has been matched to the standard model with an accuracy of between 4 and 5 decimal places. This is an impressive feat for any complex model of stellar evolution (Scherrer 1996 1997).

The point is that, despite Davies' claims to the contrary, helioseismology and associated oscillations have all but confirmed the standard model for the structure of the sun (see especially Lang 1997). There is now no doubt that the sun possesses a large, dense central core capable of supporting fusion reactions. This in turn has also confirmed the standard model for solar evolution, because there are very few ways that a star with the sun's mass and elemental composition can evolve to its present state, even if it had been supernaturally created only a few thousand years ago (Graps 1997). It is rather ironic that the very phenomenon that Davies hopes will refute the ancient age of the sun instead has confirmed it.

However, the *long-term* solar oscillation problem is far from solved. Observations made in the 1980s have partially confirmed the observations made in the 1970s (Scherrer and others 1992; Kotov and others 1992), though it is interesting that Davies makes no mention of any of these other observations.

These observations set an upper limit to the frequency of any long-term oscillations which, perhaps not coincidentally, was 160 minutes. Even so, the astronomers making the observations were convinced that such long-term oscillations must be the result of gravity mode pulsations.

However, because these observations did not conclusively establish the existence of gravity mode oscillations, some researchers dismissed them as either atmospheric effects or artifacts of the earth's movement in solar orbit. If long-term oscillations do exist, then the ground-based GONG system (Global Oscillation Network Group) and the SOHO satellite (Solar and Heliospheric Observatory) should be able to detect them. So far they have failed to do so, though this might be due to technical problems (Lang 1996c). Some astronomers still are convinced they may exist, but the GONG and SOHO observations (or lack thereof) have convinced others that gravity mode oscillations are impossible (Scherrer 1997). Yet everyone agrees that long-term oscillations pose no threat to the validity of the standard model.

SOLAR NEUTRINOS

Another issue Davies uses to question the age of the sun is the solar neutrino problem. Neutrinos are subatomic particles released during stellar fusion. A certain number of neutrinos per unit of time per area (flux) is expected to flow from the sun continuously, but current measurements indicate that the observed flux is only one-third of what is expected. Severny and others (1976:89) claim that this flux agrees with one of their possible solutions—that nuclear reactions are not responsible for the sun's energy—a position Davies endorses.

Nicholson, however, notes that the same 10% decrease in core temperature which could account for the long-term oscillation would also account for the low neutrino flux (Moore and Hunt 1983:71). And while the current luminosity indicates that the core was more energetic in the past, the measured neutrino flux could represent the currently lower level of core activity. It has also been verified recently that neutrinos have mass (Anonymous 1998). In theory, if neutrinos have mass then they can interact with matter which could cause them to change from one type of neutrino to another. This is known as neutrino oscillation, and it can reduce the flux produced by the core.

The point that Davies missed, however, is that a neutrino flux of *any* amount is strong evidence that the sun is in fact being powered by nuclear fusion. Gravitational contraction would not be expected to

[D]avies is both naive and premature to propose that long-term oscillations indicated that the sun must be homogeneous, that it must be getting its energy from gravitational contraction, and especially that it must therefore be young.

BOOKREVIEW

Digging Dinosaurs

Special issue of *The National Forum* edited by James P Kaetz.

*Reviewed by David R Stronck PhD,
Professor of Science Education,
California State University,
Hayward.*

The *National Forum*, the journal of the Honor Society of Phi Kappa Phi, publishes four times each year issues that cover a wide range of topics. The Summer 1998 issue entitled *Digging Dinosaurs* is an issue of special interest to *RNCSE* readers. Editor James P Kaetz explains that the title is a pun: "This issue is literally about digging dinosaurs—finding fossils, preparing them, wrestling from the bones their secrets. But on another level, it is about digging dinosaurs in the time-honored "Beat" meaning of the word: enjoying all there is to know about one of the most successful species in earth's long history."

Seven working paleontologists wrote the articles in this issue. NCSE Board President Kevin Padian, Professor of Integrative Biology and a curator in the Museum of Paleontology, University of California, Berkeley authored "How to Collect and Identify a Dinosaur". Jane Mason, a senior preparator at the same museum, wrote "From Picks and Shovels to Pins and Needles". Karen Chin of the US Geological Survey provides earthy insights in "On the Elusive Trail of Fossil Dung". She recognizes that fossilized feces provide a unique record of animal activity, not available from skeletal fossils.

The first article in this issue reveals a new way to interpret dinosaurs in the controversy between those who believe dinosaurs are overgrown reptiles and those who find them as the predecessors of birds. John R Horner, Curator of Paleontology at the Museum of the Rockies in Bozeman, wrote "Dinosaur Behavior". He concluded that some dinosaurs behaved like modern birds in caring for their young. The evidence comes from nest-like structures discovered near the tiny town of Bynum, Montana.

The remains of post-hatching nestlings were found in two of the nests. The partial skeleton of a *Troodon* sitting on a clutch of eggs has been discovered. An artist's reconstruction of this scene is on the cover of this issue of the *National Forum*.

Most of the articles deal with interesting interpretations that are often controversial. David J Varricchio, Curator of Paleontology at the Old Trail Museum in Choteau, Montana, contributed "Warm or Cold and Green All Over". He observes that over the last 20 years biologists and paleontologists have largely switched from traditional classification to one based on evolutionary relationships, that is to phylogenetic systematics. Recent classification shows dinosaurs are between their cold-blooded crocodilian cousins and their warm-blooded bird descendants. Dinosaurs could have been warm-blooded or cold-blooded or something in between. The recent discoveries of brooding by the dinosaurs *Oviraptor* and *Troodon* imply body heat to raise the temperature of the eggs above that of the environment. Several groups of dinosaurs occupied latitudes possibly as far as 80° away from the equator. The drastic seasonal changes in day length of these high latitudes would present a severe environmental challenge to cold-blooded species. Cold-blooded species alive during the same period do not appear in these latitudes.

Dale A Russell is a curator at the North Carolina State Museum of Natural Sciences. He wrote "Dinosaurs and the Concept of Fitness". Fitness describes how well suited is a species to thrive in an environment. Evidence shows that dinosaurs that came later during the 165 million years of their existence, had larger brains, longer legs, larger eggs, more rapid growth shortly after birth, and better teeth. Beginning about in the middle of the dinosaurian era, body size diminished toward the end. This pattern would be consistent with higher metabolic rates.

Russell believes that at the middle period in their evolution, dinosaurs were more reptilian than mammalian or avian.

J David Archibald, Professor of Biology at San Diego State University, summarized the 3 best proposed causes of dinosaur extinction in "Death, Taxes, and Extinction". Among the 80 dinosaur-extinction scenarios, only 3 seem well enough formulated and testable: marine regression, volcanism, and asteroid impact. Marine regression refers to the lowering of sea levels and a related major loss of low-coastal-plain habitats, establishment of land bridges, and cooling of emerged land masses. Over 4 million years there were massive eruptions of flood basalts on the Indian subcontinent. The changes caused by this volcanism at the end of the Cretaceous Period (65 million years ago) have not been well studied, but may have had an effect similar to marine regression or asteroid impact. The crater Chicxulub near the tip of the Yucatan Peninsula is about 60 miles across and occurred at the time of massive extinctions. But the Popigai Crater in Siberia is the same size and was formed almost 36 million years ago without identified extinctions. Only the marine regression theory supports the present fossil records that show a highly selective extinction of animals at the end of the Cretaceous Period.

All of the articles without question support the theory of evolution. Many of the articles discuss controversies of interpreting the fossil evidence—for example, what were the causes of the massive extinction of dinosaurs, and whether dinosaurs were warm-blooded or cold-blooded. Creationists assert that such controversies show that scientists do not accept evolution and have serious doubts about the "theory". Teachers and parents need to emphasize that there is total agreement in the scientific community that species have changed over time, that is that evolution has occurred. The excitement of science that comes from dealing with puzzling questions does not undermine the basic fact of evolution. Many of these questions about dinosaurs may soon be answered as more fossil discoveries are made.

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REPORTS

"Equal Time" In School Libraries?

Molleen Matsumura
Network Project Director

Most evolution/creation controversies in public schools involve questions of whether "creation science" will be presented to students in the classroom or at assemblies. However, libraries are also a target of creationist efforts. For example the Idaho School Boards Association recently defeated a resolution that called for including "creation science" materials in school libraries (RNCSE 18/4:6), and some state party platforms have included planks like this one:

3.38 We support the stocking of CREATIONIST produced resources in ALL TAX funded public and school libraries. We OPPOSE the current censorship of CREATIONIST resources (Iowa Republican Party, 1998).

NCSE has assisted school districts under pressure to add "creation science" books to their libraries. In 1998, we evaluated books that had been suggested for use as library "resources offering [theories] considered contrary to evolution" in a Michigan school district (RNCSE 18/3:6). We also advised a New Mexico parent whose local schools were being pressed to purchase creationist books on the premise that "libraries must have materials on all controversies."

Two issues emerged from these incidents. First, is your school or public library required to purchase or accept donations of books presenting "creation science" or "arguments against evolution"? Second, how can the appropriateness of such books be evaluated?

LIBRARY DONATIONS AND PURCHASES

Public libraries

No public library is currently *required* to accept donated materials, though they should use consistent policies to assess donations. A good illustration is the case of the Athens Regional Library in Oconee County, Georgia. When the library

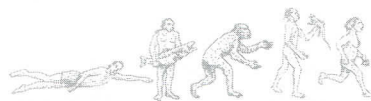
refused the donation of a subscription to the Answers in Genesis publication *Creation Ex Nihilo* in 1996, there was considerable public controversy, and the would-be donor announced that he was considering a lawsuit. However, the library's decision prevailed because it had been made fairly: the library staff was not attempting censorship, but had applied the same standards to the donation as they did to possible purchases. They judged that the magazine's content was too specialized for their limited shelf space. They had consulted the American Library Association (ALA) and had been advised that such decisions are generally legal when they follow policies applied to all library materials (NCSE Reports 16/3:18-9).

School libraries

Like public libraries, school libraries have space and budget constraints, and must carefully evaluate materials whether they are purchased or donated. A school library also *differs* from public libraries in two important respects: it serves a less diverse community—a specific age group—and it must further the school's educational mission. According to the American Library Association:

School library media professionals cooperate with other individuals in building collections of resources appropriate to the developmental and maturity levels of students. These collections provide resources which support curriculum and are consistent with the philosophy, goals, and objectives of the school district (ALA 1990).

While the library should have some materials that satisfy the general reading and learning interests of students, a large proportion of material must support classroom curriculum—for example, if students in the school study early American history, the library should have biographies



FEATURE

of leading figures of the time, historical novels set in that time, and material covering various topics in greater depth than do textbooks—both to provide supplementary readings and to support research assignments. The number of such books related to any given topic is limited by the need to provide similar support for other courses and teaching units.

Both civil liberties organizations and many individual school districts emphasize the importance of providing students with diverse collections that prepare them to debate social issues responsibly. However, these concerns must be understood in the context of a district's legal responsibilities and educational goals, and the school librarian's responsibility to provide materials of high quality. The ALA puts it this way:

Members of the school community involved in the collection development process employ educational criteria to select resources unfettered by their personal, political, social, or religious views. Students and educators served by the school library media program have access to resources and services free of constraints resulting from personal, partisan, or doctrinal disapproval (ALA 1990).

Proposed "creation science" or "evolution/creation" materials must be evaluated within this context. Even citizens who support putting such materials in the school library will not want to change district policies in a manner that would lead to filling school libraries' shelves with third-rate novels and tabloids that report UFO sightings. They can also see why it is untrue that "*all* controversies must be heard." "All contro-

A school library also differs from public libraries... it must further the school's educational mission.

**[O]ne book
NCSE evaluated
this year ... con-
tained no cita-
tions more
recent than the
early 1960s.**

versies" could include everything from disagreements in neurology journals over the best treatment for Parkinson's disease, to disagreements within militias over the best way to "resist" the federal government.

Again, considerations of age appropriateness and educational value apply. To take American history as our example again:

There *was* a controversy about adopting this country's constitution, but a book containing the Federalist Papers is at the wrong reading level for an elementary school library. It might be appropriate for the high school library—but teachers and the librarian might have good reasons to choose other controversies.

The fact is, *scientific* controversy over evolution died in the closing decades of the nineteenth century; it is now a *political* and *religious* controversy. Even people who believe that there is still a *scientific* controversy about evolution cannot deny that many "creation science" books discuss long-dead "controversies"—like the Piltdown hoax that scientists uncovered decades ago—which are too dated for library use. Books presenting *religious* arguments against evolution should not be brought in as part of the *science* curriculum.

**EVALUATING PROPOSED BOOKS—
LESSONS FROM EXPERIENCE**

The crux of the matter for libraries is the *process* used to evaluate the material. School administrators and elected officials face many decisions and balance many legal, financial and curricular concerns while trying to satisfy a varied constituency. Some districts try to compromise by suggesting that the library obtain "nonreligious", purely "scientific" critiques of evolution. What then?

Then comes the hard work! Neither librarians nor advisory committees can evaluate materials unless they have copies of the books in question or substantial book excerpts and reviews from reliable sources such as scientific publications or library journals. Such information can be very difficult to obtain, and the information that is

most easily available may be confusing (see sidebar, *You Can't Judge a Book by Its Number*).

NCSE has published a book containing scientists' reviews of 42 "creation science" books that are frequently suggested for school use (See book list at the end of this article). In addition, we can provide reviews of other books, from our own periodicals and from other journals. Also, in some cases we can provide information about "creation science" children's books that are in the NCSE library.

Even when such information is unavailable, evaluators can use criteria and procedures based on NCSE's experience advising school districts:

- *Is the book genuinely scientific, or primarily religious? How can this be determined?*

In some instances, the religious emphasis of a book is obvious: It is explicitly stated on the cover, in the fly leaf or introduction, in a publisher's catalog or on the website of the publisher or another organization promoting the book. Often, however, it is necessary to review the text itself. For example, the cover of one book in NCSE's collection makes no mention of religious views; it says: "...a new approach to biology in plain language... spectacular breakthroughs in molecular biology can be combined with the widely used laws of probability reasoning.... Topics include... How DNA Duplicates Itself." The text, though, contains numerous examples of religious advocacy, such as: "The materialist must never have stood at dawn and watched the pink light begin to tinge the sky.... If you can see a sight like that and not worship God, you don't deserve to be called a person!" (Coppedge 1973: 279).

When evaluators lack time to read an entire book, using the index can be a big help. Reading pages cited with these key words can help determine whether the book advocates religious views:

abrupt appearance, creator, design, God, intelligence, intelligent design, purpose, teleology, teleonomy. Do not assume that finding such words in the index means the book is primarily religious! A page indexed by the word "intelligence" might discuss the evolution of intelligence, or it might argue that DNA is proof of an "intelligence" that "designed" living cells.

- *Is scientific content of the book accurate and current?*

Any library book about science needs to be up-to-date, unless it was specifically chosen for its value in the history of scientific thought—for example a book of readings from pioneers in fields such as genetics, astronomy, and so on. NCSE has found that many books critical of evolution do not discuss *current* scientific views; one book we evaluated this year had not been revised since 1982, and contained no citations more recent than the early 1960s! Checking a book's bibliography and footnotes is very helpful in assessing whether it is up-to-date. You may also find that, while a book lacks religious rhetoric, ostensibly "scientific" arguments in the book—such as claims that human tracks have been found alongside dinosaur tracks—are standard, inaccurate creationist claims for which NCSE can provide scientific refutations.

- *Is the book age-appropriate and suited to students' educational level?*

Ask science teachers whether students have the knowledge they need to understand and evaluate statements in a book. For example, a book requiring high school reading skills might be donated to a middle school, or a book criticizing methods for determining the age of the earth might be suggested for use by students who have not yet studied earth science.

• *Does the book meet general selection criteria such as sturdy construction and reasonable availability?*

NCSE has found that some books suggested for adoption are no longer in print. Evaluators can check on the book's availability by consulting *Books In Print* or on-line book services. Some "creation science" books in NCSE's collection—especially those that are self-published—are so poorly bound that they literally fall apart in a reader's hands.

CONCLUSION

It's no news that evolution/creation controversies can become heated and emotional. In the heat of controversy, "creation science" proponents may complain in all sincerity that their views are being "censored". They may also ask rhetorically, "What are you afraid of?" The answer rests on common grounds that all parents can share, "I'm afraid the library will spend its limited budget on low quality books. If we aren't careful about library policies, the good books our kids need will be crowded out by junk!" Your school library can select books in a way that avoids censorship without sacrificing quality, and common-sense application of the criteria suggested here helps assure that your school's students will have access to the best science books available.

REFERENCES

- American Library Association Council (ALA). Access to resources and services in the school library media program: An interpretation of the Library Bill of Rights (as amended January 10, 1990). <http://www.ala.org/aasl/positions/PS_billofrights.html>, accessed December 3, 1998. (Note: This document appears under the auspices of the American Association of School Librarians. It can also be obtained by calling 1-800-545-2433, ext. 4, and requesting ISBN 8389-7053-2)
- Benton MJ. *On the Trail of the Dinosaurs*. NY: Crescent Books, 1989.
- Coppedge JF. *Evolution: Possible or Impossible?* Grand Rapids (MI): Zondervan, 1973.
- Gish DT. *Dinosaurs—Those Terrible Lizards*. El Cajon (CA): Master Books, 1977.
- Library of Congress Cataloging in Publications Division, Information sheet on "Preassigned Library of Congress card number or cataloging in publication data?" (Washington, DC: Library of Congress from 607-2a [rev 10/94]).
- Library of Congress Catalogs <<http://lcweb.loc.gov/catalog/>> (Note: from this page a user can choose various options for searching the Library's catalog. Information in this article was obtained using the "derived key" search in December, 1998.)
- Parker Gary E. *Dry on in this Dry Bones...and Other Fossils*. El Cajon (CA): Master Books, 1987.
- Republican Party of Iowa, State Platform (Adopted June 15, 1996) <<http://www.iowagop.org/>> (click on "Our Platform"). Accessed December, 1998.
- For a practical guide to the Dewey Decimal System of Classification (DDS) and an explanation of how DDS numbers are assigned to books, connect to <<http://www.oclc.org/oclc/jfp>>
- BOOKS REVIEWED IN NCSE'S REVIEWS OF CREATIONIST BOOKS**
- [Readers can browse the table of contents of Reviews of Creationist Books at <<http://www.natcensci.org/revcon.htm>> or buy a copy for \$10.00 (\$8.00 for members) plus shipping. NCSE also has numerous reviews of other "creation science" resources which do not appear in the current edition.]
- Aw SE. *Chemical Evolution*.
- Barnes TG. *Physics of the Future: A Classical Unification of Physics*.
- Barnes TG. *Origin & Destiny of the Earth's Magnetic Field*.
- Bird WR. *The Origin of Species Revisited: The Theories of Evolution and Abrupt Appearance*.
- Bliss RB. *Origins: Two Models*.
- Bliss RB, Parker GE. *Origin of Life: Evolution/Creation*.
- Bliss RB, Parker GE, Gish DT. *Fossils: Key to the Present*.
- Bliss RB, Gish DT. *Dinosaur ABC's*.
- Bliss RB, Gish DT. *Dinosaurs: Those Terrible Lizards*.
- Bowden M. *Ape-Man: Fact or Fallacy?*
- Bowden M. *The Rise of the Evolution Fraud*.
- Davis P, Kenyon DH. *Of Pandas and People*.
- Denton M. *Evolution: A Theory in Crisis*.
- Fox N. *Fossils: Hard Facts from the Earth*.
- Gentry RV. *Creation's Tiny Mystery*.
- Gish DT. *Evolution: The Challenge of the Fossil Record*.
- Hall M. *The Earth Is Not Moving*.
- Ham KA. *The Lie: Evolution*.
- Hoover AJ. *The Case for Creationism: Fallacies of Evolution*.
- Huse SM. *The Collapse of Evolution*.
- Johnson PE. *Darwin on Trial*.
- Kofahl RE. *Handy Dandy Evolution Refuter*.
- Lester LP, Bohlin RG. *The Natural Limits of Biological Change*.
- Morris HM. *Evolution and the Modern Christian*.
- Morris HM. *Scientific Creationism* (1974 edition).
- Morris HM. *Scientific Creationism* (1985 edition).
- Morris HM. *The Scientific Case for Creationism*.
- Morris HM. *The Remarkable Birth of Planet Earth*.
- Morris HM. *Tracking Those Incredible Dinosaurs and the People Who Knew Them*.
- Sauer B. *Walk the Dinosaur Trail*.
- Slusher HS. *The Origin of the Universe: An Examination of the Big Bang and Steady State Cosmogonies*.
- Slusher HS. *Critique of Radiometric Dating*.
- Sooter WB. *The Eye: A Light Receiver*.
- Sunderland LD. *Darwin's Enigma*.
- Thaxton CB, Bradley WL, Olsen RL. *The Mystery of Life's Origin: Reassessing Current Theories*.
- Thompson B. *The History of Evolutionary Thought*.
- Van Till HJ, Young DA, Menninga C. *Science Held Hostage*.
- Whitcomb JC Jr, Morris HM. *The Genesis Flood: The Biblical Record and its Scientific Implications*.
- Wilder-Smith AE. *The Natural Science Know Nothing of Evolution*.
- Wysong RL. *The Creation-Evolution Controversy*.
- Young DA, Morris HM. *Christianity and the Age of the Earth; Science, Scripture, and the Young Earth: An Answer to Current Arguments Against the Biblical Doctrine of Recent Creation*.

MEMBERS ACCIDENTALLY INVITED TO JOIN!!

Some NCSE members' names were inadvertently included in a "new member recruitment" mailing when the lettershop added member names to instead of removing them from the rented list. So, just ignore the letter and pink card or better yet, pass them along to someone you think would like to join NCSE!

We're sorry for the confusion.

You Can't Judge a Book by Its Number

One of the most readily available sources of information about any given book is its listing in the Library of Congress (LOC) catalog. Unfortunately, the old adage that "You can't judge a book by its cover" also applies to the Library of Congress (LOC) catalog numbers which librarians use. In many cases (including children's books of fewer than 50 pages) LOC catalog numbers are based on information supplied by publishers *before* publication, not on examination of the books themselves. In Table 1, the 2d and 3d columns show the LOC and Dewey Decimal System catalog numbers. The 4th column gives descriptions of 4 children's books; the 5th column contains quotations culled from the NCSE library which describe each book's approach to its subject.

Each book in Table 1 is a young reader's book about dinosaurs. All the books have similar LOC catalog numbers even though two describe standard scientific knowledge and two advocate biblical literalism. Of the latter, only the Dewey system provided a catalog number which reflects its religious approach. These disparities show that catalog information alone cannot determine whether a proposed book is religious, or whether it is scientifically accurate. Although librarians are not required to accept the LOC numbers provided by publishers, once a number *is* assigned, books must be shelved accordingly. This is why librarians might not shelve "creation science" books with religious materials, even though this would best reflect the books' content.

AUTHOR & TITLE	LOC	DEWEY	LOC CATALOG DESCRIPTION	QUOTE FROM NCSE'S COPY
Ray Troll & Brad Matsen <i>Raptors, Fossils, Fins & Fangs</i>	QE765 T76 1996	560.20	Notes: Includes index. Introduces lesser known prehistoric creatures, including the giant sea scorpion called a eurypterid, the Helicoprion shark, and the carnivorous land dinosaur <i>Deinonychus</i> . Subjects: Animals, Fossil—Juvenile literature. Prehistoric animals.	About 550 million birthdays ago, way before dinosaurs... the earliest relatives of all animals that you could easily see without a microscope appeared.... Descendants of these... creatures changed through time to become first fish, then ... every other animal. That is ... called evolution (p 2).
Gary E Parker <i>Dry Bones and other fossils</i>	QE714.5 P33	231.76519	Notes: A question and answer approach to paleontology which explains why fossils are formed, what they are, what kind of living things formed them, why they are found in groups, and how old they are. Subjects: Fossils—Miscellanea—Juvenile literature. Fossils. Paleontology	You can't believe in creation if you don't believe in a Creator. If there is no Creator, then creation doesn't make any sense.... If you don't believe in God, then you have to believe in some kind of evolution. And then you must try to make the fossils fit in with evolution somehow (p 68).
Michael J Benton, PhD <i>On the Trail of the Dinosaurs</i>	QE862 D5B47 1989	567.9119	Notes: Includes index. Subjects: Dinosaurs	(From a section on "Religion and Science" in the introduction):...[I]n the latter half of the 18th century...the key question was how to reconcile the Bible and science.... Scientific evidence that the Earth was much older than 6000 years was mounting all the time.... [E]ventually most [scientists] gave way to the mounting evidence.... (p 8). [Book has standard scientific information]
Duane T Gish, PhD <i>Dinosaurs—Those Terrible Lizards</i>	QE862 D5G59	568.19	Notes: Includes index. Discusses the origins, characteristics, habits, and fate of dinosaurs. Also includes Biblical references to these creatures. Subjects: Dinosaurs	There are other scientists, called creationists, who believe that the scientific evidence shows that dinosaurs did not evolve, but that they were created by God....The Bible tells us that God made Man and the dinosaurs...on the sixth day of creation (p 13).

Resources from NCSE

EVOLUTION, CREATIONISM, AND THE COURTS

NCSE produces and distributes several informational flyers as for use in discussions with public school officials, political leaders, and concerned citizens. Each flyer contains a summary of the most important issues and includes the NCSE logo and information for contacting NCSE. Members have successfully used them to help public school teachers and administrators understand the legal and educational issues involved in teaching "creation science" in any of its forms in the classroom.

In this issue we are reprinting the flyer "BACKGROUND: Seven Significant Court Decisions Regarding Evolution/Creation Issues" which summarizes court cases showing why it is illegal to teach "creation science", hold assemblies at which guests present "evidence against evolution" and so forth. Write to NCSE for copies, or download them from <<http://www.natcensci.ed.org/courtdec.htm>>. If you need a copy of the complete text of these court decisions, NCSE can provide them when appropriate; for example, when someone claims erroneously that *Edwards v. Aguillard* requires districts to "teach both sides".

BACKGROUND: SEVEN SIGNIFICANT COURT DECISIONS REGARDING EVOLUTION/CREATION ISSUES

1. In *Epperson v. Arkansas* the United States Supreme Court in 1968 invalidated an Arkansas statute that prohibited the teaching of evolution. The Court held the statute unconstitutional on grounds that the First Amendment to the US Constitution does not permit a state to require that teaching and learning must be tailored to the principles or prohibitions of any particular religious sect or doctrine. (*Epperson v. Arkansas* [1968] 393 US 97, 37 U.S. Law Week 4017, 89 S. Ct 266, 21 L Ed 228).

2. In *Segraves v. State of California* the Sacramento Superior Court in 1981 found that the California State Board of Education's Science Framework, as written and as qualified by its antidogmatism policy, gave sufficient accommodation to the views of Segraves, contrary to his contention that class discussion of evolution prohibited his and his children's free exercise of religion. The antidogmatism policy provided that class discussions of origins should emphasize that scientific explanations focus on "how", not "ultimate cause" and that any speculative statements concerning origins, both in texts and in classes, should be presented conditionally, not dogmatically. The court's ruling also directed the Board of Education to disseminate the policy widely, which in 1989 was expanded to cover all areas of science, not just those concerning issues of origins. (*Segraves v. California* [1981] Sacramento Superior Court #278978).

3. In *McLean v. Arkansas Board of Education* a federal court in 1982 held that a "balanced treatment" statute violated the Establishment Clause of the US Constitution. The Arkansas statute required public schools to give balanced treatment to "creation-science" and "evolution-science". In a decision that gave a detailed definition of the term "science", the court declared that "creation science" is not in fact a science. The court also found that the statute did not have a secular purpose, noting that the statute used language peculiar to creationist literature in emphasizing origins of life as an aspect of the theory of evolution. While the subject of life's origins is within the province of biology, the scien-

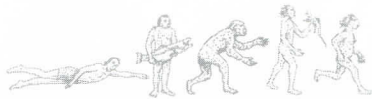
tific community does not consider the subject as part of evolutionary theory, which assumes the existence of life and is directed to an explanation of how life evolved after it originated. The theory of evolution does not presuppose either the absence or the presence of a creator. (*McLean v. Arkansas Board of Education* [1982] 529 F Supp 1255, 50 US Law Week 2412).

4. In *Edwards v. Aguillard* the US Supreme Court in 1987 held unconstitutional Louisiana's "Creationism Act". This statute prohibited the teaching of evolution in public schools, except when it was accompanied by instruction in "creation science". The Court found that, by advancing the religious belief that a supernatural being created humankind, which is embraced by the term "creation science", the act impermissibly endorses religion. In addition, the Court found that the provision of a comprehensive science education is undermined when it is forbidden to teach evolution except when "creation science" is also taught. (*Edwards v. Aguillard* [1987] 482 US 578).

5. In *Webster v. New Lenox School District* the Seventh Circuit Court of Appeals in 1990 found that a school district may prohibit a teacher from teaching "creation science". Such a prohibition is consistent with a district's fulfilling its responsibility to ensure that the First Amendment's establishment clause is not violated and that religious beliefs are not injected into the public school curriculum. The court upheld a district court finding that the school district had not violated Webster's free speech rights when it prohibited him from teaching "creation science", since it is a form of religious advocacy. (*Webster v. New Lenox School District* #122, 917 F 2d 1004).

6. In *Peloza v. Capistrano School District*, the Ninth Circuit Court of Appeals in 1994 upheld a district court finding that a teacher's First Amendment right to free exercise of religion is not violated by a school district's requirement that evolution be taught in biology classes. Rejecting plaintiff Peloza's definition of a "religion" of "evolutionism", the Court found that the district had simply and appropriately required a science teacher to teach a scientific theory in biology class. (*John E. Peloza v. Capistrano Unified School District*, [1994] 37 F 3rd 517).

7. In *Freiler v. Tangipahoa Parish Board of Education*, the United States District Court for the Eastern District of Louisiana in 1997 rejected a policy requiring teachers to read aloud a disclaimer whenever they taught about evolution, ostensibly to promote "critical thinking". Noting that the policy singled out the theory of evolution for attention, that it specifically stated that the only "concept" from which students were not to be "dissuaded" was "the Biblical concept of Creation", and that students were already urged in all their classes to engage in critical thinking, the Court wrote, "In mandating this disclaimer, the School Board is endorsing religion by disclaiming the teaching of evolution in such a manner as to convey the message that evolution is a religious viewpoint that runs counter to... other religious views." In addition to addressing disclaimer policies, the decision is noteworthy for recognizing that curriculum proposals for "intelligent design" are equivalent to proposals for teaching "creation science". (*Freiler v. Tangipahoa Board of Education*, No. 94-3577 ED La. Aug. 8, 1997).



Homeopathic Pedagogy or Read Some Taxonomy and Call Me In the Morning

Michael Alan Park

Central Connecticut State University

As a scientist I am often frustrated, and more often angered by the attacks of the "scientific" creationists. As an educator, I have the added frustration of being challenged to teach the already complex topic of evolution in an atmosphere of misunderstanding, confusion, even apprehension and suspicion about that topic.

In general, of course, teaching in the college or university classroom is not directly affected by the activities of the scientific creationists. The contents of our courses, and those of the texts we assign, can include evolution, with no encumbrance, as the powerful, central scientific theory that it is. And yet, the effects of the creationists' activities (or at least of the public conceptions on which they so blatantly capitalize) are felt.

Many of our students come to our classes with a vague sense that evolution is different from other scientific ideas. Many misunderstand evolutionary theory and are confused about just what it says. Many feel that it is in some way suspect, somehow more open to logical, scientific challenges than are any other subjects within the natural sciences. Others are apprehensive about evolution, having understood that there are serious philosophical questions about the theory. Indeed, they think of evolution as a theory in the *vernacular* sense of the word—a synonym for hypothesis or even guess.

These misconceptions are not necessarily the results of any overall lack of scientific background. A poll recently conducted at Central Connecticut State by my colleague, archaeologist Kenneth Feder, showed that nearly 80% of our introductory level students agreed that evolution accounted for the nature of life on earth, and nearly 60% agreed that the earth was almost 5 billion years old. At the same time,

however, over 30% thought that the events related in the stories of Adam and Eve and Noah's Flood were historical (and 25% and 35%, respectively, said they "didn't know" if those stories were literally true). Among the predominately Roman Catholic student body at my university, a fair number come with the erroneous idea that evolution is at odds with their religious beliefs.

As a result of my perception of such attitudes, I noticed a few years ago that as soon as I introduced the topic of evolution (even on the first day of a class), I would treat it differently from my discussions of, say, cell structure or Mendelian genetics. I would state, ever so emphatically, that the theory of evolution is every bit as well-supported as are the theories of gravity, relativity, and continental drift. Indeed, the general idea of evolution is, I would propose—my voice getting louder and my speech faster—as much a fact as the heliocentric nature of the solar system. This would lead to my promising to expand in a few weeks upon the matter of the relationships between science, belief systems, and those sometimes dangerous nemeses, the pseudosciences. My subsequent discussion of the nature and history of the modern scientific method was really a history of evolutionary thought. Evolution was my example of how the scientific method can be applied to things unseen or in the past.

In short, I was doing everything in my power to make *absolutely sure* my students thought evolution was somehow different. By launching such a full frontal attack, I was risking hoisting myself by my own pedagogical petard.

Certainly, evolution is a central focus of my field of biological anthropology, and one must at some point explain it head-on in all its detail. At some point, too, "scientific" creationism should be dealt with. The most obvious solution to the problem of my demeanor would simply have been to train myself to explain evolution calmly in the same way that I explain any other facet of bioanthropology. But, given those

suspicions on the parts of my students, as well as my own lack of confidence in my ability to remain as calm as I would have liked, I felt some other devices were needed, and a little of what I came to call "educational homeopathy" seemed to help.

The premise of homeopathic medicine (the efficacy of which is another issue) is the treatment of disease by giving the ailing patient small doses of a substance that would normally cause symptoms of their disease. As a (very) loose analogy, I have found that by getting students involved in some question *within* evolutionary biology, they can come to find acceptance of the general idea suddenly quite obvious.

One example I have found particularly effective is the topic of taxonomic nomenclature and categories. Modern taxonomy, traditional or cladistic, presupposes evolutionary relationships and constitutes a codification of some of the most powerful and persuasive evidence for the fact of evolution. Some debates within that topic seem to be inherently interesting to many students.

My own favorite is the on-going debate over the phylogenetic relationship between birds and dinosaurs. (This is also, because the debate continues with new evidence or a new interpretation appearing almost weekly, a perfect example of real science "in the act".) I guess because everyone is fascinated by dinosaurs, and because of the ubiquity of birds, the possibility that birds might *be* dinosaurs is capable of stimulating the imagination, of conjuring up all the implications, of causing one to feel more alive just by thinking about it. It is amazing but true that one can get students to actually care about a hole in the pelvis shared by birds and dinosaurs but nothing else, about a semilunate carpal bone and fused clavicles (wishbones) in velociraptors, and about the possible genesis of feathers from dinosaur integumentary structures.

Other examples, of course, would work just as well. If you'd

This article was adapted from a paper presented in the symposium Teaching Evolution (and Confronting Creationism) in the College Classroom at the meetings of the American Association of Physical Anthropologists, Salt Lake City, Utah, April 3, 1998.

like your example closer to home, there's always the issue of whether your Lhasa Apso deserves the same species name as the wolf. If you want to keep the focus on human evolution (which, as my colleague Martin Nickels points out on page 24, is a splendid case study for the evidence of evolution), there is the matter of whether the African apes are hominids or humans are pongids.

At any rate, at the end of such a discussion—which can generate some fairly insightful questions—one can gently, even obliquely, point out that at no point in the discussion was the general concept of evolution or phylogenetic relationships ever questioned, that, no matter which point of view on the issue one took, the fact of evolution was taken as a given.

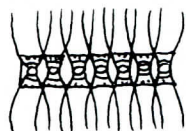
Such a tack—as opposed to presenting some defensive exhortation of what I saw as the irrefutable logic of the data—accomplishes several important goals. It avoids sending up a warning flag that there is some problem with the idea of evolution. It supports the idea of evolution in a manner that is at the heart of real science—the deductive testing of hypotheses. And it might actually initiate some class discussion. Most important, it promotes that most effective method of learning (though students may need a bit of tugging or nudging in the right direction); it allows students the wonder and satisfaction of *self-discovery*—the same phenomenon as those little (or occasionally big) epiphanies that make our profession so personally fulfilling to us.

Students need and expect us to provide them with detailed, accurate, and straightforward information. But, especially in the case of a loaded topic like evolution, some pedagogical device (the one described or many others) that leads students to discover something for themselves is—keeping with my medical metaphor—perhaps the most potent antidote for *a priori* confusions and suspicions.

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Grabbing Readers by the Eyeballs

Andrew J Petto
NCSE Editor

Headlines, pictures, and graphics are ways to make readers stop and look at the text on a page, so a powerful headline increases the likelihood that someone will actually *read* an article. However, despite a couple of decades of collaboration between news media and the scientific community devoted to improving the *content* of science-related articles, the *headlines*, pull quotes, and other "grabbers" are usually chosen by someone other than the writer. In a recent article on the *New York Times* web site, the potential for seriously misleading the reader became clear.

In an article by Gina Kolata on the interaction within a fetus between genes contributed from the father and those from the mother, the headline proclaimed "Mouse Study Fails to Verify Evolutionary Theory" (*New York Times* 1998 Dec 1; <<http://www.nytimes.com/library/national/science/120198sci-health-imprint.html>>). The article reports work done by Shirley Tilghman at Princeton to test a hypothesis proposed by David Haig at Harvard about genes responsible for fetal growth rates.

There is a long history of studies examining the different reproductive strategies and objectives of males and females under different sorts of social and ecological conditions and how those strategies may promote selection for traits which increase success. In some species, different fetuses in the same litter may be sired by different males. Therefore, Haig hypothesized that the male of these species should carry genes which cause *his* fetuses to grow large quickly, to secure a larger share of the mother's resources and to outcompete other fetuses sharing the womb. On the other hand, Haig proposed that females would be better off with genes that maintained a more equal distribution of resources to all fetuses, and so selection should promote genes in the females for more even fetal growth which would counter those of the male. Kolata's article reports on Tilghman's study in

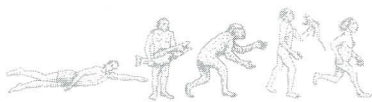
Nature Genetics which describes experiments designed to test the predictions of Haig's hypothesis.

So, why did the headline writer get it so wrong? The most likely reason is a combination of factors. First, the headline writer (and the general public) confused the vernacular usage of "theory" with the scientific one. In this case, s/he used "theory" to mean "hypothesis" in the same way that the "disclaimer" crowd uses it to mean "unsubstantiated speculation". Second, the text of Kolata's argument itself shows an imprecise use of the word "theory".

Evolutionary biology can be long on theory but short on evidence. So biologists were delighted when they thought they had a rare chance to conduct an experimental test of a popular and appealing theory involving a kind of molecular arms race between the sexes. ... The evolutionary theory drew on a notion that there could be a battle between the sexes, even in the womb. ... Haig's theory says ... there can be a sort of genetic tug of war in polygamous species.

What was really at stake here, of course, was *not* evolutionary theory, but one hypothesis to test an explanation of the phenomenon of "genomic imprinting" in which some genes seems to work only if inherited from the father while others seem to work only if inherited from the mother. The hypothesis was based on other research which suggested that the differences between the sexes in their investments and interests in reproduction might lead to selection for this sort of genetic regulation in the fetus. Haig's explanation of the inheritance of growth-regulating genes may well be wrong, but nothing about this research threatens the theory of evolution. Perhaps no one got the mechanisms of inheritance more wrong than Charles Darwin, yet his theory of evolution by descent with modification still informs all of biology today.

[Just before press time we received a copy of the print version of Kolata's article. We were relieved to see that the headline in that version was "Mouse Study Fails to Verify An Evolutionary Theory." *New York Times* 1998 Dec 1:D2. *emphasis added.*]



Objections Overruled!

Arthur M Shapiro
University of California, Davis

[Ed.: Readers of NCSE publications will immediately recognize Phillip E Johnson, professor of law at the University of California at Berkeley, critic of science's commitment to naturalism, anti-evolutionary debater, and prolific author. He has recently published *Objections Sustained: Subversive Essays on Evolution, Law, and Culture*. (Downer's Grove (IL): InterVarsity Press, 1998. 180 pages). Arthur Shapiro examined Johnson's book and discusses it in this essay.]

Authors want to be reviewed, and they are usually grateful if the reviewer demonstrates that he has read the book carefully, no matter what opinions he expresses about it (Johnson 1998, p 10).

The very first essay in this collection purports to be a review of Adrian Desmond's *Huxley: From Devil's Disciple to Evolution's High Priest*. I say "purports to be" because it says little about the book and a great deal about Phillip Johnson and (pardon the California argot) where he is "coming from". This is true of virtually everything Johnson writes. He has a world view which informs his voluminous output—he writes at least as much as Stephen Jay Gould—and his word processor is fully in service to his social-religious-political agenda.

He jumps from Desmond's book to what is really a review of Gould's tedious and unsuccessful two-part attack on "Darwinian fundamentalists" which appeared in 1997 in the *New York Review of Books*. He calls Gould a "Huxleyist"—one of the few terms of opprobrium never before heaped on Gould. As a self-described Marxist, Gould must enjoy the convergence of name-calling styles in the Christian Right and the Old Left, where any deviation from orthodoxy was quickly labeled with the

odious name of its alleged instigator. Gould is a "Huxleyist" because, according to Johnson (following Desmond), Thomas Henry Huxley was never much of a believer in natural selection. Johnson's aim is to show that "Darwinism" has been schismatic from the get-go. He thinks that the only thing that unites "Darwinists" is their ideological commitment to materialism and its inevitable companion—hostility to religion, especially to Christianity. He says that the true goal of "Darwinists" is to keep the Divine Foot from getting in the door. The Image of God as an aggressive door-to-door salesman is not one of Johnson's better metaphors. At any rate, one tends to sympathize with the homeowner, not the salesman, in such cases.

Johnson wants the reader to believe that "Darwinism" is intellectually bankrupt, and he uses all his lawyerly skills to advance that viewpoint. He wants you to accept that "Darwinists" quarrel among themselves constantly—precisely because none of them truly understands evolution—while presenting a united front to the public so as to prevent their Christian opponents from exploiting their internal divisions. How do they manage this juggling act? Supposedly by conducting their quarrels behind closed doors at professional venues and in arcane journals inaccessible to the public.

But how, then, can we explain Gould's recourse to the very public *New York Review of Books* to air his gripes, or fellow-Marxist Richard Lewontin's use of the same vehicle to grouse about sociobiology and genetic determinism? Phil J would say that the *New York Review of Books* is not for the *boi polloi*; it may not be a venue for the biological elite, but it is very much one for a self-described cultural elite.

Sociologists have often described multiple, parallel power structures in the same society. In Philadelphia,

where I grew up, elective political power was and is vested in neighborhood-based ethnic blocs, while economic power was and to a significant degree still is concentrated in old-money WASP families, with a leaven of parvenu Catholics and Jews. Fraternity and sorority systems are often structured in similar ways.

The US today has 2 parallel cultural elites, mirroring the so-called "culture wars". Each has its own set of publications, and the subscription lists hardly overlap at all. The *New York Review of Books* set represents the Left cultural elite. The *First Things / Books and Culture / Intercollegiate Review* set represents the intellectual Christian Right. They basically talk past each other, but the relationship is asymmetrical.

The Christian intellectuals, very much including Phil Johnson, are not only aware of everything the other side says and does, they deeply resent it. They regard as utterly illegitimate the status accorded the "New York Intellectuals"—the *New York Review* set—as America's official intelligentsia. The *New York Review* set, for its part, does not reciprocate the attention, let alone the envy. Norman Mailer did publish a bizarre novel about Christ and Christianity recently, but by and large the words and ideas of the Christian Right receive as much attention by the Left as the average tree stump. Frankly, the Christians do have a beef here. On the other hand, to say so seems to smack of cultural special pleading, which is uncomfortably close to affirmative action—a notion very much out of favor with the Christian right.

If we read *Objections Sustained* carefully, as Johnson says he wants us to do, we find some fascinating contradictions along kindred lines. One of the more unusual essays, called "Wundergadfly", is an appreciation of the late philosopher Paul Feyerabend, who spent most of his career at Berkeley not far from

Johnson's office, but whom he discovered only much too late. Feyerabend admits in his autobiography *Killing Time* that he was never a deep intellect; he was basically having fun. Nonetheless he staked out a very radical position on the "demarcation problem" (the question of how to delimit science from non-science, a matter of increasing social importance). He said it was insoluble. There *was* no conceivable universal criterion to enable us to distinguish science from everything else, he claimed. For this he was treated as a pariah.

Even today, when increasing numbers of philosophers of science have come around to this position, they diligently avoid crediting the perennially irresponsible Feyerabend for getting there first. Indeed, they do not mention him at all. But Johnson is attracted to Feyerabend for his skill at deflating scientists' pretensions of objectivity and claims to constitute an elite priestly class. As a layman whose critiques of evolution (and AIDS epidemiology and virology) have been savaged on the grounds that he has no professional *bona fides*, Johnson appreciates such a position.

Fine. But in another essay in this book, "Pomo Science", Johnson also revels in the now-legendary "Sokal hoax". In this episode, widely reported in the mass media, "leftie" NYU physicist Alan Sokal hoodwinked the editors of a "postmodernist" journal, *Social Text*, into publishing an incoherent nonsensical essay portentously entitled "Transgressing the Boundaries: Towards a Transformative Hermeneutics of Quantum Gravity". He did this by salting the essay with postmodernist buzzwords and numerous citations of work by "pomo" gurus, including some of the editors themselves. (He did this because he thought that what passes for Leftist ideas in postmodernist circles is vacuous obscurantist drivel.)

The contradiction in Johnson's positions in these two pieces lies in his attitude on "outside" critics of science. He is consistent in enjoying the deflation of pomposity, but he ridicules one set of outside critics of science—the postmodernists—because he does not like where their criticism is grounded (the Left). Outside criticism from the Christian Right, however, is not only acceptable, but great. The logical conse-

quence of there being no solution to the "demarcation problem" is to open the door to pyramid power, reincarnation, astral travel, demonic possession, and so on. Surely Johnson does not want that. His only escape is to claim that science does not have access to objective reality and absolute truth. Only the revealed truth of Christianity is eternal. (And in Johnson's defense, this "truth" is certainly closer to eternal than the "pomo" cant set up by Sokal.)

Since he became a gladiator in the culture wars, all of Johnson's books have been published by InterVarsity Press, an arm of the InterVarsity Christian Fellowship USA. That is to say, he is basically preaching to the choir. Despite his high productivity and his voluminous correspondence, his work has become ever more overtly informed by Christian apologetics and thus decreasingly appealing across the cultural gap. His personality is not ideally suited to high-profile controversy. He is so mild-mannered and avuncular as a debater that one almost hates to score zingers off him (this is experience speaking). He would be another William F Buckley, but he is too *nice*, and too unimaginative by half. So, he will never be the contrarian he fancies himself, because the minority he represents has no vanguard, only a rear guard.

Once, in mid-life, Johnson turned an unfamiliar corner and discovered "orthodox" Christianity, which has become his new vocation. He credits evolution as the idea that drove him there. Since his religious epiphany he has settled into a groove: his essays are fun to read—to a point—but ultimately they converge to sameness. He once suggested that we meet for lunch on his home turf in Berkeley. I suggested the Triple Rock, Berkeley's landmark brewpub, quite close to his office. Despite nearly 30 years in Berkeley, he had never heard of it. To his credit he accepted the invitation and seemed to enjoy the atmosphere and the food.

Perhaps there is still time for him to turn another unfamiliar corner, to venture into new territory, to stop being so *comfortable* a contrarian. "Orthodoxy is my doxy and heterodoxy is another man's doxy," said William Warburton, Bishop of Gloucester. For all his condemnation of scientific materialism as today's orthodoxy, Phil Johnson is a man

who knows what he likes in a doxy. Alas, the *New York Review* set turns down its collective nose at her.

REFERENCES CITED

Desmond A. Huxley: *From Devil's Disciple to Evolution's High Priest*. Boston: Addison Wesley, 1997.

Feyerabend P. *Killing Time*. Chicago: U Chicago Press, 1995.

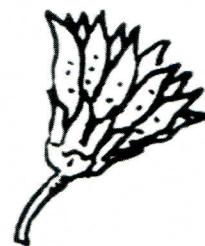
Gould SJ. The Darwinian fundamentalists. *New York Review of Books* 1997 Jun 12; 44(10): 34-7.

Gould SJ. Evolution: The pleasures of pluralism. *New York Review of Books* 1997 Jun 26; 44(11): 47-52.

Johnson PE. *Objections Sustained: Subversive Essays on Evolution, Law, and Culture*. Downer's Grove (IL): InterVarsity Press, 1998.

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A short article in the November 23, 1998 *Washington Post* on page 2B showed a picture of a rock thought to be a remnant of the Chicxulub impact which marked the Cretaceous/Tertiary (K-T) boundary. The caption explained:

"Rock from the Crustacean era sediment beneath ocean floor has makeup of something from outerspace."

It looks like an unsupervised spell checker in action.

[Contributed by Paul Heinrich.]

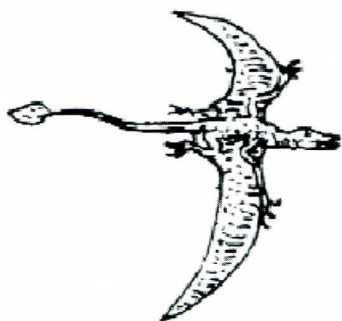
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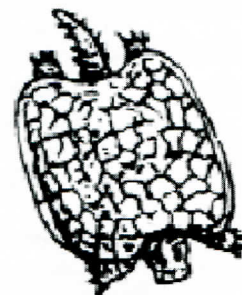
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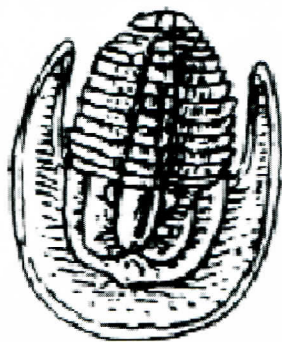
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In the same spirit as Daniel Dennett's *Darwin's Dangerous Idea*, Cziko presents a universal selection theory that attempts to account for all novel instances of adapted complexity. He extends the evolutionary process of cumulative blind variation and selection to a wide range: not only biology, but complex ideas and scientific theories as well. See a sample of this book at http://www.ed.uiuc.edu/people/gac/without_miracles. Cloth, 385 pages. *List price \$30.00, sale price \$23.50.*

Darwin's Dangerous Idea

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Darwin and the Genesis of
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Unraveling the Mystery of
Extinction**

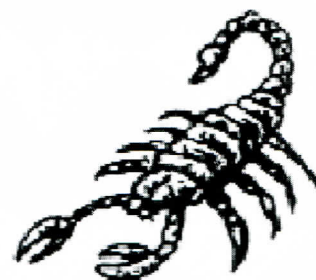
by Niles Eldredge.

"Somewhere between the massive extinctions that wipe out nearly all living things, as during the time of the dinosaurs, and the small-scale individual case of an unknown beetle that slips away in the tropic, lies an understanding of the cause of ecosystem, evolution, and collapse." Eldredge's views on extinction. Cloth, 246 pages. *List price \$20.00, sale price \$15.00.*

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Shadows of Forgotten Ancestors

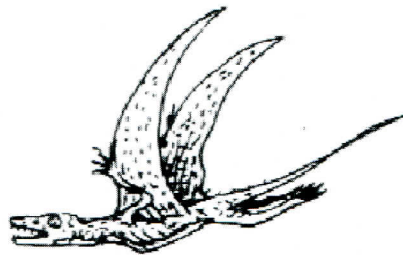
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***The Human Odyssey: Four Million Years of Human Evolution***

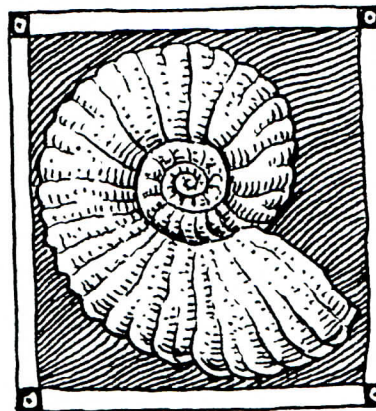
by Ian Tattersall.

The Human Odyssey grew out of the American Museum of Natural History's "Hall of Human Biology and Evolution" and the many illustrations include photos of fossils and reconstructions in that exhibit. Combines scientific accuracy with vivid photography. Cloth, large format, 190 pages. *List price \$27.50, sale price \$20.75.*

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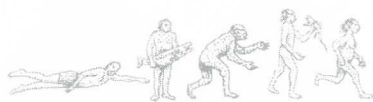
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Humans As a Case Study for the Evidence of Evolution

Martin Nickels, Illinois State University

As physical anthropologists we are either blessed or cursed when it comes to teaching about evolution. The reason for the dilemma is that, on the one hand, we focus on the organism that is clearly the most problematic and difficult for many people to accept as having evolved and, on the other hand, we deal with the species that is probably unparalleled in terms of the sheer amount of scientific information and evidence supporting the idea that evolution has occurred on this planet.

Personally, I regard our focus on human evolution as an unparalleled and golden opportunity for teaching about evolution and addressing important aspects of the creation-evolution controversy. There are several reasons for this.

First, we get to deal with the organism that more people and students are most inherently interested in than any other: themselves. This means that we can take advantage of this interest and use it to deal with one of the most important ideas in all of science, namely evolution.

Second, because of the amount of scientific evidence that exists for human evolution, we are in the enviable position of being able to draw upon knowledge from many areas of scientific research and build one of the strongest cases for evolution in

all of biology.

Third, because of our primary focus on humans, we can underscore and reinforce the idea that humans are indeed animals (that is to say, we are a part of the natural world rather than a creature set apart from it. This idea becomes even more important, of course, when we make the case that humans are a *natural product* of biological processes.

Fourth, by making the case convincingly for human evolution, we pretty much assure that making the case for any other species will be that much easier. After all, having already dealt with the single most problematic species of all, there can't be too many objections to thinking that other—indeed all other—organisms have also evolved.

Fifth, we have the opportunity to illustrate several important aspects of the nature of science and scientific knowledge. These include using such criteria as independent lines of evidence, concordance or consistency of evidence and the predictive power found in the patterns inherent in nature to advance scientific understanding of the world we live in and have emerged from.

The focus of this discussion is to illustrate both the strength of the many lines of scientific evidence supporting the idea of human evolution and the importance of the concordance or agreement that exists among them. Some of the most important criteria by which the strength of any scientific theory is assessed include the number of independent lines of evidence that are concordant with one another and the ability to use knowledge of one line to predict the pattern we should find in another. Thus, using humans as a case study in evolution also allows us to illustrate some broader aspects of the nature of science and how one can judge the overall strength of any scientific theory or explanation.

I want to underscore the impor-

tance of using the term "evidence" rather than the more colloquial term "proof" in normal scientific discourse. Scientists deal with evidence, not proof, in the sense that we deal with information and data that must be made sense of or interpreted rather than being, pardon the expression, self-evident. Mathematicians and logicians may deal in undeniable proof because of the nature of the abstract ideas and concepts that they deal with, but scientists must discover the patterns inherent in the natural world and then explain them in light of our understanding of the natural processes that we *must* use to account for those patterns.

Scientists have, in turn, developed criteria to assess and evaluate the relative merits of alternative explanations of the evidence. These criteria include valuing concordance among independent lines of evidence and the ability to predict one line of evidence from another as ways to distinguish better explanations from worse ones.

Now, let me turn to 12 lines of Evidence for Human Evolution. I've grouped them into 7 that represent evidence from the biological present and 5 that represent evidence from the geological and biological past. I will make observations about their significance and interrelatedness rather than explain what each line means since I think they're mostly self-explanatory in that regard.

Category number 1 (Hierarchical Taxonomic Classification) is a good example of a pattern that can, of course, be explained by special creation. Linnaeus did just that. But, Darwin—a century later—explained the same set of orderly relationships between organisms as being the result of divergent evolution and shared ancestry. More important, though, is the fact that organisms created *de novo* need not show varying degrees of similarity to one another. Each creature could be constructed completely differ-

This article was adapted from a paper presented in the symposium *Teaching Evolution (and Confronting Creationism) in the College Classroom* at the meetings of the American Association of Physical Anthropologists, Salt Lake City, Utah, April 3, 1998.

Martin Nickels is Professor of Physical Anthropology at Illinois State University in Normal. His research interests include the history of human evolutionary studies, hominid paleontology and prehistory, primate behavior, and the biological bases of human behavior. He twice was selected as the Outstanding University Teacher at Illinois State University and was a Sigma Xi National Lecturer in 1995 and 1996. He co-authored *The Study of Physical Anthropology and Archaeology*, as well as articles in many professional journals.

ently from every other creature and made from very different materials. Humans need not look like apes, but we do. We show varying degrees of similarity to them and we are made of the same stuff. We *could* have been created this way but we *must* look like this if, indeed, we have evolved and diverged from a relatively recent common ancestor.

Another important and seldom appreciated characteristic of the evolutionary explanation for the existence of organisms in naturally nested or hierarchical groupings is that it allows us to predict that organisms with certain combinations of features—such as chimpanzees with wings, flowers with bony skeletons, or humans with hooves instead of feet—are biologically impossible because of the unbridgeable gaps produced by the major divergent evolutionary events that separate chimps from birds, flowers from vertebrates, and humans from horses. An all-powerful creator, of course, could create almost any combination of such fantastic and fanciful creatures.

It is indeed remarkable that this theory has been progressively accepted by researchers, following a series of discoveries in various fields of knowledge. The convergence, neither sought nor fabricated, of the results of work that was conducted independently is in itself a significant argument in favor of this theory.

– Pope John Paul II addressing the Pontifical Academy of Sciences on October 22, 1996.

Number 2 (Comparative Anatomy) and Number 3 (Comparative Embryology) are similar to Number 1 in that organisms could have been deliberately formed to resemble one another but they need not have been. But if organisms share varying degrees of evolutionary kinship with one another, then such anatomical and embryological similarities are mandatory. There is probably no more powerful or striking example of such similarity than that seen among the fetuses of primates, especially the hominoids.

Category Number 4 (Comparative Biochemistry) is of special interest and importance. This is due to the fact that the agreement or concordance of the biochemical evidence with the anatomical evidence illustrates another important consideration when evaluating the strength of evolutionary theory: namely that our 20th century ability to compare the biochemical similarities among species provided a test of evolutionary theory which had been mainly based on the evidence from 19th century comparative anatomical studies, biogeography and a very limited fossil hominid record. If the same overall pattern of biochemical similarities did not agree with the pattern based on anatomical comparisons, evolutionary theory would have been in serious trouble. But the patterns do agree and evolutionary theory is all the stronger because of that.

Number 5 (Adaptive Compromises) and Number 6 (Vestigial Structures) are both very difficult to explain as being the result of deliberate design or special creation since they represent such "poor" engineering. But they are exquisite examples of the constraints inherent in biological systems evolving over time and having only existing ancestral structures available for modification in the face of new and often competing selective pressures. The human examples I've listed under Number 5—the pelvis and the larynx—are two of the better examples of adaptive compromises between competing selective pressures that I know of.

Item Number 7 (Biogeography) refers simply to the observed fact that similar-looking species tend to be found in close proximity to one another—as illustrated by the primate examples I've listed. The special case of biogeography pertinent to human evolution, of course, is that in 1871 Darwin used the work of Huxley and others which showed that humans most resemble chimpanzees and gorillas who live only in Africa to predict where we would most likely find fossils of our own earliest ancestors—Africa.

That Darwin was correct is borne out by Category Number 8 (Paleobiogeography) as, indeed, all of the earliest-known hominids are from Africa and nowhere else. But the fact that Darwin could use evi-

dence from biogeography to predict what the pattern should look like in a completely separate body of evidence—the fossil record—is a wonderful example of how concordance among separate lines of evidence is both a testable prediction of a scientific theory and further support for a theory—in this case, evolution—when the prediction is borne out.

Number 9 (the Fossil Sequence) for hominids is just a single case study of the general pattern present in the overall fossil record. That pattern is that modern species are not found throughout the fossil record from top to bottom—which they should be if all species were formed at one time at the very beginning of life on this planet. Instead, what we discover is less and less evidence of modern species as we go deeper and deeper into the fossil and geological record—a pattern both predicted by evolutionary theory and completely consistent with evolutionary theory. Indeed, this is the *only* pattern consistent with evolutionary theory. And there is no more impressive fossil series one can use to illustrate this pattern than the overall hominid fossil sequence. There is also no more pedagogically powerful example for students than that of our own lineage.

Number 10 (Fossil Intermediates) refers to the fact that, regardless of the mode or rate of evolutionary change, there should be evidence of morphological continuity over time in the fossil record if species are evolutionarily linked and related to one another. Is there a better classroom example one can use to illustrate this point than a fossil like Lucy with her mixture of ape-like and human-like features? I sometimes think that as physical anthropologists we are especially blessed to have such a wonderful example to use in our teaching.

Number 11 (the Ecological Coherence of Fossil Assemblages) is an especially powerful point to use when countering the associated claims of Flood Geology that many creationists make. The idea that the fossil and geological pattern seen on this planet is really a record of a single, recent, global catastrophe in the form of the Great Deluge and Flood postulates that no real chronological order of any consequence exists in the earth's geological or fossil record. But the fact that successive

12 LINES OF EVIDENCE FOR EVOLUTION OF HUMANS (& OTHER PRIMATES)

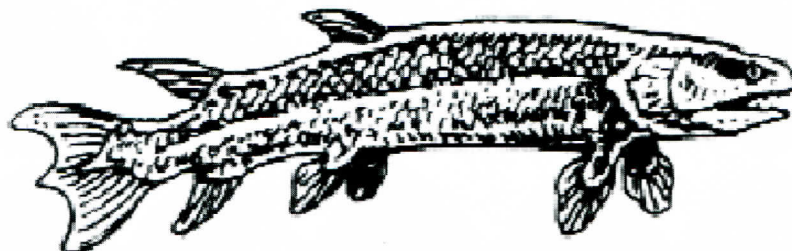
SEVEN LINES OF EVIDENCE FROM BIOLOGY

1. Hierarchical (Taxonomic) Classification (Linnaeus)
primates naturally forming nested hierarchical groupings
2. Comparative Anatomy
homologies
general adaptive attributes of all primates (including humans)
distinctive brachiating anatomy possessed by hominoids
3. Comparative Embryology (Ernst Haeckel)
4. Comparative Biochemistry (1950's)
served as a substantial test of evolutionary theory (and illustrates concordance between independent lines of evidence)
amino acid sequences of proteins (genetic products)
chromosomal banding patterns (genetic loci)
DNA structure itself (genes)
5. Adaptive Compromises or "Imperfections"
"contrivances" (Charles Darwin)
"evolution as tinkering" (François Jacob)
human examples:
pelvic structure adapted both for fully erect bipedalism AND giving birth to big-brained babies
lowered larynx an adaptation for speech
BUT also a liability in that it makes us more likely to choke compared to other mammals
6. Vestigial Structures
"senseless signs of history" (Stephen Jay Gould)
human examples: ears with muscles, Darwin's tubercle, appendix, little toe

7. Biogeography
refers to the geographical distribution of similar species as a result of shared ancestry; for example, lemurs on Madagascar, New World and Old World monkeys, lesser apes
Darwin's 1871 prediction about finding fossils of early humans in Africa

FIVE LINES OF EVIDENCE FROM PALEONTOLOGY & ARCHEOLOGY

8. "Paleo-biogeography"
earliest hominid fossils are from Africa as predicted by Darwin and evolutionary theory
9. Fossil Sequence
more "primitive" (less modern forms) found earlier and before more "evolved" (more modern) forms
10. Fossil Intermediates
intermediate fossils theoretically should and *do* display a combination of primitive and derived features: Mosaic Specimens
"Lucy" (Hadar, Ethiopia; 3 MYA)
various archaic/"modern" specimens (for example, Jebel Irhoud, Predmost)
11. Ecological Coherence of Fossil Assemblages
fossil assemblages represent ecologically-sensible collections of fossil species (*contra* the "Flood chaos" model)
virtually any hominid site but especially those with both hominid remains and faunal and/or floral fossils
12. Chronological Sequence of Stone Tools
the same sort of developmental sequence seen in more "primitive" to more "advanced" fossils is seen in the archeological sequence of stone tools from cruder to more sophisticated and refined



fossil assemblages actually contain ecologically-coherent groups of species common to specific environments counters this creationist claim by illustrating that environments come and go and come again many times over time but the species within them change.

The fossil record, then, is not merely a jumbled collection of drowned flood victims but a record consisting of ecological snapshots of the natural history of life on this planet. The number of ecologically-coherent paleoanthropological and archeological sites from Laetoli, Lake Turkana, Olduvai Gorge on up to the present is stunning, and all provide excellent examples for us to use in our teaching.

Finally, Number 12 (the Archeological Record) of stone tools and other artifacts is a uniquely human line of evidence available to us because we teach about human natural history. No other organism has left such a record of its behavioral evolution. More importantly, the pattern of change in the lithic prehistory of humans parallels that of the fossil record in its change from more primitive to more modern over time. The archeological record uniquely enriches our study of human evolution.

Individually, perhaps, one can claim that any given line of evidence looks the way it does because that is the way it was intended to look by a/the Creator. But such a creationist claim actually involves mixing elements of different creationist models such as the "young earth-quick creation with a flood" model and the "old earth-progressive creation without a flood" model in ways that are fundamentally incompatible and inconsistent with one another. Only an evolutionary explanation can rationally account for these lines of evidence both individually and collectively. Indeed, it is their combined strength that supports evolution so extraordinarily well.

In conclusion, the fact that there are so many lines of evidence in support of the idea of human evolution simply means that we, as physical anthropologists, have an unrivaled opportunity to teach about evolution and effectively confront creationism in our classrooms. We have the best case study for evolution in all of biology. Let us rejoice in that and use it in our teaching. The opportunity is

yours, and I hope you all take advantage of it.

Acknowledgment: Many thanks to Craig Nelson of Indiana University for helping me develop and enrich my thinking about the strength of the case for evolution in general. He encouraged me to apply several of these lines of evidence to humans as a case study.

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Creationist beliefs, on the other hand, can never increase our understanding of the physical world because what is not already known is the unknowable hand of God moving in his creation. People repeated the Genesis story to each other for three thousand years and at the end of the day knew no more about biology than when they started. In about two hundred years of a scientific approach we have learned most of what we know about how living things work.

Rick Littrell on TalkOrigins, <<http://www.talkorigins.org/origins/feedback/oct98.html>> accessed Dec 20 1998.

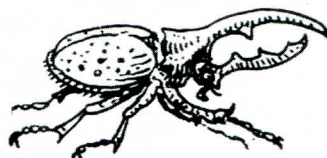
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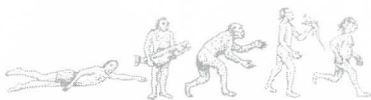
Andrew J Petto
NCSE Editor

The African origin of the first human ancestors has been considered a "settled" fact for decades. However, there have been competing hypotheses about the way in which our species *Homo sapiens* may have emerged from our most recent ancestors. One view held that the pattern was similar to that of earlier hominids—the first modern humans emerged in Africa and then spread throughout the world. The other main view was that modern humans emerged from a number of "local" or regional populations in several parts of the world. This latter view is based on anatomical characteristics that seem to relate Asian *H sapiens* fossils more closely to their *H erectus* predecessors than with the African *H sapiens* fossils.

JY Chu and colleagues reported in September that genetic testing of 28 populations in China indicate an African origin for all *H sapiens*. They argue that previous conclusions about the degree of genetic separation between Chinese and African populations may be an artifact of the underrepresentation of Chinese populations in many genetic studies. Their studies also indicate that migration into east Asia was probably via a restricted route through southeast Asia. This restricted access might explain the pattern of anatomical traits which was taken as support for the latter hypothesis.

Chu JY, Huang W, Kuang SQ, Want JM, Xu JJ, Chu ZT, Yang QY, Lin KQ, Li P, Wu M, Geng ZC, Tan CC, Du RF, Jin L. Genetic relationship of populations in China, *Proceedings of the National Academy of Sciences USA* 1998 Sept 29; 95(20): 11763-8.





Lucy and the ICR: Bearing False Witness Against Thy Neighbor

Pierre Stromberg

In November 1973, during his first major expedition to the Hadar region of Ethiopia, paleo-anthropologist Donald Johanson stumbled upon a single locking knee joint—a type found only in hominids. Inspired by this discovery, Johanson kept digging and the following year discovered the now famous “Lucy” skeleton that established the existence of *Australopithecus afarensis*. Although most scientists saw Lucy as excellent evidence for human evolution, creationists were of a much different opinion.

On May 28, 1997, I attended an Institute for Creation Research (ICR) lecture series conducted by Richard LaHaye. The lectures were presented at a local church to an audience sympathetic to the ICR's version of Bible-based creation “science”. LaHaye's talks were entitled “The Differences between Creationism and Evolution” and “Nature's Challenge to Evolution”. Among the more interesting claims LaHaye made were:

- If humans came into existence millions of years ago as scientists propose, simple arithmetic shows that all of the world's landmass couldn't support the number of graves required to accommodate all those corpses. In his words, “We'd be up to our necks in bodies.”

- *Archaeopteryx* was a simple bird, nothing more. In particular, LaHaye erroneously claimed that other birds have teeth like *Archaeopteryx* and that the claws on the specimen are not particularly interesting because “other birds, like bats, also have claws on their wings.”

LaHaye's lecture continued with

Pierre Stromberg has been a longtime member of the skeptic community, but has only recently developed an active interest in the creationism controversy and other pseudo-science promulgated by religious groups. Image scans of the related letters in this article as well as any updates can be found on Pierre Stromberg's Paranormal Northwest website (<<http://www.eskimo.com/~pierres/>>).

standard creationist arguments including, “What use is 1/5th of an eye?”, “Horse evolution is simply the breeding of bigger horses,” and “There are no transitional fossils.” He also offered \$200 000 to anyone who can prove to him that evolution is a fact.

The audience was sympathetic to LaHaye's testimony, punctuating his discourse with words of “amen” and nodding their heads in approval. Up to this point in the lecture, LaHaye's basic argument was that evolutionists were intelligent, but because of their bias, they had made serious mistakes in their interpretation of the available data.

LaHaye then started discussing Lucy. Instead of attacking the evolutionist interpretation of Lucy's skeleton, however, LaHaye described how Lucy clearly was an apelike creature from the waist up (anatomically speaking), but below the waist, had a locking knee joint, indicating that she walked upright. How to explain such a strange, transitional discovery to an audience of creationist believers? LaHaye's answer was to recount a lecture Donald Johanson delivered at the University of Missouri in 1987. LaHaye claimed that when Johanson was pressed with a question by a member of the audience, he admitted that the knee was found 2-3 kilometers away from Lucy, a stratigraphic separation of nearly 70 meters.

As LaHaye made this startling revelation, a chorus of gasps emanated from the audience in the church. To their minds, LaHaye had established that evolutionists were not only wrong about the data, but that they lie and conceal information in order to promote the dogma of evolutionism. Unfortunately for LaHaye and his audience, however, his claim wasn't true.

Of course, Johanson had in fact discovered the locking knee joint prior to his discovery of Lucy (who has a knee joint of her own), but the two discoveries have always been treated as discrete specimens of the

same species. All of the bones shown in photographs of Lucy were found at a single location during Johanson's subsequent expedition in 1974. And anyone who actually read Johanson's *Lucy: The Beginnings of Humankind* would have come away with the same understanding. Other specimens of *Australopithecus afarensis* have been discovered and have occasionally been referred to as “Lucy” in the interest of brevity, but there is no mistake among members of the paleontological community regarding the details of Johanson's “Lucy” skeleton.

In the course of researching this controversy, I discovered that NCSE member Jim Lippard had already waged a long battle with creationists over this very issue (a full account is available at Lippard's web site <<http://www.talkorigins.org/faqs/knee-joint.html>>). According to Lippard, ICR President John Morris, in a 1993 telephone interview, indicated that he was aware the claim was false, but didn't feel it warranted a retraction of his 1989 article, “Was ‘Lucy’ an Ape-man?”

I sent a letter to LaHaye on June 9, 1997, explaining what I had discovered, including what Morris had said during his interview with Lippard in 1993. In the letter, I asked LaHaye simply to retract his statement and have it noted in Lippard's talk.origins FAQ page on the knee joint controversy. I also included the latest edition of the FAQ which noted the creationist track record on the Lucy myth.

Since I received no response to my first letter, I wrote to the pastor of the church where I heard LaHaye's lectures. I remained bothered that all those attending the lecture did not know what had previously transpired in regard to his Lucy claims and might be continuing to perpetuate this erroneous claim. In the letter, I recounted my research, Morris's acknowledgment, and the apparent continuing willingness of the ICR, as I put it in my letter, “to

bear false witness against thy neighbor." In conclusion, I expressed concern that "the ICR is not only corrupting science, but the good deeds of the Christian faith as well. Ultimately, their strategy may wind up chasing individuals away from Christ if they are not called to task." Then I sent 2 more letters—one to Morris and a second one to LaHaye. In each, I again noted that they were "bearing false witness" and that I had contacted the pastor of the local church where the lecture had been conducted.

Within two weeks, I received a letter from LaHaye informing me that "more pressing matters" had kept him from responding to me earlier. He also advised me that his letter was his personal stance on the subject and should not be considered the policy of the ICR. Basically, LaHaye refused to acknowledge that he was in error. He wrote, "I do not consider the information you forwarded as evidence, of truth, that Johanson's statement was in fact not made." Of course, no one disputes that Johanson made the comment about the knee joint's discovery in a separate location from the Lucy skeleton. The issue in dispute, however, was whether Johanson implied that the knee joint was consolidated into Lucy's skeleton. Johanson never made this implication, and all of his published works prior to the 1987 speech at the University of Missouri are also quite clear that the first knee joint, AL 129, is a separate fossil from Lucy. Furthermore, the ICR seems to be unaware that the very way the specimens were classified (AL 129 for the original knee joint and AL 288-1 for the Lucy skeleton) indicates that the two were found in different locations.

LaHaye's letter continued, "Please furnish me with written evidence that...Johanson did not say what has been stated that he did say [at the University of Missouri on November 20, 1987]."

Of course, I already *had* the evidence that LaHaye demanded—courtesy of Lippard's web site outlining his previous correspondence with Johanson on this very controversy.

Even though LaHaye wouldn't acknowledge his error, he nonetheless revealed, "For your information, ICR has directed me not to bring up the subject of 'Lucy's knee joint' in

my lectures and I will abide by their request. But for me to retract my statement for you or Jim Lippard, I don't think so. If you think I am going to jump through some kind of hoop for the Skeptics Society or the FAQ (who or what ever they think they are), forget it."

Before I could respond, I received a letter from Morris in his capacity as President of the ICR. In it he noted, "I was unaware that Dick LaHaye was speaking on subjects that would include the details of Lucy's anatomy and have since discussed this with him. His lecture topics were to include biblical creationism and its societal relevance, not the scientific details. Not being a scientist, we had intended for him to point people to the ICR materials for scientific content." Unfortunately for his audience, that directive did not prevent LaHaye from making reference to research he conducted at the ICR's facilities with the aid of other creation "scientists".

What impressed me the most, however, was Morris's contention that, "While I am grateful that Lippert [*sic*] pointed out to me the details, correcting my misunderstanding, no scientist here at ICR uses the questionable knee in their scientific writings or lectures any more. It is regrettable that LaHaye picked up on something that was written years ago." What Morris didn't include in his letter, though, is that he noted Lucy's "questionable knee" (using that very term) in several published articles after speaking with Jim Lippard. But each time, he didn't clarify what was "questionable" about the knee joint.

Furthermore, 3 months *after* I received Morris's reply, ICR adjunct faculty member Donald Chittick lectured at North Seattle Christian Fellowship, repeating the knee joint allegation to an audience of more than 200. When I confronted Chittick after the lecture, he appeared completely unaware that Morris had retracted the bogus claim regarding Lucy. Even though I presented Chittick with a copy of Morris's letter, he refused to retract his claim and demanded to see the evidence that was already provided to him by Lippard 3 years earlier. I subsequently sent those materials to Chittick again and asked him to clarify his stance on Lucy. He did reply shortly after receiving my letter, but

did not discuss Lucy at all. Instead, he claimed that he had very little to do with the ICR, even though he is listed as an adjunct faculty member of the organization, praises their work in his lectures, sells their literature, and encourages his audience to sign up for ICR monthly reports. Nevertheless, subsequent monitoring of his lectures indicates that he *has* dropped the claim regarding Lucy's knee joint.

Meanwhile, my follow-up letter to Morris requested a clarification on his own writings regarding Lucy's "questionable knee" and suggested a rigorous peer review of all ICR materials. I sent a second letter to John Morris immediately following Chittick's lecture and one more letter to LaHaye. I explained to LaHaye that he appeared to be even more confused about Lucy than I had originally thought. In an attempt to clarify the issues, I enclosed a personal letter from Johanson to Lippard that not only detailed Johanson's research regarding *Australopithecus afarensis*, but also discussed the lecture that led to the bogus accusation.

As yet, I have received no further responses from either LaHaye or Morris. Why they decided to respond to me at all and institute some form of damage control is still a mystery. It is possible that my attempt to contact the pastor may have gotten their attention. It is also possible that my specific use of wording, such as "bearing false witness against thy neighbor", may have struck a chord that they found impossible to ignore. It could have been a combination of both. In any event, creationism watchers should be on the lookout for any future attempts by creationists to propagate this fallacious accusation.

ADDENDUM:

On September 5, 1998, the official ICR website updated its content with the full archive of "Dr. John's Q&As" which also appears as a section of the monthly ICR publication, "Back to Genesis". Despite Morris's assurances that the ICR would no longer propagate the bogus knee joint myth, his November 1989 article "Was Lucy an Ape-man?" now appears on the ICR website without a disclaimer or retraction.

REFERENCES CITED:

- Chittick D. The Puzzle of Ancient Man, public lecture at North Seattle Christian Fellowship. 1997.
- Johanson DC. Letter to Jim Lippard, August 8, 1989.
- Johanson DC. Letter to Jim Lippard, May 30, 1990.
- Johanson DC, Edey MA. *Lucy: The Beginnings of Humankind*. NY: Simon and Schuster. 1981.
- LaHaye R. Presentation at an Institute for Creation Research public lecture in Redmond, Washington, May 28, 1997.
- LaHaye R. Letter to Pierre Stromberg, July 30, 1997.
- Lippard J. Lucy's Knee Joint: A Case Study in Creationists' Willingness to Admit their Errors, <<http://www.talkorigins.org/faqs/knee-joint.html>>. Last accessed Jan 1999.
- Morris JM. Letter to Pierre Stromberg, August 1, 1997.
- Morris JM. What distinguishes man from ape? *Back to Genesis*. In *Acts & Facts*, Nov 1995; d.
- Morris JM. Who or what was *Australopithecus ananensis*? *Back to Genesis*. In *Acts & Facts*, Dec 1995; d.
- Weaver KE. The Search for Our Ancestors, *National Geographic* 1985 Nov; 168(5): 560-623.
- Willis T. Lucy Remains at College. Revised reprint of "Lucy" Goes to College". *Bible-Science Newsletter* 1987 Oct; 1-3.

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Mutation Station— DNA Deletion Does Not Destroy Cell Function

Andrew J. Petto
NCSE Editor

One of the main reasons that evolution is so fundamental to biology is that it helps us make sense of findings in a variety of related fields of research. Because of this explanatory power, research designed to help us understand problems in one field of biology often ends up answering questions in another. A recent report by Chou and colleagues on the lack of certain molecules on the surfaces of human cells shows that one event in the emergence of humans from ape ancestors involved the deletion of over 90 base pairs from the human genome without any catastrophic results for cell function.

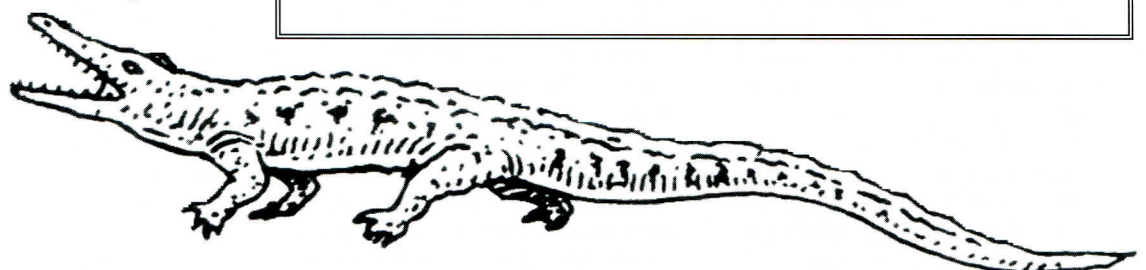
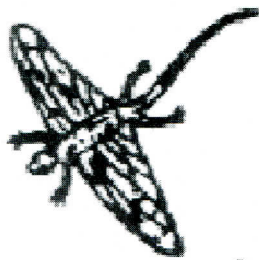
Sialic acids are commonly expressed by the cell surfaces of all animals classified as deuterostome (which includes all the chordates). Researchers often detect these compounds by studying the products of various chemical reactions which are easier to collect and study. However, one common by-product of sialic acids is not usually present in humans in "easily detectable" amounts. Furthermore, Chou and colleagues report that these compounds are present in all great ape tissues *except* the brain. They propose that the reason for these differences between humans and other chordates may be due to a lack or inactivation of an enzyme.

To study this problem Chou and colleagues cloned a segment of complementary DNA (cDNA) from humans and chimps which is responsible for constructing this enzyme. They discovered that the human cDNA "contains a 92 [base-pair] deletion resulting in a frameshift mutation." They also located a gene on

Chromosome 6 (in both humans and great apes) where the deletion is evident in humans, but not in apes. They report that this chromosome shows no other evidence of evolutionary rearrangement between humans and great apes.

So the lack of the by-product in humans is due to the lack of an enzyme activity, not to the lack of sialic acid itself on the cell surfaces. The researchers know that our cells contain sialic acid, since the by-products are seen in a few adults and most fetuses, but especially in tumors. Yet, the cells themselves seem to function perfectly well in chimp and human brains, and in human bodies in general, without this enzyme which is a typical component of cell structure in all the other chordate animals. The association between the sialic acid by-products and the presence of cancers was a primary motivator for this study, but the outcome supported the two-step divergence of apes from monkey ancestors and humans from ape ancestors with yet another biological indicator confirming the phylogenetic pattern. The great apes are distinct from other chordates because they do not use this enzyme in their brains, and humans took this change one step further by eliminating it from the whole body by deleting the genetic instructions that are responsible for it. At the very least, this study shows us how much organisms can tolerate disruptions in biochemical pathways and how oversimplified are the claims of "intelligent design" theorists on these matters.

Chou H-H, Takematsu H, Diaz S, Iber J, Nickerson E, Wright KL, Muchmore EA, Nelson DL, Warren ST, Varki A. A mutation in human CMP-sialic acid hydroxylase occurred after the *Homo-Pan* divergence. *Proceedings of the National Academy of Science USA* 1998 Sept 29; 95(20): 11751-6.



BOOKREVIEW

Digging Dinosaurs

Special issue of *The National Forum* edited by James P Kaetz.

Reviewed by David R Stronck PhD, Professor of Science Education, California State University, Hayward.

The *National Forum*, the journal of the Honor Society of Phi Kappa Phi, publishes four times each year issues that cover a wide range of topics. The Summer 1998 issue entitled *Digging Dinosaurs* is an issue of special interest to RNCSE readers. Editor James P Kaetz explains that the title is a pun: "This issue is literally about digging dinosaurs—finding fossils, preparing them, wrestling from the bones their secrets. But on another level, it is about digging dinosaurs in the time-honored "Beat" meaning of the word: enjoying all there is to know about one of the most successful species in earth's long history."

Seven working paleontologists wrote the articles in this issue. NCSE Board President Kevin Padian, Professor of Integrative Biology and a curator in the Museum of Paleontology, University of California, Berkeley authored "How to Collect and Identify a Dinosaur". Jane Mason, a senior preparator at the same museum, wrote "From Picks and Shovels to Pins and Needles". Karen Chin of the US Geological Survey provides earthy insights in "On the Elusive Trail of Fossil Dung". She recognizes that fossilized feces provide a unique record of animal activity, not available from skeletal fossils.

The first article in this issue reveals a new way to interpret dinosaurs in the controversy between those who believe dinosaurs are overgrown reptiles and those who find them as the predecessors of birds. John R Horner, Curator of Paleontology at the Museum of the Rockies in Bozeman, wrote "Dinosaur Behavior". He concluded that some dinosaurs behaved like modern birds in caring for their young. The evidence comes from nest-like structures discovered near the tiny town of Bynum, Montana.

The remains of post-hatching nestlings were found in two of the nests. The partial skeleton of a *Troodon* sitting on a clutch of eggs has been discovered. An artist's reconstruction of this scene is on the cover of this issue of the *National Forum*.

Most of the articles deal with interesting interpretations that are often controversial. David J Varricchio, Curator of Paleontology at the Old Trail Museum in Choteau, Montana, contributed "Warm or Cold and Green All Over". He observes that over the last 20 years biologists and paleontologists have largely switched from traditional classification to one based on evolutionary relationships, that is to phylogenetic systematics. Recent classification shows dinosaurs are between their cold-blooded crocodilian cousins and their warm-blooded bird descendants. Dinosaurs could have been warm-blooded or cold-blooded or something in between. The recent discoveries of brooding by the dinosaurs *Oviraptor* and *Troodon* imply body heat to raise the temperature of the eggs above that of the environment. Several groups of dinosaurs occupied latitudes possibly as far as 80° away from the equator. The drastic seasonal changes in day length of these high latitudes would present a severe environmental challenge to cold-blooded species. Cold-blooded species alive during the same period do not appear in these latitudes.

Dale A Russell is a curator at the North Carolina State Museum of Natural Sciences. He wrote "Dinosaurs and the Concept of Fitness". Fitness describes how well suited is a species to thrive in an environment. Evidence shows that dinosaurs that came later during the 165 million years of their existence, had larger brains, longer legs, larger eggs, more rapid growth shortly after birth, and better teeth. Beginning about in the middle of the dinosaurian era, body size diminished toward the end. This pattern would be consistent with higher metabolic rates.

Russell believes that at the middle period in their evolution, dinosaurs were more reptilian than mammalian or avian.

J David Archibald, Professor of Biology at San Diego State University, summarized the 3 best proposed causes of dinosaur extinction in "Death, Taxes, and Extinction". Among the 80 dinosaur-extinction scenarios, only 3 seem well enough formulated and testable: marine regression, volcanism, and asteroid impact. Marine regression refers to the lowering of sea levels and a related major loss of low-coastal-plain habitats, establishment of land bridges, and cooling of emerged land masses. Over 4 million years there were massive eruptions of flood basalts on the Indian subcontinent. The changes caused by this volcanism at the end of the Cretaceous Period (65 million years ago) have not been well studied, but may have had an effect similar to marine regression or asteroid impact. The crater Chicxulub near the tip of the Yucatan Peninsula is about 60 miles across and occurred at the time of massive extinctions. But the Popigai Crater in Siberia is the same size and was formed almost 36 million years ago without identified extinctions. Only the marine regression theory supports the present fossil records that show a highly selective extinction of animals at the end of the Cretaceous Period.

All of the articles without question support the theory of evolution. Many of the articles discuss controversies of interpreting the fossil evidence—for example, what were the causes of the massive extinction of dinosaurs, and whether dinosaurs were warm-blooded or cold-blooded. Creationists assert that such controversies show that scientists do not accept evolution and have serious doubts about the "theory". Teachers and parents need to emphasize that there is total agreement in the scientific community that species have changed over time, that is that evolution has occurred. The excitement of science that comes from dealing with puzzling questions does not undermine the basic fact of evolution. Many of these questions about dinosaurs may soon be answered as more fossil discoveries are made.

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REPORTS

BOOKREVIEW

Faith, Reason, and Earth History

by Leonard R Brand, 1997.
Berrien Springs (MI):
Andrews University Press.
322 p.

Reviewed by G Brent
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& Atmospheric Sciences, Oregon
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Leonard R Brand received his PhD in vertebrate zoology from Cornell University and is a professor of biology and paleontology at Loma Linda University, a Seventh Day Adventist institution located in southern California. He specializes in the study of small mammals, especially squirrels, and has done some interesting work in ichnology (the study of fossil tracks—usually in the absence of other remains, which adds to the challenge of this particular field). He has published papers in the biological and geological literature, as well as in creationist journals. Thus, his credentials both as a scientist and as a creationist seem to be well established.

The first four chapters of *Faith, Reason, and Earth History* are about how science works, including some historical examples. Mostly, Brand gets it right. He emphasizes that scientific conclusions are always tentative and may have to be modified or abandoned as new knowledge becomes available, that science is self-correcting, that theories and hypotheses must be testable, and that theories are predictive, organize and explain facts, and suggest new avenues of research. He does fail to distinguish adequately between a scientific theory and a hypothesis, and he argues that science is a search for "truth" without

explaining that truth has many forms—only one of which is addressable by science. But these are minor quibbles.

In chapter 6 ("Faith and Science—What is Their Relationship?"), Brand sets the stage for the rest of his treatise. He argues that science can inform religion—up to a point—and vice versa. When a conflict exists, biblical interpretation needs to be examined to ensure that Scripture is being interpreted correctly. If study shows that revelation clearly contradicts science, then further scientific study is indicated, and the result will eventually be a scientific interpretation that is consistent with the revealed truths of the Bible. His view seems to be that if scientists just keep working at it, all conflict between creationism and science eventually will disappear. Here Brand takes a slightly more flexible approach than most creationists—but not much. The Bible, or more precisely, the creationists' interpretation of it, is the final "word"; and when science disagrees with revelation, it must be science that has got it wrong.

Chapters 7 through 12 are devoted to developing a framework for the history of life on earth which is based on what Brand calls "informed intervention". In Brand's view the interventionist (the "intelligent designer" of the God of Genesis) is directly responsible, in the creationist sense, for complexity in plants and animals. Thus, all major extant and extinct groups were created by the supreme being during creation week, and what has happened since is the loss of genetic information by natural selection. Evolution is fine on a small scale and not lim-

ited to the species level, but has only acted to diversify and adapt life from the originally created taxa. Where science has a "tree of life", Brand has a forest.

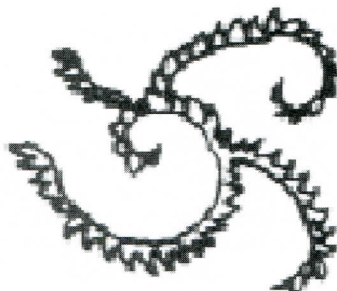
In chapters 13 through 16 Brand delves into geology and formulates his earth history. His training and experience are not in geology, and it shows. Unlike his chapters on biology, he relies too heavily on the creationist literature for his data and ideas. The result is an analysis that is naïve and uncritical. Like many creationists, Brand struggles with the apparent conflict between the creationist dogma of a young earth and the scientific evidence—particularly from radiometric dating—which indicates otherwise. The result is an earth history in which radiometric dating works for Precambrian time, thus indicating an old earth with a long history, but fails for the most recent 600 million years or so (the Phanerozoic), allowing a short time scale for living things. Why should radiometric dating so suddenly fail? Perhaps, according to Brand, the ages for Phanerozoic rocks are "inherited" or the elements were "unstabilized" at the time of the flood, speeding up radioactive decay. All of the major "groups" of plants and animals were created during creation week. The bulk of Phanerozoic sedimentary rocks and the fossils contained in them, then, are the result of the Noachian Flood and of "ecological zonation", in reality a variation on the silly idea of hydraulic settling to explain the fossil sequence. And what about the present distribution of certain problematic terrestrial mammals like the marsupials of Australia? "Perhaps the God who initiated the flood and brought

the mammals to the ark also involved Himself in concluding the process by distributing the mammals so that the re-population of the earth would proceed in a balanced fashion."

I enjoyed reading this book, although I would not recommend it to anyone wanting to learn biology or geology. Brand has an easy and informal style, has organized his thoughts logically and has succeeded in expressing his ideas clearly. Scientific concepts and terms are explained carefully, and nonscientists should have no trouble reading or understanding the text or the illustrations. It is also an honest book in that Brand, in contrast to many creationists who write about science, has not willfully attempted to mislead the reader on either the religious underpinnings of his thinking or on the nature, power, or current findings of science. For a creationist book there is a refreshing absence of science bashing and deceit. The occasional errors, omissions, and odd interpretations are either honest mistakes (all books have them) or Brand's religiously driven conclusions clearly labeled as such. He makes an admirable attempt to evaluate scientific evidence, including some touted by creationists, in a rational way, pointing out what he perceives to be the strengths and weaknesses of both. By and large he succeeds, but when push comes to shove interventionist theory, as he calls it, wins the day.

As a vehicle for learning about earth history, Brand's book suffers from the same malady as all creationist works on science, that is, he is all too ready to ignore or set aside scientific evidence when such evidence conflicts with what he believes to be an inerrant interpretation of the Bible. Miracles and supernatural events are permissible agents when it becomes necessary to reconcile the really knotty difference between science and creationism. But Brand is open and straightforward about this. In the preface of the book Brand states that it should not be used as an authority on the subject, but that "it should be read as one person's

thinking on the topic at this time." Fair enough; as an exposition of how one unusually thoughtful creationist, who is also a scientist, is attempting to reconcile his religious faith with his understanding of science, the book is worth reading.



The latest issue of the Hugh Ross newsletter *Facts & Faith* has a two-page article describing the evidence for an old universe and criticizing the use of astronomical data by young-earth creationists, particularly the work of Russell Humphreys, author of *Starlight and Time*. The article is available on the Reasons to Believe website at <http://www.reasons.org/resources/FAF/98q4faf/trap.html>.

[Contributed by Bob Schadewald.]

NEW EXHIBIT ON HUMAN ORIGINS

The Field Museum in Chicago has opened an exhibit on human evolution entitled *Origins*. The exhibit will be up from January through April 1999 and presents an exciting up-to-the-minute look at the story of human evolution.

Accompanying the exhibition in the museum is a learning game introducing school groups and family visitors to some of the key hominid fossils. The game asks visitors to figure out what types of environments were suitable for these different human ancestors in the context of the cultural and technological attainments of these different species.

For information on Project Millennium's *Origins* program, connect to <http://www.projectmillennium.org/origins/index.htm>. The program of events at Chicago's Field Museum of Natural History is at <http://www.projectmillennium.org/origins/institut.htm#field>. Information is also available by writing to Project Millennium, Field Museum of Natural History, 1200 S Lake Shore Drive, Chicago IL 60605-2496 or by calling (312) 922-9410.

[Information provided by Robin Wagner, PhD, Programming Coordinator for Project Millennium.]



RECAPITULATIONS

[In the final issue of Creation/Evolution we published Carl Bajema's review of Del Ratzsch's book *The Battle of Beginnings: Why Neither Side is Winning the Creation-Evolution Debate*. In this issue we present Ratzsch's response to the review of his book and Bajema's reply.]

DEL RATZSCH RESPONDS

I have just finished reading Carl Bajema's review of my book *Battle of Beginnings*, in your Winter 1996 issue. Unfortunately, the review consists almost exclusively of either complaints that certain things are not in the book (when they explicitly are) or criticisms of things allegedly in the book (which simply are not there). Your readers deserve better.

For example, Bajema says that "Ratzsch should have asked himself What are the characteristics of successful science?" As an example of how that *should* be done, Bajema cites Kitcher and reproduces Kitcher's abbreviated list of "important characteristics" of "successful science".

But I devote a subsection of one chapter on the nature of science explicitly to the question: "What are the earmarks of theoretical truth?" The answer I give is a more extensive and detailed list than Kitcher's, and one which (in slightly different technical terminology) overlaps most of his list. Exactly how Kitcher's presentation of a short list constitutes an exemplary answering of the question, whereas my producing a more extensive overlapping list constitutes failure even to address the question, Bajema does not tell us.

Another example is how Bajema constructs his review around three foci, one of which is "Ratzsch's discussion of ... who is entitled to be called a 'creationist'." In that connection, he claims that I talk about who are "the only 'true' creationists", claims that I engage in "haggling" over who is a creationist and who is not", and so on.

Such a discussion (much less any such terminology) exists nowhere in the book. Since the focus of the book is on bad arguments advanced

from both sides in the creation/evolution debate, it is, of course, necessary to identify the various parties to be discussed. To do that, I give a characterization in the Introduction that covers such groups as ICR, CRS, AIG, B-SN, CM, and so on. Not only are those groups *nowhere* endorsed, not only is it *nowhere* claimed that they are what creationists ought to be or anything of that sort, but that issue is never even mentioned in the book. (And I do not fit into their category, so no endorsement is even indirectly implied.) Indeed, that definition is never so much as *discussed* in the remainder of the book.

To make clear that the definition I give is simply for identification, the definition (which Bajema quotes in his review) is immediately preceded by this phrase: "I take the present popular usage to refer to those who hold the following...." Bajema does not quote that lead-in phrase, nor does he indicate that he has left anything out. Instead, he introduces the definition this way: "According to Ratzsch, the only 'true' creationists are those individuals who believe the following" That is simple misrepresentation.

Immediately after the definition, I indicate some groups which that definition would and would not include, then say:

"However, since young-earth creationists have been the primary focus of recent debate, I will normally use *creationist* to refer to that group." (Bajema doesn't include that in his quote either.) Could it have been made any plainer that the definition was simply to identify one of the groups to be discussed? Yet, Bajema presents the book as involving an exercise in establishing who are and are not the "true" creationists (a phrase which the book does not contain, incidentally).

Bajema also neglects to mention that the paragraph following the one containing the definition of *creationist* contains a definition of *evolutionist*—again, for purposes of identifying one group I'll be discussing. Why a definition for identification of creationists constitutes haggling over who are the "true" creationists, whereas a definition for

identification of evolutionists in the next paragraph apparently does not constitute haggling over who are the 'true' evolutionists, Bajema does not tell us. In any case, the "discussion" Bajema wishes to focus on simply does not exist.

There are a number of other major misrepresentations of roughly the same order. For instance, Bajema says that "Ratzsch presents a modern version of the classic natural theological argument from design in nature to the existence of an intelligent deliberate divine designer (p 192-5)." I do not. I do, on those pages, discuss the question of whether or not some of the traditional grounds for prohibiting the concept of design in the natural sciences are cogent grounds. That is (trivially obviously) a vastly different issue than the one Bajema presents. Bajema claims that in my discussion of falsificationism I am "unaware or unwilling to discuss..." a key aspect of falsificationist strategy which would undercut my major criticism of it. Bajema has simply missed the issue here.

The issue in the discussion in question was whether or not falsification would save the "rigorous proof" ideal of older conceptions of science, and the strategy Bajema mentions is irrelevant to that question, as even Kitcher (Bajema's authority) would cheerfully admit. At one point I claimed that merely adding up theoretical successes and failures *in terms of retention or abandonment* of specific theories would not alone settle certain conceptual and methodological issues (since virtually all theories are eventually abandoned), although I left open the possibility that successes and failures in *other* terms—such as a theory's being "scientifically fruitful, useful or productive" might have such implications. Bajema represented that as my saying that "failures or successes of a strategy for gaining an understanding of nature would be irrelevant." Again, this is a rather large-scale misrepresentation.

The above by no means exhausts the list. (Again, such misrepresentations constitute the foundation for

most of the review.) And Bajema also does a fair amount of pretty free speculating about my positions, motives, and so on—almost all of it completely mistaken.

Again, your readers deserve better.

Del Ratzsch
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CARL BAJEMA REPLIES

I made a mistake in my review of Ratzsch's book. I should have only criticized his treatment of the scientific and philosophical issues concerning *The Battle of the Beginnings: Why Neither Side is Winning the Creation-Evolution Debate*. I misinterpreted Ratzsch's motives. I apologize for that. The issues involved are important and need to be clarified.

Philosophers and scientists evaluating what is a successful science ought to take into account advances or lack of advances when making comments concerning the extent to which a science is testable and fruitful. The two independent tests confirming the ancient age of fossils I will briefly summarize are major scientific advances that occurred in the past 100 years. They deserve more careful philosophical evaluation in a book that spends so much time discussing the young-earth position.

Professor Ratzsch chose to define a "creationist" as a "young-earth creationist" for the purpose of discussing the battle of beginnings in his book and to use adjectives such as "old-earth creationists" when discussing other creationist beliefs. Given the centrality of a young earth in Ratzsch's working definition and the importance of the question as to what constitutes a successful science, it is important to ask the following question: Are there quality examples of 1 of the 3 major characteristics of a successful science—
independent testability—that address this question of age of the earth beyond the very general philosophical discussion that Professor Ratzsch engages in?

INDEPENDENT SCIENTIFIC TESTS CONCERNING THE AGE OF FOSSILS

In response to Ratzsch's concern, I will briefly summarize two independent tests that have contributed to a better scientific understanding of the age of geological strata containing fossils. These independent tests involve theories that scientists constructed and tested to solve prob-

lems involving physical processes produced by the discovery of radioactivity and the discovery of magnetic bands in geological formations. Both of these theories have greatly improved our scientific understanding of the age of the earth, the age of particular geological structures and the paleogeographic patterns of movement of these structures.

The discovery of radioactivity led physicists to construct and test scientific theories concerning (1) the amount of energy released by radioactive isotopes as they decay and (2) the half-lives of radioactive elements. This research provided physicists with a more accurate way to scientifically estimate (1) the age of the earth and (2) the age of fossils (Dalrymple 1991).

Scientific estimates of the amount of energy released by radioactivity and the half lives of radioactive elements provided tests of the age of the earth independent of scientific theories concerning biological processes involved in producing evolution and geological theories concerning the relative age of fossil-bearing rocks (Dalrymple 1991).

The discovery of magnetic banding patterns in geological formations led geophysicists to devise and test theories to explain the particular orientation of the magnetic bands in different geological formations. The magnetic banding patterns made scientific sense if the formations were not locked permanently in geographical place but rather had moved over time. The scientific theories concerning magnetic banding patterns and concerning how the tectonic plates that contain them move over time provided scientists with another way of estimating the age of the earth independent of sedimentary rocks which contain fossils. Plate Tectonics provides scientists with a way to estimate the age of igneous geological structures and their geographical location in time independent of the fossils that are contained in sedimentary strata and that are moved along as part of a particular plate (Cox and Hart 1986, Sullivan 1991, Lowman 1996).

These two independent tests scientifically examine the very "heart" of the young-earth creationist position. Both the radiometric and magnetic orientation/reversal dating methods have produced a scientific understanding of the age of the earth and of the fossil sequences contained in sedimentary strata which greatly contradict the idea that the earth and all fossil-bearing strata are young. These two tests provide great independent scientific support both for

fossils' being old and for the changes in fossil sequences over more than two billion years fitting the phylogenetic tree pattern that Darwin theorized when he championed the theory that species have undergone "descent with modification".

CONCLUSION

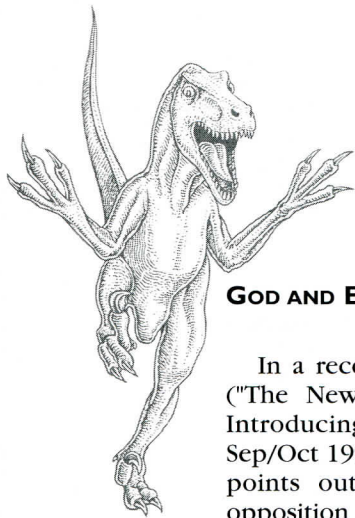
It was not my intent to misrepresent Ratzsch's motives. The scientific issues are far more important than an individual's motives. It is important to discuss the major scientific theories of this century that have affected our scientific understanding of the age of fossils and of the distribution of fossils through time and space. This is particularly the case when the age of the earth seems to play such an important philosophical role in Ratzsch's book. One cannot just add up successes and failures when attempting to ascertain whether a science has been successful. It is the quality of the successes that also counts.

Professor Ratzsch's pragmatic decision about who among the anti-evolutionists normally should be called a "creationist" in his book still illustrates the problem I drew attention to in my book review—the theological "quicksand" awaiting science educators if they are forced to deal with creationist philosophical theories concerning supernatural causes in science classes. I have been at "Creation/Evolution" debates where the "hottest" debates in the audience participation period were over the issue of who were the "real" creationists.

REFERENCES CITED

- Cox A, Hart RB. *Plate Tectonics: How It Works*. Boston: Blackwell Scientific Publications, 1986.
- Dalrymple GB. *The Age of the Earth*. Stanford (CA): Stanford University Press, 1991.
- Lowman PD Jr. Twelve key 20th-century discoveries in the geosciences. *Journal of Geoscience Education* 1996 44: 485-91.
- Sullivan W. *Continents in Motion: The New Earth Debate*. 2nd Ed. NY: American Institute of Physics, 1991.

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Letters to the Editor

GOD AND EVOLUTION

In a recent feature in *RNCSE* ("The Newer Anti-Evolutionists: Introducing Greg Koukl," Sep/Oct 1997) Stephen B Hunter points out that much of the opposition to evolution is motivated by the belief that it is incompatible with divine action. He goes on to say that if "it were possible to convince [anti-evolutionists] that evolution need not threaten their [belief in God], the rest of the conflict would largely evaporate." Let us explore how feasible this desirable effort may be.

Hunter suggests an approach of the following kind: Humans have come to exist in part because a meteorite impact killed off the dinosaurs; so "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 idea, of course, constitutes deism—the view that God originally set the universe into motion but takes no further action. Anti-evolutionists typically believe that God should be able to respond creatively to conditions as they develop, rather than limiting Himself just to initializing some long-range plans.

However, modern science provides for a variation on Hunter's suggestion: Quantum mechanics specifies that the development of the universe is not entirely deterministic. The tiniest microscopic events occur at random, only their statistical distribution being fixed by the laws of nature. This randomness is demonstrated through the use of certain statistical tests.

So, if we assume that God is able to dictate the seemingly random outcomes at the quantum level, then it is possible for Him purposefully to intervene in the

universe whenever and wherever He wishes without violating any of the natural laws that He has laid down. Therefore, whenever God wants a new species, He readily can induce the necessary mutations by choosing the appropriate outcomes for a relatively few quantum events during the replication of a strand of DNA. Even if scientists were watching while it happened, they would not observe anything out of the ordinary. So evolution can take place exactly as the biologists claim yet at the same time be directed entirely by the will of God. When anti-evolutionists say that "evolution is run by chance, not by God," they are overlooking that it might be run by both, chance being only an appearance and the hand of God being the underlying actuality.

The reasoning hinges on our present understanding of nature. That understanding some day may change so as to become less—or more—compatible with the idea of God. One must remember that the deterministic physics that preceded the advent of quantum mechanics offered no natural means for divine action. This calls attention to two related points: First, most proponents of evolution more accurately should be characterized as proponents of whatever theory is best supported by the current scientific evidence; it is that theory—evolution today but perhaps something else tomorrow—that they want taught as science. Second, the opponents of evolution may not fully grasp the implications of the tentative character of scientific theories; while they may prefer that those theories support the idea of God, they most likely would not be prepared for the possible withdrawal or reversal of such support in the light of future discoveries.

Might this line of reasoning bring about significant defec-

tions among the opponents of evolution? The reasoning does not accommodate a literal interpretation of Genesis. So young-earth creationists will not be swayed. The reasoning shows that evolution does not deny God but does not show that it affirms Him. Belief in Him remains an act of faith. Some may be willing to accept only views that require the existence of God, not views, such as evolution, that leave the question open.

*John G Fletcher
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CULT OF THE "EXPERT"

Phil Speith's review of Michael Denton's latest was entertaining, but stimulated a recurring question and disturbing answer. Why are we concerned when an obviously ignorant author publishes a treatise exposing his deficiencies? Too often it is because s/he 1) has a PhD and 2) is *classified* as a biological scientist. We who care fear that the layperson assumes an "expert" is speaking. I propose that we commit ourselves to terminate this "cult of the expert".

It is important to point out that Denton and his "co-conspirator" Behe are molecular biologists. Although this observation is merely anecdotal, it seems that among my "biological science" colleagues, the highest incidence of [evolutionary] theory ignorance appears in molecular biologists. Their background is in cells and chemistry; rarely does it include a single course deserving classification as evolutionary biology. Questions about the intact phenotype, niche, and

environment are off their radar screens.

How can we advocate teaching evolution-based biological science in high school without requiring an understanding of it by any college graduate with a "bio" major? How can we confer doctorates on any of these people without at least one question in their comprehensive and/or oral exams which evaluates their understanding of the Darwinian model? Would you consider a drama PhD to be worthy of his/her degree who believes that Shakespeare had no important influence on the English theater? Our efforts at secondary level are doomed unless we can convince chairs of the degree-granting departments that they live up their philosophical responsibility.

If we are equivalent as biological scientists, then Pogo's pal Porkypine was right: "We have met the enemy and he is us!" We need to make obvious to any lay person the fact that the Dentons of this world are creationists who happen to work in science; not biology "experts".

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Science Information On the Web

New Zealand Science Monthly recently launched a website devoted to science information, including articles from journals, magazines, and news services, plus links to every major science publication online and many major world newspapers. Connect to *Scitechdaily* at <<http://www.scitechdaily.com/>>.

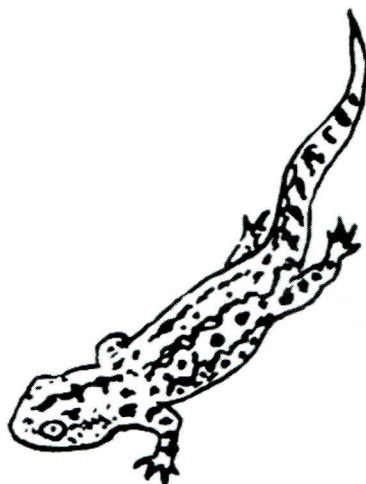
[Contributed by John R Cole]

SCIENCE AND RELIGION

One-hundred-two years after Andrew Dickson White imprinted the warfare metaphor on discussions of the religion-science split, it is refreshing to see *RNCSE* adopting a nonbelligerent stance that more accurately reflects the mission of science and science education *per se*. That mission is *not* to do battle with religion. There are plenty of militant atheists and anti-religious organizations to carry on such a fight. If we take our own philosophical claims seriously, we need to recognize that atheism is a position just as much grounded in faith as is theism. Promoting faith is not what science is about.

I congratulate *RNCSE* and its writers for the increasingly sophisticated tone of discussions of the religion-science interface in its pages. Such sophistication, and avoidance of the vocabulary of warfare, does not indicate any wavering in NCSE's resolve to uphold rigorous standards of science education and to keep religion out of the science classroom. It does indicate recognition that we disarm our opponents when we deny them the opportunity to claim that our mission is to oppose religion *everywhere*.

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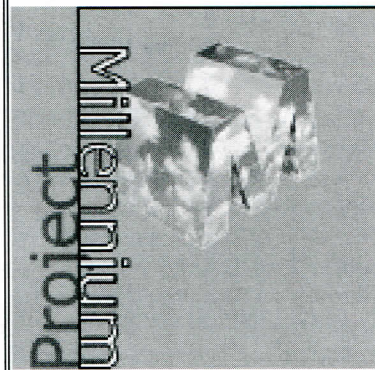


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NEWS ITEMS

Topic: AIG Appeal of Permit Denial
Owner: *Kentucky Post*
Location: <http://www.kypost.com:80/news/genisis112198.html>
Last visit: Jan 1999

Topic: Party Platform
Owner: Republican Party of Iowa
Location: <http://www.iowagop.org/>
Last visit: Dec 1998

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Topic: Library of Congress Catalog
Owner: Library of Congress
Location: <http://lcweb.loc.gov/catalog>
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Topic: School Library Policies
Owner: American Library Association Council
Location: http://www.ala.org/positions/PS_billofrights.html
Last visit: Dec 3 1998

Topic: Dewey Decimal System Guide
Owner: Forest Press
Location: <http://www.oclc.org/oclc/fp/ddc/ddcpg/chapt7.htm>
Last visit: Jan 1999

Topic: Lucy's Knee
Owner: TalkOrigins Archive
Location: <http://www.talkorigins.org/faqs/knee-joint.html>
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RESOURCES

Topic: Creation/Evolution Court Decisions
Owner: National Center for Science Education
Location: <http://www.natcensci.org/courtdec.htm>
Last visit: Dec 1998

Topic: Science News Service
Owner: *New Zealand Science Monthly*
Location: <http://www.scitechdaily.com>
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Topic: Origins Program
Owner: Project Millennium and Field Museum of Natural History
Location: <http://www.projectmillennium.org/origins/institut.htm#field>
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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.

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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.

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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* 1995 Jan-Feb; 1015(1):22-9.

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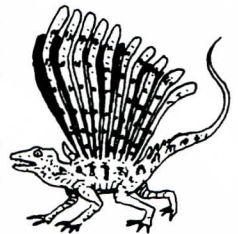
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