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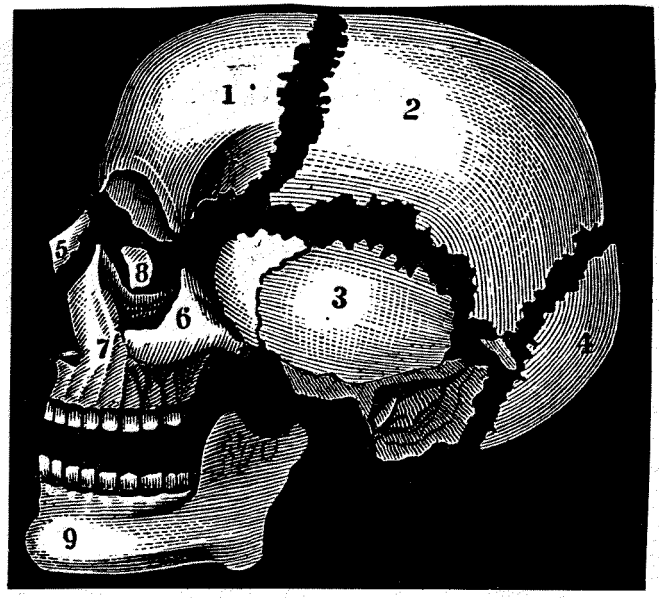

Issue 32 Summer 1993

Articles

About this issue . . .

Some of this issue is more "topical" than usual. That is, writers address current creationist news more than usual for the journal. Karl Fezer describes and analyzes ICR's debate tactics (part II, concentrating on Duane Gush, in our next issue), and Frank Sonleitner reviews a series of recent articles in *Creation Research Quarterly* touted to be the best and most scientific of recent creationism.

Other articles are more typically analytical, perhaps, in that they do not just target specific recent creationist utterances. Creationism as a cultural phenomenon is discussed further by Christopher Toumey, and an example of our oft-repeated argument that "scientific" creationism and evolution are not the "two possible origins accounts" is demonstrated by the analysis of some non-Western, Native American origins accounts by Hanson and Hanson—who show how some origin myths have evolved in a fairly short time; "scientific" creationists might read this and compare their own historical evolution.

Allison Brooks offers a clear, short overview of the current arguments in human evolution, illustrating the difference between serious scientific debate and antievolutionist carping, I think. In an article reprinted from the University of Pennsylvania alumni magazine, Arthur Shapiro explores the reasons he finds evolution non-threatening to religion and religious belief, and a creationist reply is reprinted.

For readers interested in more Lippard-Price debate info:

In *C/E* 31, we published a reply to criticism by Barry Price, and a couple of other comments. We noted that further discussion should be taken up with the principals involved. Price had prepared a much longer manuscript than we could publish as a response, as earlier noted. Lippard has since prepared a 13-page rejoinder available from him c/o Department of Philosophy, University of Arizona, Tucson, AZ 85721 or electronically via E-Mail at lippard@ccit.arizona.edu (Internet) or JIM.LIPPARD (GEnie).

If you have no idea what this last gibberish means, you are not alone, but the world IS moving towards electronic communications at an amazing rate—a science newsletter informs me today that a third or more of Americans (US and Canadian) will be "online" by 1994. . . . I frankly doubt this percentage, but it is indeed the wave of the future.

Our next issue will focus on debating creationists—the history, pros and cons, and techniques will be "debated."

John R. Cole

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Contents

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Cover: Modern human skull, from an 1872 anatomy textbook by Calvin Cutter

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Modern Human Origins—What's New With What's Old

Alison S. Brooks

In a lecture at George Washington University in September 1992, Richard Leakey argued that one of the most controversial and least well-understood events in human evolution occurs toward the end of the story. Where, when, and why did modern humans like ourselves first appear, and how did they come to occupy most of the earth?

Study of this stage of evolution is not new; in fact, it began more than 160 years ago with the first discovery of Neandertal fossils in Belgium in 1830. As early as 1868, the co-existence of extinct animals such as mammoths with anatomically modern but very robust humans was documented at the site of Cro-Magnon, in southern France.

Why don't we know more after all this time about an event so close to our own era? And why are the arguments over this event so bitter?

What's So Modern About Modern Humans?

Anatomically modern humans are distinguished from their predecessors by their relatively "gracile" (less robust or less muscular) skeletons and smaller teeth. Males, in particular, became smaller and overlapped the female size range to a greater extent than previously. Although brain size did not increase in moderns from the preceding "archaic" stage, the braincase itself became taller, less elongated from front-to-back, and more sharply flexed at its base, where it joins the face. In essence, the face became almost completely situated under the braincase, rather than sticking out in front of it as in earlier human ancestors and other primates. Smaller teeth also left the chin sticking out in front, and reduced the need for heavy brow ridges to take up some of the stress of chewing. (If you put your fingers on your remnant "brow

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ridges" over the outer corner of your eyes and clench your teeth, you can feel the chewing stress transmitted to the brow ridge area). Archaic *Homo sapiens*, with modern-size brain but big brow ridges, large faces, and large teeth, occupied Europe, Asia and Africa before the appearance of modern *Homo sapiens*. The term "Neandertals" refers in some theories to one relatively isolated, cold-adapted population of these "archaics." In other theories, Neandertals refers to all later "archaics," ca. 130,000 to 40,000 B.P.

Candelabras and Hatracks

Throughout this century, two basic variants of the story have vied for acceptance by the scientific community. The "candelabra" view recognizes only one major branching of the human line. After the initial dispersal of humans to the three major Old World continents, beginning as early as 1.1 million years ago with the species *Homo erectus*, the populations of each region evolved in parallel fashion into modern humans. Some migration or gene flow between the regions assured that new characteristics appearing in one region would eventually spread to all. In this theory, most of the immediate ancestors of the modern humans of Africa are found in Africa, while the immediate ancestors of the Chinese are found in China and so forth.

According to this view, the immediate ancestors of Europeans are their predecessors on that continent—namely the Neandertals. The current version of the "candelabra" theory is referred to as "multi-regional evolution" (MRE), because it allows more migration from region to region than earlier versions.

In a contrasting view, known as the "hatrack" theory, a single main stem or center pole leads to modern humans, with branches at intervals through time representing evolutionary dead ends. According to this theory, the Neandertals of western Europe are one such dead end; the "Peking Man" or *Homo erectus* fossils of east Asia are another. Until recently, the central stem was always given a European or Near Eastern identity, through such fossils as "Piltdown" (a now-discredited forgery), Swanscombe (a large English skullcap without a face, dating to a period just before the earliest Neandertals), or the Skhul fossils from Israel. The central role of Europe in human evolution was attributed by some to the influence of a colder climate, a limited growing season, and more reliance on both hunting and food storage, all of which would have promoted intelligence and growth of the brain.

In the current version of the "hatrack" theory, however, the central stem is African, and all the earlier fossils of other continents constitute the dead ends of human evolution. Since, in this view, all anatomically modern humans derive from recent African ancestors, the modern theory is called the "out-of-Africa" hypothesis.

How can two such disparate views continue to co-exist? Why does not the data exclusively support one or the other? And why has the "hatrack"

school shifted its focus from Europe to Africa? Three new D's—new dates, new data (fossil and archaeological) and new DNA studies—have combined to create a heightened level of argument over modern human origins.

Dating the Data

By 35,000 years ago, the shift to modern humans was virtually complete throughout Europe, Asia, Africa and even Australia. The most accurate dating technique for the later periods of archaeology, radiocarbon, gives good results back to about 35,00, but not much older. Some dates of 38 to 40,000 are acceptable, but dates in the 40,000 or older range or decidedly dubious. Most of the story of modern human origins lies beyond 40,000 years ago. Until recently, there were no reliable ways to determine the age of anything between 40,000 and 200,000 years ago.

Recently, however, a range of new techniques have come into general use for exactly the period when modern humans must have emerge, between 200,00 and 40,000 years ago. These techniques include: 1) measuring the accumulation of "radiation damage" from soil radiation in buried crystalline materials such as flints or quarts sands (thermoluminescence), 2) measuring the decay of uranium which soaks into buried bones and teeth from groundwater (uranium series), or radiation damage in the crystals of tooth enamel (electron spin resonance), and 3) studying the decay of the proteins encapsulated in hard tissues of fossil animals such as mollusc shells, bones, teeth, and ostrich eggshells (amino acid racemization).

Unlike radiocarbon, none of these techniques is entirely independent of the burial environment. Thermoluminescence and electron spin resonance dates can be thrown off by inaccurate measurement of the soil radiation or by heating or re-exposure of the sample before the archaeologist finds it. Protein decay rates are dependent on temperature, which is difficult to estimate for 40,000 to 200,000 years ago. And the uranium which soaks into bones and teeth can also wash out again. Using two different techniques to date the same site can help avoid these problems, at least when the two sets of results agree.

The effect of the new dating techniques has been to make many sites and fossils in Africa earlier than was previously thought. The European dates did not change quite as much, because the ebb and flow of ice ages had provided a chronology that tied most of the sites together, even in the absence of exact numbers.

Once the chronology of Africa was based on its own internal sequence of dates, comparative faunal extinctions, and climate changes, it became obvious that the earliest fossils in Africa with "chins" and small teeth were much older than the Cro-Magnons of Europe. In a paper given last spring on ostrich eggshell dates, I and my colleagues suggested that several of the most important early African sites with modern humans (Klasies River Mouth and

Border Cave) date to as much as 105,000 years ago or older. Modern human teeth at Mumba shelter in Tanzania were dated to ca. 130,000 years by uranium series.

Meanwhile new dates for Zhoukoudian (Peking Man sites), and other sites from China and Java suggest that east Asia was occupied exclusively by the more primitive species *Homo erectus* until about 300,000 years ago. The new Chinese fossils announced this year that supposedly represent a transition between *erectus* and *sapiens* do *not* show that this transition happened in China *first*, as several newspaper reports seemed to suggest. That the earliest modern humans were African seems quite well-established, although very few sites have been dated thus far.

In Europe, the principal effects of the new dates have been twofold. One is to demonstrate the great antiquity in Europe of the Neandertal-type long face, big nose, and flattened bulge at the back of the head. The oldest fossil now referred to as Neandertal (Le Biache, France) was discovered in 1976 and is about 190,000 years old, while older fossils (for example Arago in the Pyrenees) with some Neandertal characteristics, date to the 300,000s or older. Secondly, newer, more precise radiocarbon dates from the end of Neandertal times, show that, in particular areas, the transition from Neandertal to Cro-Magnon was quite abrupt. A Neandertal from St. Cesaire in France, found in 1979, is about 35,000 years old, while the Cro-Magnon fossils probably date to at least 34,000, based on comparisons with the Pataud site next door. Such an abrupt transition does not leave enough time for evolution to have occurred in place. In addition, the oldest modern human fossils and archaeological sites of the Aurignacian culture of Cro-Magnon are found in eastern Europe just before 40,000 years ago, while Neandertals still lived in the west, just what one would expect if modern humans invaded Europe from Africa via the Near East. And, in the Near East itself, modern humans from Qafzeh, in Israel, excavated in the 1960s, have been dated to ca. 92,000 years ago by thermoluminescence on burned flints, and a similar antiquity was suggested for at least some of these fossils by our work on ostrich eggshells.

One problem in the Near East remains the chronological relationship of the Qafzeh modern humans to Neandertals. What might explain Neandertal dominance of the region *after* a brief period of modern human occupation at 92,000 years? One possible answer lies in the tiny bones of birds, rodents and insectivores found with the human fossils. Earlier modern humans are accompanied by tropical African birds, mice, voles and so on, while later Neandertals are accompanied by cold-adapted animals from Eurasia.

If Neandertals were the cold-adapted archaics, and the earliest modern humans were tropical, this shifting pattern implies that the distribution of the two populations was originally limited by ecological considerations, and that the Near East represented a boundary zone that shifted as the world's climate changed. By 40,000 years ago, when modern humans returned to dominate the region, they seem to have invented a way to get around this ecological

limitation. The animals found at the post-40,000 year-old modern human sites remain primarily cold-adapted.

The 'African Eve' Hypothesis

That humans were "modern" in appearance in the tropics long before these characteristics appear in Europe seems confirmed by the new dates and data. But what is the relationship of the first modern humans in Africa to the later ones who occupied Europe after 35,000 years ago? This relationship is the hottest part of the current controversy.

In 1987, geneticist Rebecca Cann and colleagues proposed that a recent migration out of Africa within the last 200,000 years had totally replaced all other human populations. None of the "archaic" East Asians, or the Neandertals of Europe had left any descendants at all. All modern humans share a recent African ancestor. The data used to support this hypothesis did not come from the fossil record, or from the dating lab, but from analysis of genetic differences among people living today.

The most common and abundant genetic material (DNA), which occurs in the nucleus of the cell, changes too slowly to measure recently evolved differences—even comparing humans to chimpanzees reveals a less than 1% difference between the two species. But mitochondria, small organelles within cells that are important in converting food to energy, contain a more rapidly changing form of DNA. Since sperm consist almost entirely of nuclear DNA and lack mitochondria, your mitochondria derive entirely from your mother via the ovum. A family tree of human genetic similarities, based on mitochondrial DNA (mtDNA), reflects only female ancestry, hence the "Eve" in the hypothesis.

This last common ancestor of all humans is thought to have been African because Africans are more variable in their DNA than the peoples of other continents, which suggests that they have been in place the longest. Furthermore, some genetic variants are unique to Africa, while all the variants on other continents are found in Africa as well. If Neandertals from Europe or *Homo erectus* from China contributed to our ancestry, where is their unique DNA?

What about "Adam"? A similar study was done on the genetics of the Y-chromosome, which appears to determine maleness but little else. Family trees based on similarities in genetic make-p of the Y-chromosome reflect only male ancestry, since women do not have one. The same pattern was observed—greater variability and unique patterns in African populations, but no unique patterns outside of that continent. The most variable DNA in both studies belonged to the small isolated populations of hunter-gatherers in the Kalahari Desert (!Kung) and Zaire forest basin (Mbuti, Aka, Efe) respectively.

At first, the major debate was over possible errors or omissions in the sample (use of African-Americans instead of Africans, assuming little ad-

mixture in the maternal line) and the timing of the dispersal from Africa. Using the degree of differentiation developed within Australia and New Guinea (first colonized ca. 50-40,000) years ago, or among the populations of the Americas as a guide, it was estimated that human mtDNA diversifies from a common ancestor at a rate of 204% per million years. Since the total amount of difference observed in modern populations was only about 0.57%, this implies a time scale of 140-129,000 years since all humans last shared a common ancestor.

More recently, the family tree itself has been questioned on statistical grounds. Given enough time and repeated tries, the computer program used to generate the published family tree can also generate alternative trees in which Africa plays a diminished role. The genetic basis for total replacement of all previous human populations by the descendants of "African Eve" appears to be in doubt, although this does not negate the importance of the early *fossil* evidence from Africa.

Ancient Africans, Whose Ancestors?

What was the relationship between the Neandertals or other archaics of regions outside Africa and their successors? Is there any evidence of population movement from Africa to Europe or east Asia? Did the invaders interbreed with the older populations of these areas, or did they simply wipe them out? Much of the argument hinges on current analyses of the fossils themselves. Three issues are central: 1) who were the Neandertals (and what "explains" their robust body form), 2) are there any intermediate fossils between Neandertals (or archaics) and modern humans, and 3) are there regional continuities in facial shape or teeth that continue across the transition from archaic/Neandertal to modern.

Up through the early 1970s, many scholars tended to lump Neandertals with other archaics as having modern brains and large primitive faces (and teeth). Western European Neandertals, whose faces were longer and more projecting, and whose elongated heads appeared to have and "occipital bun" of bone at the back, were simply more extreme than others. It was widely suggested that "if you gave a Neandertal a shave and a haircut [and a shopping trip to J.C. Penny], you wouldn't recognize him on the New York subway."

In the 1970s Erik Trinkaus began a lengthy study of Neandertals from a new perspective—below the neck. His study suggested very strongly that *all* Neandertals, including those from the Near East but *not* the archaics from tropical environments and east Asia, shared a common and very unusual "post-cranial" form. Their bones, even the fingers and toes, were extremely thick and bore heavy markings for the muscle attachments that could not be duplicated in modern samples of skeletons. The joint surfaces were sometimes twice as large as the modern human average. Discovery of a pelvis

from Kebara, in Israel, suggested that the way the body was carried was quite different, as the spinal column was more deeply indented into the back than in ourselves. Yet, from the same site, a hyoid bone, which attaches to the voice box, suggested that the movement of the throat, tongue, and voice box in producing speech was similar to ours, despite the greater distance in Neandertals between the neck and the back of the throat.

In addition, Neandertals, like other cold-adapted animals, had very large deep chests and short lower arms and legs, to better conserve body heat. New studies of the face suggested that the very long projecting face and huge, broad nose were distinctive; other large-faced archaics from Africa or East Asia had shorter, flatter faces, with more angulated cheek bones. The distinctions of Neandertals from other archaics appeared quite striking, and resulted in most scholars excluding fossils formerly grouped as "Neanderta-loids" from this category. Neandertal morphology was peculiar: you would definitely notice it even on the N.Y. subway!

Are there any transitional fossils? In Africa, several fossils are intermediate between archaics and moderns. Even the early moderns themselves at Klasies River Mouth, for example, are described by Trinkaus as more robust in their limbs than Cro-Magnons of Europe. In Europe, the argument is very heated. Those who argue for interbreeding between Cro-Magnons and Neandertals (Wolpoff and Smith), or even for an indigenous evolution from Neandertals to Cro-Magnons (Brace), point to the less extreme characteristics of some later Neandertals, or to the presence of significant brow ridges and rugged large faces along with definite chins at modern human sites in central Europe.

Transitional or even archaic *Homo sapiens* fossils from Asia are quite rare; most of the best specimens from China have not been well-published in a accessible format. Regional continuities in Asia, however, are striking to proponents of the multiregional evolution theory (Wolpoff, Wu, Thorne, and Pope). If the earliest modern Asians came from Africa, why do the earliest ones we find already have the flat upper faces, and dental characteristics of Asians today? Why are the earlier archaic Asians also flat-faced? "Out of Africa" theorists (Stringer) argue that the flat faces and other features are either primitive features retained in that population, or simply adaptations to the cold dry Asian climate that are favored each time a new human population reaches the area.

Revolution or Evolution?

In his recent book, *The Last Chimpanzee*, Jared Diamond argues that modern humans became fully modern in their behavior rather suddenly about 40,000 years ago. This "great leap forward" or "human revolution" is largely based on the perspective from Europe, where major changes in technology (blade and bone tools); economic strategies (ambush hunting, fishing); size

of social networks; and symbolic activities (art) occurred over a few thousand years as the Cro-Magnons replaced the Neandertals.

The recovery of new sites, fossils and data dating to between 250,000 and 40,000 has accelerated since the 1960s. Even with the limited exploration of Africa to date, it seems that, like modern human facial shape, some of the modern behaviors of the "human revolution" appear well before 40,000 years ago in Africa. While the later Neandertals ran down their prey and stabbed it with sharpened sticks or an occasional stone-tipped spear, central and eastern Africans hafted small delicate stone points onto spear- or even arrow-shafts; made stone blades, backed triangles or crescents, barbed bone points, and other bone tools; engaged in regular fishing and ambush hunting; ground their food (and some pigments) with grindstones; scratched designs on ostrich eggshell fragments; and traded precious raw materials such as obsidian over more than 500 miles. Like the later Neandertals, the early modern humans also buried their dead with grave goods.

By 50-40,000 years ago, new data show that Africans wore beads of ostrich eggshell, and engaged in organized mining of precious raw materials. Elsewhere, modern humans had used boats to reach Australia, New Guinea, and New Caledonia, where rock art has been dated to 32,000 years ago. Outside of Europe, the "great leap forward" began earlier and was more like a slow jog, with occasional detours and backward movements.

But Were The Cro-Magnons African?

Although modern humans appear to have developed earlier in Africa, physical anthropology and archaeology do *not* demonstrate migration of modern humans to Europe. Despite earlier claims for the fossils from Grimaldi, Italy, African characteristics such as nose shape and width, wide distance between the eyes, and forward projection of the mouth, do not occur in the early Europeans. Grimaldi itself is not only not "African" but is considerably later in time that the earliest modern Europeans—new dates suggest an age of less than 28,000 years. According to recent dates on archaeological sites, the Aurignacian culture of the Cro-magnons appears *first* in central and southeastern Europe, just before 40,000 BP, spreading to near Barcelona, Spain by ca. 38,000 and finally to France and Germany by 34,000. Southern Spain, near the straits of Gibraltar, is one of the *last* areas to make the transition from the Mousterian culture of Neandertals—archaeology does not suggest an invasion via this route. The big blades, thick scrapers, and bone points of the Aurignacian are quite unlike anything from the preceding Mousterian culture of Neandertals, so it was assumed that it came into Europe from outside. Yet there is nothing "outside" in this time range, either in the Near East or in north Africa, from which the Aurignacian can be derived. In much of Africa and the Near East, at ca. 40,000, the stone industries were characterized by finely-made small blades, many with nar-

row points created by blunting or battering the sides, or by small points with a tang or projection for hafting. The Aurignacian does show up in the Near East, but recent dates suggest that this is only *after* it is well-established in Europe, at about 34,000. The Near East may have been a migration corridor, but it was open in both directions.

Can This Controversy Be Resolved?

The controversy over modern human origins is particularly heated because it concerns ourselves and our most recent history. The argument has been widely featured in the public media: *Time, Newsweek, The New York Times*, and at least two television specials on PBS. Unlike the controversy over earlier phases of human evolution, many of the voices expressed in these pieces are the voices of non-scientists, who argue that up to now, Eurocentric bias has suppressed recognition of our "true" heritage. While the discoveries of the past two decades have gone far towards demonstrating the priority of continents other than Europe in the evolution of modern humans, the data also suggest that this was not a simple event of evolution followed by migration in one direction. Replacement of earlier populations may not have been total. More and better dates and data, particularly from regions such as western Asia, Turkey and the Balkans, as well as Africa, may go far towards clarifying the complex interactions involved in this transition.

Resources

Excellent discussions on this topic can be found in recent journals:

Discover, September 1992.

Scientific American, April 1992, October 1991, December 1990.

Science, February 7, April 3, May 29, June 12, 1992; August 23, 1991; March 11, 1988.

U.S. News and World Report, September 16, 1991.

A bibliography on human evolution is available from the Anthropology Outreach and Public Information Office, NHB MRC 112, Smithsonian Institution, Washington, DC 20560.

[Reprinted with permission from *Anthro Notes: National Museum of Natural History Bulletin for Teachers, Vol. 14 No. 3 (Fall 1992) pp.1-4 and 12-15.*] C/E

God and Science

Arthur M. Shapiro

"See to it," the Apostle Paul told the Colossians, "that no one takes you captive through hollow and deceptive philosophy." Good words, now as then. But they are words readily adapted to the defense of any creed against any other. Rhetoric is the art of persuasion and philosophy is the pursuit of wisdom, and the seeker after truth must strive to disentangle the two. The debate between so-called "creationists" and "evolutionists" in contemporary America is a splendid demonstration of what happens when that effort fails.

What is the fuss about? It is *not* about whether or not evolution is good science, whether evolution or creation is a better scientific explanation of the diversity of life, or whether natural selection is a circular argument. The fuss actually isn't even really about *biology*. It is basically about world-views. It can be analyzed in political, sociological, juridical, or philosophical terms. Any attempt at a deep understanding of the issues must take into account not only all these dimensions but the interconnections among them. It must also take into account the perceptions and the words of the actors in the conflict.

The history of Western civilization since the Middle Ages is commonly, and reasonably, portrayed as the retreat of faith in the face of reason. Certainly, the explanatory function of religion has been reduced as that of science has grown—but the same is true of secular philosophy, which is the main reason why contemporary academic philosophy tends to be so unsatisfying. The triumph of science has been the triumph of the system of assumptions necessary in order that science be done—but I am getting ahead of myself.

The Copernican revolution placed the hegemony of the Church in peril. Christendom was obliged to deal with the dangerous notion that man was competent, by reason and the evidence provided by his senses, to discover his own truth, and again and again that truth appeared to contradict Holy Writ. The issues were in clear focus in the Enlightenment, and by most accounts, reason and the senses won. Commentators of the time define the issues well. Pierre Bayle, writing in 1702, stated:

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> The Cartesian, Geoscientists, and the other modern Philosophers are obliged to maintain that the motion, the situation, and the figure of the parts of matter suffice for the production of all natural effects, without even excepting the general arrangement that has placed the Earth, the Air, the Water, and the Stars where we see them. . . .

The reactionary Domenico d'Aulisio fulminated in 1733 that

> It is well-known that Benedict Spinoza and Thomas Burnet . . . drew their blasphemies from no other source than the physics of Descartes . . . where the laws of motion have mechanically produced the world out of matter, and what is in the world has thus arisen without architect.

And Maupertuis, in his introduction to the posthumously published 1768 edition of the *Essay on Cosmology*:

> All of today's philosophers form two sects. Some would like to submit nature to a purely material order and exclude from it any intelligent principle—or at least would like to avoid all recourse to that principle in the explanation of phenomena—and to banish final causes entirely. The others, to the contrary, make continual use of such causes, discover the views of the Creator throughout nature, and penetrate His designs into the most minute phenomena. According to the first, the universe could do without God; at least, the greatest marvels we observe in it are no proof of His necessity. According to the second, the smallest parts of the universe are as many proofs of God—His power, His wisdom, and His goodness are painted on butterflies' wings and spiders' webs.

The advance of rationalism, deism, and kindred philosophies was stimulated by, and in turn served to stimulate ever-greater awareness of the material evidence for great antiquity of the earth, of life, and of human civilization. There were creative and impassioned debates over the meaning and nature of fossils and of extinction, and the reliability of the historical records of civilizations outside the Judeo-Christian tradition. Could God in His goodness allow any species to perish utterly? How could heathen antiquity appear to extend back into pre-Adamitic time? Geographical, biological, and anthropological discoveries throughout the globe revealed the narrowness of the Scriptures and underscored the growing problem. The literature of this problem exemplifies Ortega's aphorism—that politics, as viewed from afar, is a struggle between paralytics and epileptics.

The history of life was thus one of many issues in the debate between faith and reason. By the late nineteenth century, the "Higher Criticism" movement, which subjected sacred literature to the same sort of literary

analysis as the profane, had put religious apologists in full retreat. The movement spawned by Copernicus and the Protestant Reformers, continued tacitly or openly by Galileo, Descartes, Spinoza, Hobbes, the English Freethinkers and German Rationalists and French Encyclopedists, now fused with burgeoning technology and became the province of geologists and historians, physicists and biologists, philologists and anthropologists. As evidence of the triumph of scientific method over even secular philosophy, we may cite Herbert Spencer, perhaps the last serious pretender to an all-embracing philosophical system, *who grounded his system in biology.* And Thomas Henry Huxley, "Darwin's bulldog," could pridefully proclaim that "extinguished theologians lie about the cradle of every science, as the strangled snakes beside that of Hercules."

Yet today, the Supreme Court of the United States has had to decide whether a state may mandate "balanced treatment" of "creation-science" and "evolution-science" in public-school biology classrooms, and surveys consistently reveal that the man in the street prefers the Bible to *The Origin of Species* as an explanation of the living world. Why?

There are several answers:

- Because the underlying assumptions of scientists are incommensurable with those of Christian Fundamentalists, and have therefore not been reconciled whatever may have happened a century (or two) ago;
- Because science educators consistently fail to convey the idea of the unity of science, so it remains easy to attack or reject portions of it with little consideration of what that does to the greater whole;
- Because the political and social climate in America is in one of its periodic phases of nativism, populism, and anti-intellectualism (though not, I think, a very profound or lasting one—and, indeed, it has probably already peaked);
- Because the emotional appeal of the question of origins, and of human origins in particular, makes evolution an attractive ground for Fundamentalist attacks on the perceived secular-humanist world-view;
- And because it suits the political aims of ideologues on *both* "sides" to distort the nature of the conflict.

Scientists, evolutionary biologists included, normally practice some variant of the hypothetico-deductive method, which combines elements of inductive generalization and allows for the disproving of hypotheses, the most distinctive feature of scientific method, raised by Sir Karl Popper to the status of *the* criterion for separating science from non-science.

Inductive generalization is involved in our daily lives below the level of consciousness; we do not think about whether the sun will rise tomorrow morning, and we assume our car will be where we left it—if it isn't, we tend to get very upset and to call the police. Since animals in general behave this

way, and, indeed, so many biological processes have an element of "prediction" about them, many evolutionists infer that generalization is a consequence of natural selection and is inherently adaptive in dealing with a reasonably lawful world. And some philosophers use it to justify their claim that a real world exists—however inaccessible to us, since we filter it through our demonstrably biased senses; if there were no external reality, why would so many organisms seemingly be adapted to one, and the same one at that?

Deduction, of course, is the logical extraction of conclusions from premises in which it is already implicitly contained. We use deduction to make predictions, and design the experiments we carry out to test them. A theory, in science, is a body of hypotheses in which we have considerable confidence because they have stood up well to test; it is not a mere flight of fancy. The term "natural law" is less common in science that it used to be, but it refers to a theory we have reason to think is universally true, at least within its properly defined domain.

The synthetic or neo-Darwinian theory of evolution is the central, unifying theory of biology. It is called "synthetic" because it draws on a variety of widely disparate disciplines for both concepts and data. A theory is not a mere hodgepodge of disconnected ideas; it must have internal coherence; its components must be interconnected in logical ways, and, as a bare minimum, they must at least be consistent with one another.

Such a structure is very different from the structure of religion; scientific ideas are inherently different from religious ideas. Religious truth is revealed truth; it is eternal, unchangeable, and untestable, at least as concerns any referent but the Being from whom it emanates. Religious experience is unique and intensely personal. Systematic theology is a branch of philosophy which proceeds from the basic tenets of religious belief to elaborate upon and interpret that belief, largely by deductive argument. Apologetics is a theological specialty which attempts to justify religion by the evidence of reason and the senses. It is a form of hypothesis-testing, but an odd one.

When a scientific hypothesis is disproved definitively, the scientist must go "back to the drawing board." Of course, it is naive to believe that real scientists are driven to attempt to disprove their pet ideas—but any successful refutation is a celebration of the logic of the system: the overthrow of Newtonian by Einsteinian physics is one of the greater triumphs of reason. But apologetics uses facts only to *prove*, not falsify, its preconceptions; it is at liberty to ignore inconvenient facts, and it does—or, at best, it rationalizes its failures in untestable ways that would never wash in science ("God moves in mysterious ways"). When prophecy fails, the believer faces a choice between rationalization and apostasy.

So what is so-called "scientific creationism"? Is it derived scientifically, as its advocates commonly claim? Has its "model" (a word creationists use in preference to *theory*) any internal structure of interconnections and inter-

dependence? There are numerous versions of the creation "model," several of which emanate from the Institute for Creation Research in southern California, America's best-known, most voluble source of creationist literature. Perhaps the most definitive of these is *Impact* Leaflet #85, "The Tenets of Creationism," published in 1980 and written by I.C.R.'s president, Dr. Henry Morris. Dr. Morris carefully distinguishes between "scientific" and "Bible" creationism. Among the "tenets" of the "scientific" version, we find:

> The physical universe . . . has not always existed, but was supernaturally created by a transcendent personal Creator who alone has existed from eternity.
> The first human beings did not evolved from an animal ancestry, but were specially created in fully human form from the start. Furthermore, the "spiritual" nature of man (self-image, moral consciousness, abstract reasoning, language, will, religious nature, etc.) is itself a supernaturally created entity distinct from mere biological life.
> The universe and life have somehow been impaired since the completion of creation, so that imperfection in structure, disease, aging, extinctions, and other such phenomena are the result of "negative" changes in properties and processes occurring in an originally perfect created order.
> Since the universe and its primary components were created perfect for their purposes in the beginning by a competent and volitional Creator, and since the Creator does remain active in this now-decaying creation, there does exist ultimate purpose and meaning in the universe.

By their words shall ye know them.

Does that read like a scientific theory? Were these "tenets" arrived at by inductive generalization, or by deduction? and if by deduction, *from what*?

Moreover, it is incoherent logically. For example: another "tenet" is a young earth. Observe that creation is compatible with any age of the earth; the only basis for invoking a young earth is the famous and slightly absurd attempt to fix the time of creation by adding together the ages of the patriarchs, which gives one a few thousand years. (Since there seems to be no clear Scriptural mandate for such calculations, some creationists have dropped this "tenet" and accept the possibility of an old earth and an older universe.) If the earth were only a few thousand years old, evolution would be impossible—that's logical coherence, interdependency, and consistency within a theory.

If young-earth creationists want to prove evolution impossible, they need only prove the earth is young. They have not. There is, in fact, one odd bit of data—Robert Gentry's "polonium haloes"—that seems to agree with the "young earth" notion, though nothing else in science does. One of the foremost "old-earth creationist" stump speakers told me recently that he fully

expects Gentry's evidence to be explained satisfactorily in a manner consistent with the rest of physics. The gentleman has, in fact, no empirical basis for being a creationist. He is one on pure faith, which is fine. That's how it *should* be.

Anyone who still harbors doubts that creationism is merely a form of apologetics should read its literature carefully. It consists of a long string of *ad hoc* hypotheses, many of them laughable, but—and more important—many of them inconsistent or contradictory among themselves, though all purport to explain away elements of the interlocking evidence for both cosmic antiquity and organic evolution, *one at a time*. Thus, to discredit evolution, creationists have claimed that radioactive isotopic dating is worthless (the arguments against it range from total rejection of the underlying physics to variations on the theme "Mistakes have been made, therefore all uses must be mistaken"), or that the Doppler effect does not work in deep space.

To discredit evolution, creationists must, in fact, discredit central concepts in physical science, for all science is ultimately unitary if there is a "real world' out there. The Fundamentalist belief system repudiates scientific method to a degree unrealized even by many Fundamentalists. Yet, creationists downplay the breadth of their disagreement with science in their public presentations, preferring to act as if evolutionary biology stands alone. That is not surprising. The public accepts and daily uses the fruits of physical science; it knows that the internal combustion engine and the measles vaccine were not derived by study of Holy Writ.

Harold W. Clark, an Adventist geologist, used to "explain" the entire sequence of geologic strata, with their characteristic fossils, in terms of the altitudinal zonation of natural communities before Noah's flood. Thus, the lowest strata contain marine invertebrates because that's what lived at the bottom of the sea; the fish appear higher because they were swimming in the water; giant reptiles lived in tropical lowland swamps, mammals (furry, of course) in the cooler highlands (and birds in the air!), and so on—with man appearing only at the very apex because, intelligent creature that he is, he saw the waters rising and hied his sin-wracked form to the hills. Now that's the quality of creationist hypothesizing!

Admittedly, real scientists sometimes erect *ad hoc* hypotheses, too. But they generally abandon indefensible positions when they fail; committed creations do not have that option. *Creationism cannot be science because it proceeds from the prior assumption that the Bible, read literally, is absolutely true and all that is inconsistent with it is error.* It does not seek to understand the material world on its own terms, but rather to show that the world makes sense within the Fundamentalist Christian belief system. Its viewpoint is indistinguishable from that of the Christian apologists who for so many years denied that pagan history could be true, because it did not match the Bible's history.

Creationists, however, are not really very interested in science anyway. They are interested in what they perceive as the moral consequences of science. Here is Henry Morris again:

> Who can say the evolutionary philosophy is not significant, when it has been made the basis of Social Darwinism, economic and military imperialism, anarchistic individualism, Fascism, Communism, animalism, racism, modernism, atheism, and practically every other harmful philosophy known to man?

The appropriate rhetorical response is, perhaps, to point out that the first recorded act of genocide, perpetrated by the Hebrews against the Malekites on Divine orders, occurred before Darwin. So did the Inquisition, the burning of Jan Huss, and indeed the martyrdom of Hypatia and the destruction of the library of Alexandria at the hands of a Christian mob. But that is rhetoric; let's return to analysis. The key words in Morris's improbable claim are "evolutionary *philosophy*."

Creationists commonly equate biological evolution with materialism as an ideology, and here we return to the confusion I alluded to earlier. The roots of this confusion can be traced back to Greece but are certainly clear by the 18th century. Recall that the broad, pre-Darwinian struggle was between secular, scientific explanation on the one hand and the teachings of the Church on the other. Any advance by the former was at the expense of the latter, and reason was cast as the enemy of faith—though throughout the contest, some perceptive thinkers realized otherwise.

Subsequent developments in biology, and clerical reactions to them, fit readily into this confrontational mode; the reactionary Presbyterian theologian Charles Hodge concluded his 1874 treatise, *What is Darwinism?*, with the concise answer: "It is atheism." We return to the analysis of Maupertuis; the effect of triumphant science was to render God apparently *unnecessary*. But as theologians should have known, God could well remain necessary on other grounds. Indeed, He could exist, and merit our worship, even if it were impossible to demonstrate His necessity, and even if His existence were inconsistent with the evidence of reason and the senses. As Bacon wrote in the *Novum Organum* in 1620,

> We are obliged to believe the word of God, though our reason be shocked at it; . . . . the more absurd and incredible any Divine mystery is, the greater honor we do to God in believing it, and so much more noble the victory of faith.

Bacon, of course, attempted to delimit the separate spheres of theology and science, an enterprise continued in modern mainstream Protestant and Catholic theology. He wrote:

> It is therefore most wise soberly to render unto faith the things that are faith . . . sacred theology must be drawn from the word and oracles of God, not from the light of nature, or the dictates of reason. . . . Some have endeavored to build a system of natural philosophy on the first chapter of *Genesis*, the book of Job, and other parts of Scripture; seeking thus the dead among the living.

One is able to do science at all only if one accepts certain intrinsically unprovable postulates about the universe: that a material universe exists in some meaningful sense; that the evidence of reason and our (extended) senses is sufficient to comprehend that universe; that the universe is lawful; and that its laws are and always have been the same everywhere. (Properly understood, this last assumption—the uniformitarian assumption—does no exclude the possibility of singularities like the Big Bang; it only requires such events to be lawful.) This is a materialistic belief system, an ideology if you will, no more subject to empirical or logical validation ("proof") than any religious belief system. (Of course, some creationists have claimed evolution is a religion, a point to be considered below.)

Note that the minimum set of materialistic beliefs enumerated above neither denies nor excludes the possibility of the supernatural; it *ignores* it. Since a supernatural Creator by definition falls outside the realm accessible to scientific method, science *per se* neither affirms nor denies the existence of God. This was perfectly clear to the liberal Presbyterian theologian James Woodrow when he made his famous defense of Darwinism in 1884, and it is no less clear now.

Some individual scientists may have personal quarrels with religion; some may carry their materialistic ideology an additional step and declare their belief that God does not (or cannot) exist. That is their right, but it is not science that compels them to do so.

The fundamental error of those who equate evolution with atheism is the classical logical fallacy of confounding the whole with a part thereof. The "evolutionary philosophy" blasted by Henry Morris is not biological evolution. It is something much larger, which is not entailed by biological evolution. Evolution is not a religion or an ideology. Evolution is a scientific idea.

Resurgent Biblical inerrancy rejects the claims of several centuries' philosophy, as well as the pretensions of the "Higher Criticism." A careful critique of the modern inerrancy movement, which began in the last century, reveals little that is new or substantial and much that is extremely vulnerable. Ultimately, any defense of Biblical inerrancy traces back to internal Biblical *claims* of inerrancy, thereby firmly embedding the doctrine in circularity—for if the Bible is not inerrant, why should we believe it when it says it is? This, however, has nothing to do with evolutionary biology. Our mission is not to dissuade people from believing that every word in the Bible is literally true. Our mission is to try to understand the biosphere, within the self-im-

posed limits of scientific explanation. We do not preach from the pulpit, and we view with consternation the creationist's will to preach in the biology classroom.

Let me close by recapitulating my argument: God and science are irreconcilable only if one insists that science can only be true if it conforms to the literal reading of Scripture. Latter-day claims of Biblical inerrancy arose as a reaction to Enlightenment philosophy and 19th-century scientism and the "Higher Criticism," but they are a reworking of older defensive positions dating from much earlier times and controversies. For Fundamentalist Christianity, most of what has happened in the past several centuries is best viewed as an unfortunate aberration. Most branches of Christianity are not, however, wedded to the notion of inerrancy. Most have made their peace with science by some form of Bacon's argument that the spheres are separate and need no reconciliation. To do science, one must proceed from certain materialistic assumptions. These are ideological in character and no more defensible than is religious faith, but they do not encompass the full set of materialist claims. Thus, a scientist may believe in God in the Baconian manner, and very many do—just as the vast majority of Christians accept as valid science's claims to knowledge about the universe. It is illegitimate to posit precisely two ways of looking at the world, "evolutionist" (meaning "materialist-atheist) and "creationist" (meaning Biblical literalist). Yet, those are the terms in which the public "debate" is usually cast. Both creationists, who seek legitimacy for their claim, and scientists, who all too often equate religious belief with superstition, have been guilty of misrepresenting what is at issue. You need not choose between science and God unless you want to, and you should arrive at such a decision well-informed. Then and only then, let us render unto Caesar that which is Caesar's and unto God that which is God's

Reply to Shapiro

Dr. Arthur M. Shapiro in his article "God and Science" (October 1987) has provided no new evidence in his defense of evolution, because there is none. The Biblicist knows that the *Genesis* account of creation is truth because it was confirmed by Christ Jesus in the *Gospel of Matthew*, Chapter 19. God has revealed this truth to His elect body of believers that they might be saved from the condemnation that is upon all men.

In contrast, the theory of evolution is a delusion sent by God to those who have rejected the truth of the Gospel (*II Thess.* 2:11, 12). Those that cling to evolution to explain their own creation make up the growing body of AntiChrist, which has been given over to a reprobate

mind as compensation for their error. Thus, Dr. Shapiro, along with a host of others, cannot discern between truth and error, nor between good and evil, and is himself a very poor product of the "evolutionary" process. His doctrine merely conforms to the unholy, AntiChrist trinity of Darwin, Freud and Marx who are all reactionaries and deceivers masking the truth of their own Creator and the resurrection of His only begotten son.

Erik R. Thorp
Providence, RI
(dated 10/16/87)

 Mr. Thorp recently organized the successful challenge to a Rhode Island state park billboard which he felt promoted evolution. C/E

Creation Science and Creation Myths: An Ethnological Perspective

Jeffery R. Hanson and Jerry E. Hanson

This is how it all began. There was only water—there was no sky, there was no land, only nothingness. Then out of the waters rose a mist, and it became the sky. Still there were no sun, no moon, no stars—just darkness. But deep down in the waters lived Kokomaht, the Creator. He was bodiless, nameless, motionless, and he was two beings—twins.

—A Yuma Myth (Erdoes and Ortiz 1984:77).

Before there were people on the earth, the Chief of the Sky Spirits grew tired of his home in the Above World, because the air was always brittle with an icy cold. So he carved a hole in the sky with a stone and pushed all the snow and ice down below until he made a great mound that reached from the earth almost to the sky. Today it is known as Mount Shasta.

—A Modoc Myth (Erdoes and Ortiz 1984:85).

In the ethnographic record literally hundreds of creation stories exist which explain the origins of the world, the place of life within that world, and the creative role that supernatural forces or beings may have played. A large number of these explanations differ widely from the core assumptions made by the Biblical model. For instance, data from the World Atlas (Murdock and White 1969) sample of 563 societies show that only 131 (or 30.7%) societies conceive of a high god active in human affairs (Figure 1). And 183 societies (43%) lack a belief in active or inactive high

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gods entirely. In addition, in the Standard Cross-Cultural Sample of 186 societies, where data were available, only 33 (or just over 49% of the societies) conceive of their gods as male (Figure 2). Some are personified as female, and some with varying degrees of power, intervention, and support. Creation narratives also exhibit a great deal of variation in the specifics of creation such as time, place, origin of plants, animals, humans, etc, and also in the number, gender, and structure of the "Creators."

Additionally, ethnological studies demonstrate a clear functional relationship between qualities of godliness and cultural development. For example, data from the World Atlas show a direct statistical correlation between a belief in a high god who is active in human affairs and the level of agricultural development (Table 1). Note that active high gods are most likely associated with "Developed" or complex agrarian systems, the cultural context out of which Biblical exegesis arose. If one compares the distributions of stratified social systems, that are characterized by asymmetrical power and authority, (another Biblical element), with active high gods there is again a direct statistical association: belief in high gods is most often found in highly stratified societies (See Table 2). In other words, the Biblical "theory" which scientific creationists wish to test is nested within a specific sociocultural context, and, therefore, introduces a severe circularity to their hypotheses. In ethnological context, then, the *a priori* assumptions and attributes of creation and godliness as professed by Biblical creationists have not been widely shared among peoples of the world.

In this paper we challenge the belief that *Genesis* represents the only valid version of creation, for cross-cultural evidence suggests that not only is this view incorrect but also that it is highly ethnocentric to claim universal status for explanations derived only from the Biblical creation narrative. On the other hand, we would disagree with those such as Godfrey and Cole (1987:100) who seem to suggest that any belief or interpretation about the origin of the universe and life is irrational unless it conforms to current scientific knowledge. From a cultural anthropological perspective it would be more appropriate to say that the rationality of creation narratives and other non-scientific origin stories lies with how such narratives and beliefs function in cultural context rather than in their scientific verifiability. In other words, whether a cultural belief in supernatural interdiction is rational is quite different from whether or not it is correct. It is this kind of misapplication of standards from both the creationist and science camps that continue to confound the creation-evolution controversy.

In their article "Teaching Theories: The Evolution-Creation Controversy," Root-Bernstein and McEachron (1989) describe how scientific theories and hypotheses are validated and accepted. To be considered scientific a theory must be "testable;" that is, somehow the postulated statements of relationships of causality within a theory must be able to be verified through experimentation and empirical investigation. To be accepted, a theory or

hypothesis must, at a particular point in time and contingent upon the acquisition of new knowledge, be better able to explain the phenomena under study than any alternative testable theory or hypothesis. They conclude that creationism is not a valid scientific theory because the "how's" of specific "acts of God," by definition, lie beyond the human ability to measure or test while the theory of evolution by natural selection is a bounded, testable theory.

In similar fashion, Kehoe (1987) argues that creationism is not a science because it advances an *a priori* "truth" which, in an arcane Baconian way, must be "proved" through inductive means (1987:14,16). In addition, Kehoe observes that the creationist strategy of equating science with knowledge is obsolete and out of step with current scientific epistemology which embraces naturalism as a fundamental tenet (1987:14). In essence, non-natural forces lie outside the bounds of legitimate scientific inquiry, and science, unlike religion, hold no truths to be self-evident.

In the history of the creationism-evolution controversy, the Biblical version of *Genesis* has been viewed by proponents of the creation science movement as the only theoretical alternative to the theory of evolution in "explaining" the origins of the universe and life (Kehoe 1987:13-14). In addition, creation scientists have attempted to create ideological hegemony over alternative Biblical interpretations. Toumey (1990; and this issue) has documented the relationship between the "ideological hegemony" produced by Henry M. Morris and the interpretative variation he found in creationist study groups. Some adherents to creationist thought challenge some of the assumptions seemingly necessary to maintain a distinction between evolutionary theory and scientific creationism, yet they continue to support Morris and the ICR. Although interpretative variation and debate can be documented within any group operating under a certain creation narrative (Radin 1972), it is the particular equation that unites the principles of the scientific method with a narrow version of Christian theology that concerns us here. Thus Morris and others who use science to usurp the spiritual claims of others in order to establish hegemony must be consistent with the rest of the scientific community. From a scientifically informed ethnological perspective then, consistency demands that not only evolutionary theory but the creation accounts of other cultures and religions stand as theoretical alternatives to Biblical *Genesis*. The fact that Biblical creationists have attempted to validate their claims through science is itself nested within a contemporary cultural context. Modern, 20th century American culture places a high value on science and scientific experts as authenticating sources of knowledge. It should be noted that Biblical creationists are not alone in claiming scientific authority to support their religious and cosmological claims. Some Lakota, for example, are claiming scientific authority to support an ancestral origin in the Black Hills (Chirinos 1991; Goodman and Red Bird 1983).

Failure of scientific creationists to grant competing creation accounts the same epistemological status as *Genesis* leads to the conclusion that religious dogma, and a political agenda designed to recapture the means of cultural reproduction (e.g., a public education which is framed within a Biblical context), lie at the root of creation science thought. That scientific creationists exclude other creation mythologies from consideration probably stems from the fundamentalist assumption that Christianity is the only "true" religion and that the myths and legends of "pagans" are not legitimate challenges to Scripture. As Moore (1990-91:13-14) has so cogently stated:

> There are no intellectual procedures whatsoever that will allow us to establish as "historically and scientifically true" the creation myth of any religion (or support any supernatural statement). The creationist technique pretends that there can be only two hypotheses: the Priestly version of creationism or the scientific theory of evolution. So, if doubt can be thrown on the scientific theory, creationism alone remains. This is equivalent to saying that if a mammal is not a dog, it must be a cat.

Creationist claims to truth rest on Christian belief which stresses the importance of its events as having taken place within Western history rather than in a non-historic sacred Universe, and thus conflicts with coexisting theoretical alternatives (Hargrove 1989:58). Fundamentalists and their pseudo-scientific offspring the "creation scientists" have long been involved in political campaigns to actively promote and affirm religious dogma rather than the production of new and exciting forms of knowledge. However, if scientific creationists insist on the "testability" of *Genesis*, and they do, they must also consider equally testable the creation accounts of other societies whose faithful hold their versions as equally tenable. If they do not, then they weaken both the spirit and the letter of the scientific authenticity that they attach to their investigations.

To illustrate the problem as addressed above, we have selected the creation accounts of two Native American tribes, the Mandan and the Washo. The Mandan traditionally were an agricultural tribe who for centuries prior to White contact lived in large, sedentary villages along the Missouri River in present-day North Dakota (Meyer 1977; Wood 1967). The Washo were traditionally a Great Basin nomadic hunter-gatherer tribe living in the Lake Tahoe area (Downs 1968). Examples drawn from these cultures will serve to illustrate that not only do competing creation accounts exist between cultural groups, but within them as well. Clearly, versions of creation can change through time, vary at a single point in time, or be a complex interaction of both of these factors. Thus establishment of the "correct" version largely depends upon which version is selected, at what point in history, and for what purposes.

The Mandan Creation Accounts

Turning to the Mandan, we can illustrate how a relatively consistent creation account can be affected by historical circumstances and, as a result, revised through time.

In 1833 the Mandan chief Dipauch related to Prince Maximilian what was then the current version of the Mandan creation (Thwaites 1906). At this time, the Mandan had been intimately involved in the fur trade with Europeans for over 50 years; ample time for the Mandan to adapt their accounts of creation to fit contemporary circumstances. Some of the more significant highlights of the Mandan creation will illustrate our point.

According to Dipauch, in the beginning everything was water. Two male gods and culture heros, Ohmahank-Numakshi (The Lord of Life) and Numank Machana (First Man) created the earth and all that lived on it. The Lord of Life, who lived in the sun, had created First Man, who, while moving over the water, encountered a duck. At the request of First Man, the duck dove to the bottom of the water and brought up some earth. Taking the earth from the duck, First Man then scattered it over the water, creating the land.

First Man then met his father, the Lord of Life, along the Heart River in present day North Dakota, who gave him wood and grass which he had received from a weasel. With this wood and grass, the Lord of Life created all life west of the Missouri River while First Man created all life to the east of the Missouri. They both created the human race but limited their life span to a hundred years so as not to overpopulate the earth. After the creation of the buffalo (the most important animal species in the Mandan habitat) the Lord of Life instructed that the hides should be taken home, tanned and made ready for use and sale (at this time the bison robe trade was peaking in the northern Plains). Both the Lord of Life and First Man created the White Man, who possessed wampum and lived at this time on the other side of the "Great Water," and who had been conceived from the hair of floating, putrid wolves that had been tossed into the "North Ocean" (a possible reference to Hudson Bay? The earliest White traders came to the Mandan from that direction. Some Mandan may have visited York Factory, a trading post at Hudson Bay, during the latter 18th century). Through an episode of Virgin birth, First Man impregnated a Mandan girl, who gave birth to a boy who became a great chief of the Mandan. With the help of First Man, this chief built a boat with which to travel to the land of the White Man who were dangerous but desirous of beaver pelts. Upon their arrival in the land of the White Man, First Man duped them in a series of encounters, and the Mandan returned triumphant. Because First Man had so incensed the White Man, the latter caused a flood, but the Mandan were saved as First Man instructed them to build a tower or fort on a flood-free hill along the Heart River. Soon after this, First Man left the Mandan, never to return.

Like *Genesis*, Mandan creation accounts explain universal creation, human creation, a Holy land, historical events and the testing of a chosen people. Postponing for the moment the question of historically determined multiple versions, what makes the Mandan version of creation less possible or less "testable" than *Genesis*? Can either version operationalize its key concepts in order to, in principle, permit the falsification of its hypotheses? If Creationists can insist on the scientific status of *Genesis*, does not logic dictate that the Mandan version of creation is an alternative hypothesis equally testable with *Genesis*? Or is such a prospectus conflating two fundamentally different ways of viewing the world and the human place within it? Can locations of villages, key events, and chronologies be verified?

Returning to the issue at hand, other versions of the Mandan creation exist. Which version is the "correct" one? In 1908, the anthropologist Gilbert L. Wilson collected a version of the Mandan creation from Short Bull (Wilson 1908). By this time the Mandan culture had undergone tremendous change. Epidemics had decimated their numbers, the Fur Trade was no longer important in their economy, and the buffalo had been wiped out years ago. The Mandan had coalesced with their close cultural cognates the Hidatsa and, along with the Arikara, were living under the oppressive reservation policies of the assimilationist-oriented Bureau of Indian Affairs at the Fort Berthold Reservation (Gilman and Schneider 1987; Meyer 1977). In attempting to eradicate the tribal cultures, lands of the Three Affiliated Tribes had been allotted in severalty in the 1880's. Individual families at this time lived in scattered communities, tribal chiefs had lost most of their formal authority, matrilineal inheritance of land no longer existed, and tribal members were subjected to educational and religious socialization (Meyer 1977). The three tribes were being encouraged to become rural white farmers, and ranchers.

Short Bull's version of the Mandan creation is the same as the earlier version in bare essentials. All was water at first, and the Lord of Life (called First Worker by Short Bull) and First Man created the earth from sand brought up by two ducks. The Lord of Life created all things west of the Missouri River while First Man did likewise east of the Missouri.

But some noteworthy deletions and additions emerge in Short Bull's version that were not found in the Dipauch version of 1833. Gone are the references to preparing bison robes for sale and the White Man's desire for beaver. Gone also is the passage referring to the creation of the White Man from the putrid carcasses of wolves. Added, however, is a dualism in character between the Lord of Life and First Man. The Lord of Life is portrayed as a Trickster, warlike, and responsible for all the harm in the world. First Man, on the other hand, is kind and gentle, and working for good.

Are the differences which exist between the two versions in the qualities of the Mandan creators a matter of simply individual variation in the recitation of the story, an error of omission, or a Mandan accommodation of Christianity's essential good/evil dualism? White Men of the cloth, including

Gilbert Wilson, had been proselytizing the Mandan-Hidatsa for well over a quarter of a century.

Between 1929 and 1939 Martha Beckwith recorded several versions of the Mandan creation. One version by Foolish Woman is analyzed here (Beckwith 1938). The essentials of the creation are consistent with the two earlier versions. However, two interesting additions occur. First, the juxtaposition of Indian versus Euroamerican lifeways is represented for the first time. According to Foolish Woman the Lord of Life created Indians (recall he also created all things west of the Missouri River, including the buffalo) while Lone Man or First Man created the White Man (recall that he created all things east of the Missouri River, the direction from which the White Man came). Lone Man also created sheep and cattle. The two gods decided that Man should live first on the resources created by the Lord of Life, (that is, things associated with the Indians) then on the resources created by Lone Man (cattle and things associated with the White Man). By the late 1920's the Mandan and Hidatsa economy was heavily geared toward cattle ranching augmented by farming.

The two Mandan gods, then, in this version have worked out in the Creation a reconciliation of the two different lifestyles and the relative historical trajectory of each in Mandan-Hidatsa society. In the context of strong pressures to assimilate, it is also possible that the Lord of Life and Lone Man have "seen" the wisdom in the ways of the White Man and are appealing to their people to do likewise. (This might be especially significant if the translator was working closely with the missionaries.)

Which of these versions is the "correct" or "accurate" one? Clearly, the time period from which a particular version comes is critical. Some incidents and themes are dropped, others are added. The motives of the creators change. If taken literally, is one version more "testable" than another? Would one or all of these versions be less testable to Mandan scientific creationists (if there are any) than *Genesis* is to Biblical creationists? Since the details and interpretations of creation are influenced by historical and cultural context in both the Biblical and Mandan accounts, the decision to grant "scientific correctness" to one over another is based on political and/or theological rather than scientific motivation.

If we turn to the Washo case where generally two simultaneous versions are represented, the assignment of "scientific correctness" becomes even more of a problem.

The Washo Creations

As with many gathering and hunting societies the Washo did not articulate a systematic religious philosophy comparable to those found within the Judeo-Christian tradition. Nevertheless, in James Downs *Two Worlds of the Washo* (1966), a description of Washo creation accounts reveals a rich

conceptual inventory and more importantly, a toleration for differences of opinion about the details of how creation actually occurred.

In one account the world moved through a series of stages, each with different inhabitants. The historic Washo and the other Indian groups that they were aware of represented the fifth habitation. The Washo, the Paiutes, and California Indians in general were fashioned out of the seeds of a cattail by "Creation Woman."

Another tale attributes human origins to "Creation Man" who separated his three sons to eliminate conflict between them. Eventually the Washo, Paiutes, and other California Indians developed from them.

Neither "Creation Woman" nor "Creation Man," however, were responsible for creating the physical universe. Instead it was created by the adventures of a short-tailed weasel and a long-tailed weasel. For instance, the many lakes in the mountain region were caused when the short-tailed weasel came upon a Water Baby and took it prisoner. After pleading for his release and threatening to flood the world failed to win his release, Water Baby caused a flood which covered the Mountains to their tips. The wiser long-tailed weasel, angered at his companion's irresponsible behavior, forced the release of Water Baby and asked him to reverse the effects of the flood. Water Baby did this, but many mountain valley lakes remained.

Although many of the traditional tales had lost their force, been forgotten, or simply changed in the face of rapid cultural change when they were being described in the late 1950's, the belief in Water Babies continued to be an active part of their religion. They were described as two or three feet tall with long black hair that floats behind them when they walk. They are grey, clammy to the touch and are considered to have great power. Water Babies were believed to reside in all of the lakes, rivers, streams, ponds, irrigation systems, etc. Accounts of Water Babies visiting humans were empirically verified by sound, a high mewing call, or by seeing footprints.

A number of other supernatural beings existed in Washo mythology such as Ang (a giant bird who terrorized humans), a one eyed, one legged giant who hopped among the hilltops seeking Indians to eat, and coyote at various times a dangerous, benevolent, or stupid figure (Downs 1966).

Two important points result from the Washo ethnographic material. First, the inconsistencies represented by the two different versions of the Washo creation seemed to bother no one, and according to Downs were used by people whenever they seemed appropriate. For instance, the Washo were traditionally a comparatively egalitarian society which permitted women as well as men to be shaman. It did not seem important to politicize one version over another in order to destroy its competitor. In short, there was not a "politically correct" version. This flexibility has also been noted by Radin (1972) among the Winnebago where individuals with special ability had the right, indeed community approval, to embellish in their own style the details of important religious narratives. The second point is comparative. Does the

empirical evidence that the Washo use to convince themselves and others of the epistemological status of supernatural entities such as Water Babies constitute a less "scientifically " constructed explanation than, say, Abraham being visited by God and two Angels or a dead man emerging from a cave? Are the activities of weasels and lecherous coyotes less significant than an evil serpent?

Conclusion

If those with political or religious agendas purport to apply the scientific method to one version of creation or reality, then we should insist that all "creationisms" known to exist in the ethnographic record be considered as alternative theories. If not, then they should be satisfied with at least two fundamentally different categories of knowledge. One is derived from the observed operations of entities known to exist within the guiding framework of natural law, and the other from the realms of aesthetics, belief, and faith. To do less is an injustice to both, and takes us backward in time and thought to the Enlightenment when the social philosophers and natural historians were struggling to separate these different pathways to knowledge (Harris 1968).

Even as early as the 13th century St. Thomas Aquinas had solved this problem by distinguishing between philosophy, which is subject to proof, and theology, which is a matter of faith and not subject to proof. The historical veracity of creation myths and folklore has always been problematical for ethnohistorians. While some would argue that historical and scientific methodologies can be applied to these texts, albeit with caution, others would insist that such texts not be approached using these methods because their value has little to do with being "factual," but rather resides in communicating essential cultural values (Dorson 1961).

From the perspective of ethnology, one can apply either one of two mutually exclusive evaluative standards with respect to creation narratives. If one believes in supernatural or divine intervention in human affairs and in the origin and development of global life, then the "creationisms" of all cultural groups demand equal time. It is only faith and ethnocentric belief that separates one from another and elevates it as "The Truth." The other standard would view these narratives, in a somewhat Durkheimian way, as socially constructed mythologies of historical and cultural importance but nevertheless unreal to the extent that described events violate known physical and natural laws. In our view it is the conflation of these opposing standards which continues to muddle creationism controversies, Biblical or otherwise.

Table 1
Relationship between Active Gods and Level of Agriculture

	AGRICULTURAL LEVEL				
	None	**Gardens**	**Slash/Burn**	**Developed**	**Total**
ACTIVE GOD					
No High God	58	43	47	35	183
	(14%)	(10%)	(11%)	(8%)	(43%)
Inactive	23	7	64	19	113
	(5%)	(2%)	(15%)	(4%)	(26%)
Active	13	10	33	75	131
	(3%)	(2%)	(8%)	18%)	(31%)
Total	94	60	144	129	427
	(22%)	(14%)	(34%)	(30%)	(100%)

n = 427 V = .35 DF = 6 P < .01

Table 2
Relationship between Active Gods and Stratification

	DEGREE OF STRATIFICATION			
	Low	Medium	**High**	Total
ACTIVE GOD				
No High God	96	39	48	183
	(23%)	(9%)	(12%)	(44%)
Inactive	55	22	33	110
	(13%)	(5%)	(8%)	(26%)
Active	27	28	71	126
	(6%)	(7%)	(17%)	(30%)
Total	178	89	152	419
	(42%)	(21%)	(37%)	(100%)

n = 419 V = .22 DF = 4 P < .01

Figure 1
Quality of Godliness from the World Atlas (Microcase 1988; based on Atlas of World Cultures by G. P. Murdock 1981).

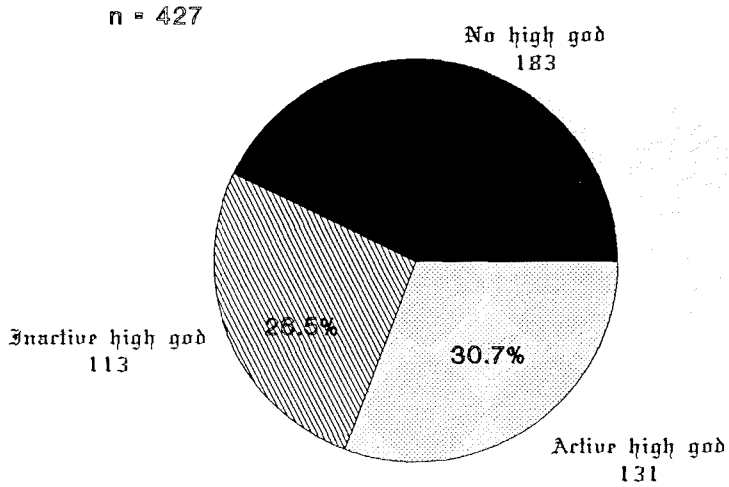
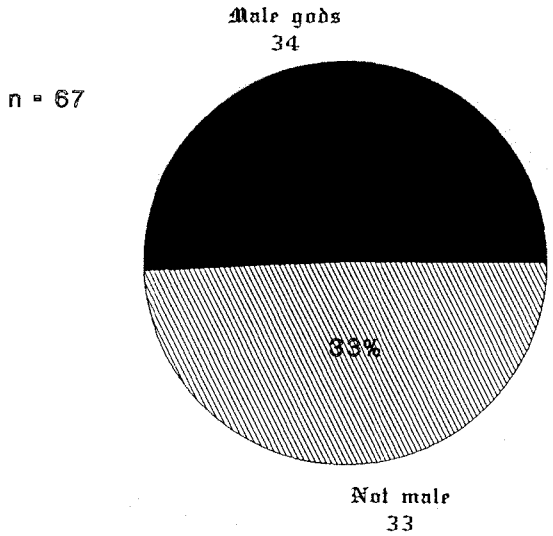


Figure 2
Percentage Distribution of Male Gods from the SCCS (based on Murdock and White 1969).



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Orthodoxy and Originality in Creationist Thought

Christopher P. Toumey

One of the most important features of modern anti-evolutionism is a strong central system for controlling belief, that is, an authoritarian ideological hegemony. Dr. Henry M. Morris and his colleagues at the Institute for Creation Research (ICR) have forged a simple set of doctrinal standards by which they judge whether one is a true believer. Periodically they broadcast these criteria in key reference documents, particularly the Creation Research Society membership pledge of 1963 (Morris 1984, p. 339), the Christian Heritage College Doctrinal Statement of 1970 (Morris 1984, pp. 353-359), and the "Tenets of Creationism" of 1980 (Morris 1984, pp. 361-365). The influence of this formula of belief is apparent in the legal definition of the term "creation-science" in Arkansas's 1981 "Balanced-Treatment" Act.

Although creationist belief obviously includes an implicit assumption that humans have no common ancestry with animals, the salient parts of the modern formula are more concerned with geochronology and geology. "Strict creationism," as this orthodoxy is called, features these specific beliefs:

1. "*Creation Week*," meaning that the six days of creation and the day of rest, as described in the first two chapters of *Genesis*, were literal 24-hour days. By this standard, it is heresy to accept "Day-Age," i.e., the belief that the six days were long periods of geological time.
2. "*Recent Creation*" (a.k.a. "Young Earth"), which is an oblique endorsement of Archbishop Ussher's chronology. Creation is assumed to have occurred within the last 10,000 years or so. "Gap Theory," which contradicts this by positing a long gap of geological time when "the earth was without form, and void," between verses 1 and 3 of *Genesis* 1, is then an "Old Earth" heresy.

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3. "*Flood Geology*," or the theory that Noah's Flood accounts for almost all geological stratigraphy and the distribution of fossil evidence. That event was supposedly a violent worldwide catastrophe, so that ideas of a "local flood" or a "tranquil flood" automatically become heretical.

This simple formula is easily communicated to large numbers of followers. With these standards for delineating orthodoxy, Dr. Morris and his associates are able to do more than merely stake out their ideological claims; they can also define and control heresy by labelling dangerous ideas Day-Age Theory, Gap Theory, or Local Flood Theory. Indeed, this is the usual procedure for purging the particulars of theistic evolution from their circles.

The urge to establish an ideological hegemony is understandable, considering the consequences of heterodoxy during the 1920s. William Jennings Bryan insisted that humanity had not evolved, but he tolerated the belief that all other species could have evolved (Bryan 1922; Numbers 1981, p. 540). The worst moment of his humiliating cross-examination by Clarence Darrow at the Scopes Trial occurred when he acknowledged the plausibility of Day-Age Theory. George McCready Price subsequently attempted to recover some standard body of creationist belief, but found himself constantly besieged by Day-Age, Gap Theory, and Local Flood beliefs (Numbers 1981, pp. 540-541). Henry Morris eventually succeeded Price as titular leader of American creationism, whereupon he and his colleagues "grew less tolerant of notions of an old Earth and symbolic days of creation, common among creationists in the 1920s, and more doctrinaire in their insistence on a recent creation in six literal days and on a universal flood," in the words of Ronald L. Numbers (1981, p. 538). One of the major themes of Morris's autobiographical history of creationism (Morris 1984) is the constant vigilance with which he protects these latter beliefs from being subverted by heresy.

I should mention that several large sectarian factions advocate varieties of creationism which contradict Morris's formula. The Jehovah's Witnesses, the Worldwide Church of God, and the Seventh-day Adventists each embrace Gap Theory; the Witnesses also believe in a very esoteric version of Day-Age. I have described their theological reasoning elsewhere (Toumey 1990a). However, their influence in the public aspects of the creation-evolution controversy is relatively weak, either because they consider the world too corrupt to reform (in the theology of Jehovah's Witnesses and the Worldwide Church of God), or because they devote their attention more to their own internal problems of parochial education than to proselytizing (in the case of the Adventists).

Because Henry Morris's Institute for Creation Research is the most influential creationist organization, I want to discuss relations between ideological hegemony and heterodoxy among Morris's followers. I examine the irony of the modern hegemony: Dr. Morris's leadership is devoutly

appreciated by grass-roots creationist activists, but many of these same people often wander across the boundaries of heretical belief, with no adverse effect on their own good standing as creationists or on their collective effort to advocate creationist views publicly.

Hegemony Among Creationist Activists in North Carolina

Between 1981 and 1985 I studied grass-roots creationism in North Carolina. My two principal research methods were participant observation with a local creationist study group that meets monthly, and a set of interviews with 51 people actively involved in advocating creationism. (These two subsamples overlapped; for detailed information on my research methods, see Toumey 1987.) With that research I was able to document the enormous influence that Henry M. Morris and ICR have upon local activists.

The usual business of the local creationist study group is to view a packaged program, e.g., a film or a slide show, produced by the Institute for Creation Research. These packaged programs tell them little they have not already heard, but they nevertheless study the messages carefully so they can bring them to their own Bible study groups, their Sunday schools, and their churches. A handful of the members are comfortable editing and re-arranging the slide shows and the scripts that come with them, but the others are less confident, so they stick closely to the scripts. Viewing these programs at the group's meetings is, for them, a rehearsal where they learn to say the right things the right way. There is no opportunity (nor any apparent desire) to challenge the packaged programs.

For guidance on difficult technical issues, they prefer to check with ICR. In 1983, one member became interested in the theories of an Australian creationist named Barry Setterfield, who proposed that the speed of light had been much greater in the past, but had eventually levelled off at the rate we know today, i.e., about 186,000 miles per second. Setterfield's speed-of-light manipulations dovetail with creationist chronologies that say the universe is less than 10,000 years old, so they obviously represent an elaboration of Recent Creation. However they also challenge one of the most basic constants in physical science. The group discussed this topic twice, once in late 1983 and again in early 1984. The first time, the group's president off-handedly cautioned against Setterfield's theories; the second time, he reported that he had asked Henry Morris about it, and that Morris was very skeptical about it. After that, they did not raise it again.

For these people, Henry Morris is much more than a mere technical expert: he is their hero, their inspiration. One of the founders of the group, an electronics engineer, traced his commitment to scientific creationism to the time he met Morris in San Diego, in about 1978. He says it impressed him greatly that Morris, a distinguished fellow engineer, explained creationism

in terms of their mutual professional standards. His respect for Henry Morris is illustrated by an angry comment he made about the judge in the 1981 Arkansas trial. He resented bitterly the way Judge Overton referred to Morris as "Mister" Morris, after having referred to evolutionist experts by the academic title "Doctor." After all, he explained, Morris has a Ph.D. in Engineering.

When this electronics engineer returned to North Carolina, he met with a science professor who had known Morris at Virginia Polytechnic Institute during the early 1960s. The professor had come to respect Morris as an engineering professor, a Christian lay leader, and a creationist. He and Morris stayed in contact after Morris left V.P.I. in 1970, and eventually he and the electronics engineer founded the local creationist study group. One of their earliest projects was to bring Henry Morris and another ICR speaker to North Carolina for a two-day seminar in Spring 1980.

The local creationists also admire Morris for several Biblical commentaries he has written, which remind the study group's members that Dr. Morris is a spiritual leader as well as a scientific authority. Thus impressed by his many abilities, they say to each other that it's amazing one man can do so much. This kind of comment then leads into folklore about the life of Henry Morris. According to one story I heard several times, Morris is a workaholic, who, when fortified by strong coffee, often stays up all night writing. Another tells of his anguish over a son who was dissolute and disrespectful. People could not understand how the son of a leading Christian could be so bad. As the narrative continues, however, Henry Morris perseveres in his creationist ministry, and ultimately wins the respect of his son, who then changes his own heart and becomes a reputable Christian. This then, is a parable about the spiritual power of Morris's personality.

The members of the study group, when dealing with their own expertise and each other's, are as curious and as cautious as any other small gathering of intelligent people trying to learn about science. But when receiving knowledge and belief from Henry Morris and the Institute for Creation Research, they defer very modestly to Morris's authority.

The Morris/ICR hegemony is reflected also in my interviews with local creationist activists. One indicator of this is the prevalence of ICR publications among the interviewees' various sources of information (Toumey 1990b:110). I had asked what literature they used to stay informed about creationism: ICR's monthly mailings constitute their single most prevalent source. The second most frequent creationist source was the books of Henry Morris and Duane Gish, which are also published by ICR. Other national sources of creationist information, e.g., the Bible-Science Association, reach far fewer activists—not nearly enough to rival ICR's leadership.

Morris's hegemony of belief is also reflected in my interviewees' ability to identify certain important persons (Toumey 1990b:111). Of all the names I posed, Morris's was the one most widely known. By comparison, another

important national creationist leader, Mrs. Nell Segraves of the Creation-Science Research Center, drew only a fourth as many acknowledgments.

Thus I conclude that what they know about creation and evolution is largely limited to what they learn from Henry Morris and the Institute for Creation Research, plus some other sources that amplify the Morris-ICR line. For information, they refer to Henry Morris's organization to lead them through *Genesis* and geochronology; for inspiration, they turn to Morris himself to steer them past doubt and difficulty. No other authority or influence matters nearly as much. Simply stated, this local creationist study group is a satellite of the Institute for Creation Research.

A Subculture of Heterodoxy

One problem of chronology is the exegesis of the Hebrew word *yom*, which is the word for "day" in the six days of creation of *Genesis* 1, and elsewhere in Scripture. In Morris's orthodoxy, wherein the days of creation are literal 24-hour days, allegorical interpretations of this word are discouraged. As part of his strategy to protect Creation Week from Day-Age, Morris avers that *yom* always means a day of 24 hours in every Biblical verse where it appears.

Over a period of many months in the mid-1980s, the local creationist study group kept up an irregular commentary on the meaning of *yom*. Some members who attend fundamentalist Bible study groups would say they heard that the word *always* meant a 24-hour day, just as Morris said. Not surprisingly, their conservative Bible study groups encouraged literalist exegesis. Other local creationists who attended less structured Bible study groups said they heard that it *usually* meant twenty-four hours, but that sometimes it could be a figure of speech, e.g., "In the day of prosperity" (*Ecclesiastes* 7:14) or "The day of the Lord" (*Isaiah* 3:12). None of these creationists read Hebrew; in their discussions about *yom* they simply traded hearsay back and forth. Then one evening a Baptist seminarian told them that *yom* sometimes meant a figurative time, i.e., something other than a 24-hour day. Because of his credentials they accepted his opinion. However, they devalued its implications for Morris's chronology by agreeing that the six days of creation could still have been 24 hours each, even if the Day of the Lord or the Day of Prosperity were not. Later, one of their leaders confused the issue a little bit more. While the Day of the Lord, which is yet to come, *might* be a figure of speech, he said, it could also be a literal 24-hour day; we'll just have to wait and see. Thus members of the group had, simultaneously, at least four positions:

1. Morris's Creation-Week hegemony, which rules out the allegorical exegesis of *yom*.

2. The allegorical exegesis of *yom*, which makes the Day-Age heresy possible.
3. A revisionist heterodoxy, in which Creation-Week governs *Genesis* 1 & 2, while Day-Age governs the rest of Scripture.
4. A revisionist hegemony, in which Creation-Week governs *Genesis* 1 & 2, while the relevance of Day-Age to the rest of Scripture is deferred to the indefinite future.

The source of this heterodoxy is the group's Bible study format, which undermines religious orthodoxy by evoking and legitimizing personal opinions. Most of the thousands of Bible study groups that punctuate the Protestant population of North Carolina every Wednesday night are informal gatherings in which friends help each other see the meaning of Holy Scripture by contributing individual comments. They encourage do-it-yourself exegesis, and they permit Christians to by-pass the more opaque parts of the Holy Bible by attracting them to the plainer passages, where more Christians can make useful comments. For the creationist group, this means that its members can consider a matter like the exegesis of *yom*, but they do not have to resolve it. They discuss it as much as it interests them, after which they shelve it and move on to another topic. They have no reason to face divisive issues, regardless how critical, that might disrupt their friendly camaraderie. In this context, they can easily avoid agreeing with Morris's rules on Creation Week.

Among my 51 interviewees, a surprising number had apostate views that drifted toward belief in evolution, or revisionist critiques of creationism, or confused impressions of creationist orthodoxy. I have three kinds of examples: first, three individuals who disagreed with chronological orthodoxy; next, two who challenged very basic assumptions of scientific creationism; and, third, some theistic evolutionists among the creationists.

First, the chronology dissenters: I was surprised to hear one of the most active creationist, a dedicated officer of the creationist study group, say, "I think creationism should not be limited to those who believe in a young Earth, or seven literal days." Another person who was a peripheral member of the study group echoed those feelings when he told me, "Those of us in the middle of the road don't believe in literal creationism, like that God created the world in six literal days." A third individual, who has spoken publicly in favor of the scientific case for creationism, insisted that his view "is different from the stereotyped creationist, for example those who argue about the exact length of the days of creation. . . . My approach is different from creationists or evolutionists." By the terms of the ICR hegemony, such nonconformity is equivalent to peddling evolutionist chronologies.

Another kind of serious dissent from Morris's orthodoxy was voiced by an interviewee who disagreed with Morris on creationism's importance as a matter of faith. Said this interviewee:

> The relationship between creation and evolution is not fundamental to the Christian faith. There's a wide divergence of feelings among Christians, even just among conservative Christians. It's not a fundamental doctrine of the Christian faith, like the Resurrection of Jesus Christ [Cf. Morris 1984, pp. 353-359].

Equally serious, an ex-member of the study group, who had formerly been very active in advocating scientific creationism, later changed his mind, saying:

> I'm still hesitant about believing [evolutionary] phylogeny, but no one has shown me that creationism is any more scientific than phylogeny. . . . [The local creationist study group is] an organization that says they're scientific, when they're not. . . . I think it's wrong for creationists to say that they're scientific in public meetings, when many points of evidence were relating just to the Bible. That's fine for Christians, but that's not science.

Morris and most creationists disdain theistic evolutionism as a cloudy no-man's-land between evolution and creationism. Here, they feel, is a reprehensible character weakness. Again and again, I heard it said contemptuously that theistic evolution is a cop-out, a compromise, an inconsistency. As creationists understand consistency of character, an evolutionist is atheistic in his philosophy and depraved in his morality. This they expect, and they appreciate having their expectations confirmed. But a *theistic* evolutionist, to the creationists, is a horrible hybrid, cowardly and confused.

Well, there are a few theistic evolutionists slated in amongst the activist creationists. I'll introduce two. The first was a physician with a very admirable grasp of scientific issues. This man attended the meetings of the creationist study group more often than most others. He also wrote a letter-to-the-editor in the local paper, publicly advocating creationism. In addition, he was active in a local evangelical ministry. But when choosing a position from a range of five statements about creationism and evolution in my interview format, he picked the theistic evolutionist position, i.e., the "the act of creation and the process of evolution are both parts of God's plan."

The other, a chemist, lingered at the periphery of the creationist movement, occasionally attending meetings, but not participating actively in them. He received ICR's monthly mailings and owned some creationist books. From these, he knew the creationist arguments well. He shared some creationist complaints about evolution, and seemed to be very much a creationist. Nevertheless, he carefully separated himself from the creationists by stating that "people who interpret the Bible literally need creationism," then pointing out that he needed neither Biblical literalism nor creationism. He went on to say that fundamentalism bothered him. In the item on the questionnaire about

policies for science education, he chose the statement recommending that, in the public schools, "Science courses should include evolution, and creationism belongs in courses on comparative religion or comparative literature." This most definitely is *not* Henry Morris's view on science education.

Thus, there is an ethos of hegemony that holds together much of the creationist movement, but there is also a subculture where discipline dissolves and orthodoxy evaporates. This latter aspect of private sentiments contrasts sharply with the disciplined hegemony that Dr. Morris prescribes publicly. I do not suggest that any attitudes or any individuals threaten to subvert or depose Dr. Morris. Among these heretics, dissenters, and apostates in the nooks and crannies of the creationist movement, none seem intent of disrupting the general outlines of modern creationism. Some don't even know that they're out of line. Nor do I claim that this movement has any more ideological diversity than any other major movement. What it has is a lot more ideological diversity than most creationists know or admit. The unorthodox aspect of creationism is more varied, more interesting, and more human than the ICR orthodoxy suggests.

Content and Structure

There is nothing unusual about an authoritarian social movement establishing a firm ideological hegemony. Indeed, this is exactly what one would expect from such a movement, that is, a strong central system for controlling belief, corresponding to a rigid social structure. At the same time, there is nothing unusual about heterodoxy, and even heresy, growing in the shadow of an ideological hegemony, for no body of belief is so perfect as to be immune from change and variation.

But it seems very strange to observe this particular combination of hegemony and heterodoxy. When the creationist leadership proclaims its clear hegemony of belief, it then measures its own worth in proportion to the strength of that hegemony. Yet it endures heterodoxy and even heresy within the ranks of the creationist movement, with no apparent effects, either for the leadership or for the dissenters. After all the dire warnings about diabolical evolutionary ideas infiltrating creationism's purity of thought, and the supposed consequences thereof, heresy infiltrates anyway, but there are no consequences. Respect and affection for Henry Morris are diminished not at all. Even those who self-consciously disagree with him have neither desire nor intent to change anything about his leadership.

Likewise, the dissenters experience neither discipline nor admonishment. There are no witchhunts, no Inquisitions, no mechanisms for herding wayward local creationists back into the confines of the standard hegemony.

In sum, neither hegemony nor heterodoxy are as important as creationists believe they are.

This does not mean that the creationist movement is less than real. It still has the strong social structure of a personality cult, featuring very firm ties between powerful leaders and loyal followers. Also, it still has a robust schedule of teaching, preaching, publishing, lobbying, and fund-raising. All these persist regardless of the subculture of heterodoxy.

To understand this irony, we must recognize two distinct parts of a social movement, namely, social structure and cultural content. Ordinarily we expect the two to be isomorphic, by which I mean that the content of belief is closely matched to the structure of the movement. By definition, a democratic movement has both a democratic decision-making structure *and* a spirit of democratic values; an authoritarian movement has both a rigid hierarchical decision-making structure *and* a rigidly controlled set of cultural values to which the movement's leaders and followers are dedicated. Furthermore, these isomorphisms are thought to be so intimate and so organic that breakdown of belief leads to breakdown of structure, and vice versa.

Although it is ordinarily expected that social structure and content of belief are closely matched, this is not inevitable. The two can be quite independent of each other. For example, Clifford Geertz has elucidated a relationship between cultural content and social structure in his analysis of a Javanese funeral. Different kinds of people (Muslim and Hindu) once shared the same cultural expectations of how a funeral ritual should be conducted. Subsequently, however, the social structure of Muslim versus Hindu changed due to sectarian politics, but the conduct of the funeral ritual did not, thereby creating a very embarrassing conflict in which the same ritual meant very different things to Muslims and Hindus (Geertz 1973: Chapter 6). This, then, reminds us that social structure and the content of belief are not necessarily closely matched, with either one determining the other.

The same general principle is relevant to our understanding of modern creationism. If the structure of the creationist movement really controlled creationist belief, or vice versa, then grassroots heterodoxy would be unthinkable; or, it would indicate that a grassroots rebellion against Morris's leadership was underway. But neither is true. In fact there is heterodoxy within creationist belief, but it is not in any way a sign of rebellion.

Everyone who wants to understand creationism, whether creationist or not, wants a clear and simple understanding of the core values of the creationist movement. Accordingly, the CRS membership pledge (Morris 1984, p. 339), the "Tenets of Creationism" (Morris 1984, pp. 361-365), and the legal definition from Arkansas's 1981 law are all very useful, for they enable us to reduce creationism to a very simple formula of belief. But when we focus our vision only on this ideological content, we lose sight of creationism's social structure. And because the social structure persists with little regard to problems of hegemony and heterodoxy of belief, it should be recognized that this too is a basic constituent reality of creationism, no less important than the substantive content of creationist thought. This means, of

course, that the structure deserves more attention than it has previously received. The processes of decision-making; the personality cult of Dr. Morris; the channels for disseminating information; the methods of dissipating dissent; the complicated relations between ICR and other national creationist organizations; these matters and more are just as basic to creationism as its body of belief.

Let us not limit our understanding of creationism by taking Dr. Morris's hegemony at face value. Let us see that creationist belief also includes heterodoxy; that the curious co-existence of hegemony and heterodoxy fails to generate the expected consequences for structural conflict; and, therefore, that our understanding of the structure of creationism cannot be simply extrapolated from its content of belief.

Acknowledgments

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A Follow-up to "Science or Animism?"

James E. Mickle

Stewart (1992) published results of a survey on animistic beliefs given in 1954 and repeated in 1989, finding that animistic beliefs seemed to have increased in that 35 year period. In his discussion of the survey results he suggested that his 1989 sample might be atypical, and called for additional surveying elsewhere. This communication reports the results of a survey given in my general biology class for nonmajors.

The majority of the students in my course are humanities, social sciences, or business majors, with a few students in engineering and life sciences. About 86% of the student body of NCSU is native to North Carolina; presumably this ratio is reflected in the makeup of general biology classes. I would assume that a similar situation exists for Michigan State University, where Stewart made his 1989 survey.[1]

I gave the five survey questions (Stewart, 1992) as the last five questions of a 43 question, multiple-choice exam. This was the first exam of the semester. It was made clear to the students that on these five questions, all answers would be counted as correct for the purpose of the exam and that they should indicate what they honestly thought was the best answer. Exam points were given to encourage the students to complete the survey. Two hundred twenty students took the exam, which they had 50 minutes to complete.

The results that I obtained were remarkably similar to the 1989 results of Stewart (1992; Table 1), especially questions 1, 2, and 4. Discrepancies were seen in questions 3 and 5, answers D and E in each case. The 1992 students showed a lesser tendency toward animism in these answers than the 1989 survey, but in both cases, a majority (#3) or a large minority (#5) of students showed at least some animistic thinking in their responses. Stewart (1992) mentions that the 1954 survey was given after completion of the general biology course; mine was administered four weeks into the course. Whether this difference affected the outcome of the survey is unclear.

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The results of my survey suggest that Stewart's sample was not atypical, and that many, in some cases a majority of, students surveyed showed a general tendency to accept animistic explanations for phenomena. The regional difference (Michigan vs. North Carolina) in the student bodies surveyed indicates that these beliefs are widespread and pervasive. These results are especially surprising and discouraging in that the material tested by my exam included the characteristics of living things, as did laboratory exercises completed before the exam was given. This suggests that classroom and laboratory experience may be of little help in reversing entrenched student beliefs, as seems also to be the case with creationism (Lawson and Worsnop, 1992).

Stewart (1992) concluded that this type of biological nonsense should be checked and efforts made to counteract it. The results of these surveys indicate that we have a huge job ahead of us to do so.

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avoids explicitly biblical terminology. For example, Noah's flood is called "a worldwide hydraulic cataclysm" (*e.g.*, Morris and Parker 1987:16).

When the U.S. Supreme Court overturned a Louisiana law mandating "balanced treatment" for creationism, ICR redoubled its effort to persuade teachers to teach it on their own initiative. The Charleston rally is part of this effort. But *teachers should know that promoting creationism in public schools clearly violates the First Amendment.*

ICR's leaders have proven, by their own examples, that one can earn a doctorate in a branch of science and then abandon the standards of self-critical reasoning that science requires. As the following examples show, "creation science" is the result of this abandonment. It represents the triumph of rhetoric, self-deception, and wishful thinking.

Scientists have agreed for 30 years that Earth is about 4.5 billion years old. [A new book by G.B. Dalrymple (1991), *The Age of the Earth*, details the various kinds of evidence that underlie this consensus.] In contrast, Henry Morris, president of ICR and the "leading creationist scientist," insists the entire universe was created in six days, less that 10,000 years ago. In *What Is Creation Science?* Morris lists 68 arguments that yield various estimates of Earth's age, all less than a billion years. For each, Morris lists "the indicated age of earth" (Morris and Parker 1987:288-191). Figures for the last 27 are copied from an oceanographic handbook which presents them as "residence times" of various elements in the ocean, that is, the average length of time an atom of the element stays dissolved in ocean water (Riley and Skirrow 1965:164). Residence times do not indicate the age of Earth, so Morris is guilty here of blatant misrepresentation. His other 41 arguments are similarly flawed.

Astronomers have observed light from galaxies more than 10 billion light-years away, light that left those galaxies that many years ago. So the universe must be at least that old.[1] [Creationists counter that God could have created the universe recently, with the light from distant sources already in transit. (Since, according to *Genesis* 1, light shone on earth on Day 1 and the sun wasn't created until Day 4, Morris says God must have created the light *before* he created its source (Morris 1974:224 fn.).) But in 1987 astronomers saw a supernova (exploding star) 160,000 light-years away, an event that therefore happened 160,000 years ago. If creationists insist the universe is only 10,000 years old, does that mean God created light coming from an event that never happened?]

Our moon, the planet Mercury and other bodies are saturated with impact craters formed early in the history of the solar system, when many objects were still colliding. On Earth, evidence of this bombardment has since been destroyed by erosion and crustal movements. But if, as Morris says, Adam and other living things were on earth within six days of the beginning, when did the bombardment of Earth occur? During the single year of Noah's flood, suggests ICR's Don DeYoung (Whitcomb and DeYoung 1978:97). But the

heat from all those impacts concentrated in one year would have vaporized the flood waters entirely and incinerated the Ark.[2] Morris, abandoning natural explanations altogether, has suggested that the moon's craters might "reflect some kind of heavenly catastrophe associated either with Satan's primeval rebellion or his continuing battle against Michael and his angels" (Morris 1978:67).

Earth's sedimentary rocks are miles thick in places. Scientists say it took 6 million years to accumulate the half-mile thick, 12 million alternating light and dark layers of the Green River formation in Wyoming and Colorado. But Morris, who says that most of earth's sedimentary rocks were deposited during the single year of Noah's flood, suggests that the layering of the Green River formation might be due to "slight changes in velocities or compositions of the turbidity currents" of the flood (Whitcomb and Morris 1961:428). This is a good example of creationist gobbledegook. Simple arithmetic shows that one layer would have had to be deposited every one or two seconds.

The earliest fossils date back more than 3 billion years. Until shortly before the beginning of the Cambrian period 570 million years ago, all fossils are of single-celled organisms. Then, early in the Cambrian period, soon after many-celled organisms first appeared, there is a rapid increase in the variety of such organisms. Duane Gish, ICR's vice president, asserts that this "sudden" appearance of many different organisms supports creationism. But Gish knows that, if all kinds of organisms were created during the same week, fossils of many-celled organisms should occur mixed in with those of single-celled organisms in pre-Cambrian rocks. So, to cast doubt on the fact that single-celled organisms existed alone on earth for vast eons, Gish quotes some phrases from an A.E.J. Engel article expressing doubt about certain pre-Cambrian fossil claims. The fact that Engel's article begins by saying there are many undoubted pre-Cambrian fossils is ignored by Gish. This is plainly dishonest. (Gish 1985:55; Engel *et al.* 1968.)

It is true, as Gish loves to emphasize, that the fossil record is full of gaps. Also true is what Gish denies, that we do have many fossil sequences showing evolution of particular lineages. For example, *Basilosaurus* fossils have been known for some time as remains of an early whale (a mammal). In 1989 specimens were found complete with small hind limbs. Without any justification, Gish has insisted that these fossils were those of reptiles. (Schadewald 1990.)

[Scientists disagree on how, exactly, diverse hominid fossils are related to one another. They do agree that *Homo erectus* gave rise to our own species, *Homo sapiens*. Henry Morris has said that *H. erectus* is simply a variant human. Gish has called it an ape. Is it unreasonable to surmise that neither Morris nor Gish cares which it is, so long as they can claim in public that there are no intermediate fossils? (Morris 1974:174; Gish 1973:103.)[3]]

Here are some other questions for ICR's creationists:

Creationists Study Biological Variation

A review of a "Symposium" on Variation

Frank J. Sonleitner

Starting with the March 1991 issue, the *Creation Research Society Quarterly* has published a series of 15 papers constituting a "symposium" on variation. Of the ten authors with Ph.D.'s five are listed in American Men and Women of Science: Theodore P. Aufdemberge (geography), Wayne Frair (serology), Lester J. McCann (vertebrate zoology), Frank L. Marsh (botany, retired) and Emmett L. Williams (Materials Engineering). With the possible exception of Marsh, none seem to have any particular expertise in genetics. Frair is the only author who reports on his own original research.

Searching for the "Kind"

Emmett Williams' useful paper gives a short summary of all the articles on variation previously appearing in the *CRSQ*. These indicate that evolutionists believe in "infinite variation." What is meant by infinite variation is never explicitly stated, but it appears to mean that an animal breeder should readily produce large scale evolutionary transformations, ex.: horses into cows, dogs into cats, etc. Creationists, however, realize that only "limited variation," i.e., variation within a kind, is possible. What a "kind" is still eludes them. The papers seem to agree that kind is not species; one article identifies genus with kind, another family and still another some unit higher than family. The latter views also state that rapid speciation occurred to produce all the species within each of the kinds.

Bolton Davidheiser claims that because taxonomists cannot adequately define the concept of species, it cannot be said that creationists believe each species was created separately. Yet, in contrast to all the creationist authors

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cited by Williams, Davidheiser seems to doubt that speciation occurs at all. But if that is so, then each species must have been separately created. Darrel Kautz's examples would indicate that he also equates "kind" with species—roses always produce roses and humans always produce humans.

Paul A. Bartz's claim that "Creationists may now be poised to offer the first truly objective biosystematics" is overly optimistic. He admits that a definition of "baramin" (the creationists' technical term for "created kind") remains elusive, although he is sure that it is more inclusive than "species."

Wayne Frair's present viewpoint is that all turtles belong to a "monotypic baramin" having descended from the Triassic Proganochelys. Previously he considered the turtles as constituting a "polytypic baramin" (a baramin including several created kinds or ancestors?) with up to four diversification lines. Unfortunately for all the creationists trying to produce an objective definition of baramin, Frair does not say how he arrived at this conclusion. His belief that turtles constitute one created kind relies mainly on the lack of transition fossils linking turtles with other reptiles.

A New Definition of Evolution

Frank L. Marsh reviews the genetic basis of variation. His discussion of chromosomal aberrations, which takes up most of the paper, is quite good. But he (along with Javor, see below) tries to define evolution out of existence. Any genetic changes that can be observed are microevolution, even though they may involve the production of new genera and families. "The term macroevolution should be reserved for such speculative, assumed, and undemonstrable cases as the development of new basic types." Marsh equates organic evolution with the appearance of new basic types. Thus, by definition, one can never hope to see evolution. It's interesting that as an example of variation within a kind, i.e., microevolution, Marsh uses the example, "corn continues to bring forth corn." The evolution of corn (maize) from its wild ancestor (teosinte) involves considerable change in morphology and is considered a well-documented example of the origin of an evolutionary novelty, i.e., macroevolution. (Stebbins, 1982).

George T. Javor, like Marsh, tries to redefine evolution. Speciation is not evolution. Evolution requires that "a new life form" must emerge. Javor does not explain how to recognize "a new life form."

Solving the Problem of "Kinds" by Re-Mystifying Biology

Lester J. McCann claims that the genic control of the synthesis of proteins has nothing to do with the ability of cells to form the structure of embryos producing the patterns that lead to the finished organism. This is accomplished by some mysterious, nonmaterial "cellular intelligence." McCann

an eye by evolution . . . "would have gradual change from a simple to a complex eye *while maintaining perfect vision throughout the series*" (emphasis added).

Summary

Many of the papers in this symposium are steeped in scientific misinformation, only a few examples of which were mentioned above. None of the papers shed much light on the basic problems of the creationists. Views expressed by one author frequently contradict views held by other authors. What are the claimed limits to variation and how can they be recognized? This is the same as determining an operational definition of "created kind" so that one can resolve the question of which groups of species belong to different kinds. Because creationists usually identify the differences between kinds as representing macroevolution, it is also equivalent to defining macroevolution! Frair comes closest to answering these questions by utilizing gaps in the fossil record. But the problem facing creationists is that there are discontinuities in variation at every taxonomic level. Trying to find some fundamental difference at some level above the species is most likely to prove futile because none exists. Kofahl and McCann attempt to avoid this problem by making this fundamental difference supernatural. Another problem facing creationists is how did the original creations manage to incorporate all the variation later sorted out and expressed by the present day species? This is especially true if any speciation occurred after the genetic bottleneck imposed by the Flood (see Lammerts, 1975). For example, are we to suppose that Proganochelys possessed genes for all the variations of serum proteins that Frair has found in turtles? Finally, if all turtles are descended from one created kind of turtle in the space of a few thousand years, that's super evolution!

If turtles constitute a single kind, what about snakes? The Bible is very specific about a single serpent that walked and talked(!) and persuaded Adam and Eve to be disobedient. God punished the serpent by taking away its legs (and speech), condemning it to crawl on its belly. He punished Eve and all her female descendants to menstruate, suffer PMS and experience painful childbirth. This is a mythological explanation for these phenomena. But if we must take *Genesis* literally, then the original serpent must have been a parthenogenetic female from whom all present day snakes "evolved"—from tiny worm snakes to giant pythons to rattlesnakes with complex poison glands, fangs and infrared heat sensors to hunt down small nocturnal mammals. That's quite a bit of evolution to occur in a few thousand years! Or did the creator do a lot of extra creating long after the initial creation week? Jones inadvertently sums up the symposium quite accurately when he admits that: " . . . evolution . . . offers a comprehensive (if incomplete) explanation . . . " while creationists have no "coherent alternative theory."

The Symposium Papers

Creation Research Society Quarterly 1991, 27(4) March:

I. Williams, E.L. Possible Variability in Living Organisms—A Review of *CRSQ* Writings. pp. 144-149.

II. Davidheiser, B. What is a Species? pp. 149-151.

III. McCann, L.J. Is More Than Gene Action Required to Account for Variation? pp. 151-153.

Creation Research Society Quarterly 1991, 28(1) June:

IV. Bartz, P.A. A Refinement of Biosystematics which Reflects Baraminic Variation. pp. 18-20.

V. Frair, W. Original Kinds and Turtle Phylogeny. pp. 21-24.

VI. Kautz, D. The Limits of Biological Variation. pp. 24-25.

VII. Javor, G.T. Similarities and Diversity among Organisms: Which World-view Do They Support? pp. 25-27.

Creation Research Society Quarterly 1991, 28(2) September:

VIII. Anderson, K.L. New Trends in the Molecular Basis for Variation. pp. 50-51.

IX. Major, T.J. Problems in the Interpretation of Variation within the Fossil Record. pp. 52-53.

X. Marsh, F.L. Biological Variation. pp. 54-59.

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XI. Aufdemberge, T. Variation and Fixity as Seen in Climatology. pp. 98-100.

XII. Jones, J.B. The Limits to Variation. pp. 100-102.

XIII. Culp, G.R. The Limitations of Variation. pp. 102-108.

Creation Research Society Quarterly 1992, 28(4) March:

XIV. Kofahl, R.E. Is the Genome Sufficient, Where is the Design Information and What Limits Variation? pp. 146-148.

XV. Crofut, B. The Family Blattidae: An Example of "Evolutionary Stasis." pp. 149-155.

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C/E

Reviews

From the Beginning: The Story of Human Evolution
by David Peters. New York: Morrow Junior Books, 1991. 128 pp., $14.95

Reviewed by William Thwaites
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Every Junior or Senior high school student in the country should have a chance to read *From the Beginning: The Story of Human Evolution* by David Peters. The book contains a wealth of information that has not been available in such a convenient and enjoyable format. Peters has put in one place the story of our own evolution all the way from the formation of the universe to modern Homo sapiens.

There are at least three major features that make the book far better than any public school text I have seen so far:

1. The origin of life, evolution, and human evolution are covered in a straight-forward, matter-of-fact manner. There is not even a hint of apology or equivocation. The reader won't find phrases such as "some scientists believe" in Peters' book. It obviously hasn't been sanitized by some well-meaning, but poorly-informed, textbook committee.
2. The style of writing is lively, contemporary and engaging on a personal level. I have met young people who could perceive almost anything as "boring," but such a perception would be difficult with *From the Beginning*.
3. The illustrations are large, well done, original, and copious. Peters is both an illustrator and an author. The art work is the heart of the text. In combination with the boisterous writing style it makes the text fun to read and easy to understand.

Several notes of caution should be mentioned, however. Peters deals with some of these in the introduction. The title of the text, for example, indicates that the text will cover mainly the events that led to humans. This results in a more or less linear progression from atoms to people. Peters cautions that this "may give the false impression that evolution is a ladder of progress reaching toward a goal." I hope that readers will take this admonition to heart.

Since stars are being "created" right now, their completed creation in Genesis is a fable.

In the first creation account everything leads up to man, the animals having been created before man. The second creation account begins with man and works down, the animals having been created after man. Thus, we have another contradiction.

In Henry Morris's instant, created-age scenario we also have the embarrassing possibility of seeing a supernova blow up twice when, in fact, there was only one explosion! Suppose a star 7000 light-years away is seen exploding tonight. Since the earth is "really" only 6000 years old that means the light carrying that information had to be created in space 6000 light-years away so as to reach us now. (Remember, the special creation act was completed during the Genesis creation-week.) But, if that star actually exploded just after the universe had been created (The earliest possible date) the light from the explosion would reach us in 7000 years. Thus, we would see one explosion now and a future generation would see another explosion 1000 years later! If, instead, that star actually exploded today (the latest possible date), then there would be a 7000-year interval before seeing the second explosion. If that star never actually exploded, only appearing so, then we branch to a portion of Oblath's analysis. In every case the ultimate consequence of "instant age," as applied to our universe, is deception. Since there was no need for God to create unstable stars, Henry Morris's scheme of instant age involves a willing deception on God's part!

The attack on science, and on evolution in particular, comes directly from the biblical inerrancy crowd. Therefore, I find Michael Oblath's article highly relevant. I trust we will be treated, occasionally, to raids on the domain of biblical inerrancy.

Dave E. Matson
Pasadena, CA

Response to Johnson Review

• *I was appalled by the review of Phillip Johnson's Darwin on Trial by Eugenie C. Scott and Thomas C. Sager in the Winter 1992 edition. They argue that because Johnson is a respected legal scholar, he is precluded from thinking clearly about evolution by descent or natural selection. In their opinion, Johnson should say nothing about evolution because his legal background disqualifies him.*

Evolutionists should welcome Johnson's book. His belief that humans and major adaptations generally must have been produced by some kind of purposive process is shared by the vast majority of people in the USA. Scott and Sager are fearful that Johnson might mislead naive readers. Surely the decent response to Johnson by evolutionists is to refute his arguments about

design in evolution with evidence and carefully reasoned arguments based upon that evidence. What kind of debate can we have in this country about evolution if those who believe in purpose are automatically excluded?

The attempt to declare Johnson out of court on the issues surrounding purpose in evolution strengthens one of his primary arguments: that a small band of hard-core evolutionists is trying to shut off substantive discussion of the issues that most people find fascinating about evolution.

In my evolution course at Cornell this past fall (enrollment 400+) I assigned Johnson's book as our first reading, followed by Darwin's On the Origin of Species, Dawkins's The Blind Watchmaker, and Sagan and Druyan's Shadows of Forgotten Ancestors. Phillip Johnson came to give a guest lecture. The intellectual stimulus of his book and lecture was great and lasted throughout the course. In the beginning of the course, about 75% of the students were either creationists or believed in purposive evolution; this figure dropped to about 50% by the end of the course.

The Scott and Sager review is self-defeating and elitist. I hope it does not reflect a widely-held view among evolutionary biologists.

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