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THE ELUSIVE SCIENTIFIC BASIS OF CREATION "SCIENCE"

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ABSTRACT

Is there, as claimed, scientific support for "scientific creationism"? If so, arguments that scientific creationism is a legitimate scientific discipline deserving "equal time" with evolution in public-school science classes would be strengthened. An early study (Cole and Scott, 1982) revealed that 28 prominent creationists did not publish articles dealing with empirical, experimental or theoretical evidence for the scientific creationist "model" in over 4000 journals covered by the data-retrieval system SCISEARCH. To see if other scientific creationists were publishing proofs of creation, we surveyed editors of 68 journals to which scientific creationists would be likely to submit articles on this subject. Out of over 135,000 submissions from 1980 to 1983, only 18 dealt with empirical, experimental, or theoretical support for scientific creationism, and 12 of these went to one science education journal alone. No creationist articles have been published, although three were still under review at the time of this study. Papers were rejected due to poor scholarship, with editors commenting that the articles appeared to have been written by laymen rather than professional scientists. A number of differences are apparent in comparing the scholarship found in "in house" creation science sources and "mainline" scientific journals. Although scientific creationists complain that "completely scientific papers" would be rejected out of hand by "mainline" journals, it is obvious that none have been submitted. Outside of creationist outlets, then, there is no "scientific" creationism. We have documented this as a service to the teachers, professors, and lawyers who are striving to maintain high standards of science education in the face of pressures to introduce non-scientific concepts into the public school classroom.

AT THE TIME of this writing (Summer, 1984), the scientific creationism/evolution controversy in the United States is viewed by most members of the scientific community as ancient history. Judge Overton's gracefully written decision in *McLean vs. Arkansas* (Anonymous, 1982) appeared to sound the death knell for efforts to require the teaching of scientific creationism in public school science classes. And indeed, that decision depressed legislative attempts to promote

scientific creationism. In the months following the Overton decision, ten scientific creationism bills died, were killed, or were withdrawn in state legislatures (Weinberg, 1982).

One battle remains in the legislative war: Louisiana, where two lawsuits were at one point proceeding simultaneously, with anti-creationists as plaintiffs in one and as defendants in the other. Evolutionists were disappointed that the Overton decision was not appealed; a favorable decision in an appellate

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court would have made the Arkansas case a useful precedent for the Louisiana trial and any others. Hopes were raised when the Louisiana State Senate voted in May of 1984 to repeal the law, which would have eliminated a costly trial had the House of Representatives followed suit. Unfortunately, strong lobbying by creationists resulted in a lopsided vote of 41–26 against the repeal (Levin, 1984b). As part of the Arkansas decision, the plaintiffs (anti-creationists) were awarded close to \$400,000, a sum that we assume would make most states cautious about becoming involved in such trials. Creationists, however, are confident they will succeed in Louisiana, where “their” lawyers are arguing the case rather than an outsider, as was the case in Arkansas.

Even if we assume that the eventual Louisiana trial will be another setback to the creationist cause, by no means will this be the end of the controversy. Trial results unfavorable to the creationist cause will probably halt the trickle of bills introduced into state legislatures, but even now the scientific creationism movement is focusing on the local, rather than the state, level. Attempts are being made to convince local school boards to mandate the teaching of creationism. Even more difficult to monitor are the attempts by individual teachers to teach scientific creationism on their own that are already occurring in many parts of the United States (Moyer, 1984).

Scientific creationists are reluctant to have creationism taught in social studies or comparative religion classes, because this would reduce their fundamental Christian world view to merely another of the world views of many religions and cultures. They insist that creationism belongs in the science classroom. Scientific creationism must have scientific backing to be taught in science classes. Arguments that the creationist view is better supported by scientific facts than is evolution is a major thrust of their campaign. In the Institute for Creation Research “Tenets of Creationism” (Morris, 1980), *scientific* creationism is distinguished from *Biblical* creationism as having “no reliance upon Biblical revelation, utilizing *only scientific data* to support and expound the creation model” (italics in original).

What is the nature of this body of scientific data, and where can it be found? There is, of course, a body of *scientific creationist* literature that presents “evidence” for the young earth, Noah’s Flood, and Special Creation. Creation Life Publishers (now Masterbooks) has an extensive series of books, pamphlets, tapes, and video cassettes available for purchase, and also publishes the high school biology textbook, *Biology: A Search for Order in Complexity*. This is the publishing wing of the Institute for Creation Research (ICR), a major distributor of information on creation “science” as well as advice for introducing creationism into local schools. The ICR publishes science research articles in the IMPACT series, which accompanies their free monthly newsletter *Acts and Facts*. The oldest journal devoted strictly to the scientific evidence for creationism is the *Creation Research Society Quarterly*, published by the Creation Research Society (CRS). The Bible-Science Association (B-SA) publishes the *Bible Science Newsletter* and *CONTRAST*, which is their equivalent of the ICR *IMPACT* series. The B-SA also has a large list of pamphlets, books, tapes, and other educational materials. The Creation Social Science and Humanities Society publishes the *Creation Social Science and Humanities Quarterly*. The American Scientific Affiliate (ASA), an association of Christian scientists, takes no official stand on scientific creationism, and the *Journal of the American Scientific Affiliate* publishes articles both pro and con. Internationally, Creation Science in Australia publishes *Ex Nihilo*, which also has a U.S. office.

Examination of publication affiliations, content, and editorial guidelines for authors of these journals leads one to question the claim that scientific creationism is independent of religion. Authors who publish in the *Creation Research Society Quarterly* subscribe in writing to the belief that the Bible is the “written word of God and that all of its assertions are historically and *scientifically* true” (emphasis added). The *CRSQ* is not listed in *Science Citation Index*, but it appears in the *Christian Periodical Index*. The ASA also has a statement of belief that supports both religion and science: God is the Creator, but there is no dogma as to how he created (Stipe, 1977).

The major suppositions of creationism are

found in a "Summary of the Scientific Evidence for Creationism" by Gish, Bliss, and Bird (1981). This document reveals much about the nature of creationist scholarship. These claims may be summarized as follows:

- (1) The universe and the solar system were suddenly created. "Evidence" for this comes from the second law of thermodynamics in that "the Universe could not have created itself, but could not have existed forever, or it would have run down long ago. Thus the universe, including matter and energy, apparently must have been created." The "argument from design" is also invoked, an explanation outside of the realm of science.
- (2) Life was suddenly created. "Evidence" for this is also seen in the second law of thermodynamics, as "... simple molecules and complex protein, DNA and RNA molecules seemingly could not have evolved spontaneously and naturalistically into a living cell: such cells apparently were created."
- (3) Present plants and animals have remained fixed since creation, with only limited genetic variation within the originally created kinds. Gaps in the fossil record occur between "kinds" such as "single celled organisms and invertebrates, between invertebrates and vertebrates, between fish and amphibians, between amphibians and reptiles, between reptiles and birds or mammals, or between "lower" mammals and primates" Later, "kinds" are defined as reproductively isolated, interfertile groups of organisms, corresponding generally to species. The definition of a "kind" therefore extends from phyla to species, making it a most flexible concept.
- (4) Mutation and natural selection are insufficient to have brought about the emergence of present living kinds from a simple primordial organism. To support this claim, Gish, Bliss, and Bird (1981) state that mutation and selection have an "infinitesimally small" probability of producing more complex living kinds from simpler kinds. They also claim that mutations in the aggregate are "nearly always harmful" and that good ones are too infrequent to account for evolution.
- (5) Humans and apes have separate ancestry. Quoting the British anthropologist Lord Zuckerman, Gish, Bliss, and Bird (1981) again claim a lack of transitional forms.
- (6) Catastrophic processes are the main forces shaping Earth's geology. "Geological data reflect catastrophic flooding. Evidence of rapid catastrophic water deposition in-

clude fossilized tree trunks that penetrate numerous sedimentary layers (such as at Joggins, Nova Scotia), widespread pebble and boulder layers (such as at the Shinarump conglomerate of the Southwestern United States), fossilized logs in a single layer covering extensive areas (such as Petrified Forest National Park), and whole closed clams that were buried alive in mass graveyards in extensive sedimentary layers (such as at Glen Rose, Texas.)"

- (7) The Earth is about 10,000 years old, and no more than 20,000 years old. "Evidence" for this claim is the faultiness of radiometric dating methods, where assumptions such as constancy of decay rate are questionable. Gish, Bliss, and Bird (1981) also claim that alternative methods of measuring the age of the earth, such as use of the earth's magnetic field decay and estimations of cooling times of the earth, support a young earth.

We were curious about whether any creationist science existed outside of their own journals and publishing houses. In 1982, we published an article describing our first attempt to examine creationist claims of positive scientific support (Cole and Scott, 1982.) We searched the scientific literature from January, 1978 to October 1981, using SCISEARCH, a computerized listing of Science Citation Index plus an additional 1000 journals and proceedings from technical fields. Reasoning that the most prominent creationists would be most likely to publish, we searched both under the names of all editorial board members of the Creation Research Society and research associates and technical advisors of the Institute for Creation Research, and also for keywords such as "creationism", "scientific creationism", "special creation", etc. The keyword search netted only 18 items: 4 articles critical of scientific creationism as pseudoscience, 5 editorials discussing the controversy itself, and 9 letters to editors expressing opinions for or against. Nothing resembling empirical or experimental evidence for scientific creationism was discovered.

A search under the names of 28 prominent scientific creationists revealed a large number of publications. However, it was necessary to check the institutional identification and the specialty field of the author because of common last names and initials. For example,

there are two Henry M. Morris's, both in engineering. One had 27 publications, the other had one. The latter was affiliated with the Institute for Creation Research; through a telephone call we discovered the former was a reviewer for the journal *Control Engineering*, and had no affiliation with creationism. Even more confusing was the case of a productive University of Texas-Austin astronomer, T. G. Barnes, with 13 publications. Was he the creationist astronomer Thomas G. Barnes from University of Texas-El Paso, author of the new *Physics of the Future: a Classical Unification of Physics*, "showing that the modern innovations of relativity theory and quantum mechanics are unnecessary and ultimately barren?" He was not. A telephone call to Austin revealed two Texas T. G. Barneses.

After this and similar detective work had been completed, we discovered only six of the 28 prominent creationists had published anything at all during the 45 months covered by our survey. These six had published 52 articles. Two creationist authors had published 75 per cent of the articles, with 17 and 22 publications respectively. All of the articles dealt with the professional or technical field of the author, and included topics such as the chemistry and physics of food processing, simulation studies of loads, vibrations and stresses in aircraft wing structures, the effect of pollutants on aquatic microorganisms, and so forth. None of the articles dealt with theoretical support for the assumptions and concepts upon which scientific creationism is based.

The prominent scientific creationists we surveyed do not appear to be publishing studies supportive of scientific creationism in recognized scientific journals. However, our procedure (keywords and author name searches) could overlook other scientific creationist research. Although it would be impossible to review all scientific literature, we felt a survey of journal editors might accomplish much the same end.

We sought United States journals to which scientific creationists would be likely to submit articles. Criteria for journals were that they:

- (1) publish scientific articles relevant to the subject matter of scientific creationism (i.e., are non-medical journals in astronomy, an-

thropology, biology, chemistry, geology, and physics),

- (2) are refereed,
- (3) publish volunteered papers rather than solicited articles or symposia,
- (4) are generalized rather than specialized in focus,
- (5) have a basic rather than applied research focus,
- (6) have an empirical rather than philosophical focus,
- (7) are intended for professional audiences, not popular audiences (i.e., not *Science 84*, *Scientific American*, *Discovery*, *Physics Today*, etc.),
- (8) draw submissions nationally rather than regionally, and
- (9) primarily publish articles rather than abstracts.

An exception to rule 9 was *American Zoologist*, which publishes papers and abstracts from the annual meetings of the American Society of Zoologists. Anyone who is a member of the Society can present a 15 minute paper on any topic at the meetings, or can give their "space" to someone else. Abstracts are not refereed and all are published. Such an open procedure would counteract any alleged muzzling of creationist beliefs, thus we retained *American Zoologist* to give creationists all possible chances of getting into our survey. We also retained the *Proceedings of the National Academy of Science*, which accepts articles only from NAS members and individuals sponsored by NAS members. Creationist publications regularly extoll the prominence of their scientists; there is no apparent reason why one of them could not be an Academy member, or alternatively, request a member to submit an article upon his behalf.

Another exception, but one which also increased the opportunity for scientific creationists to publish in relevant outlets, was the addition of science education journals in biology, physics, chemistry, and geology. As will be shown, this inclusion accounted for two-thirds of the creationist submissions.

We compiled a preliminary list of journals after consulting reference sources (Sheehy, 1976; Garfield, 1972, 1976; King, McDonald, and Roderer, 1981; Katz and Katz Sternberger, 1982; Renschler, 1982; Kronik, 1982). We then requested science librarians in geology, astronomy-chemistry-physics, and biology libraries to review our list, and

add or delete choices based on their professional experience. As a further check, we consulted colleagues in the various fields. Based on our criteria and selection process, 68 journals were surveyed.

The editors of the following journals were questioned: American Anthropologist, American Journal of Physical Anthropology, Human Biology, Journal of Human Evolution, American Ethnologist, Ethnology, Journal of Anthropological Research, Social Biology, Plains Anthropologist, Anthropological Quarterly, Current Anthropology, BioScience, Federation Proceedings, Quarterly Review of Biology, American Naturalist, American Zoologist, Journal of Molecular Biology, Journal of Bacteriology, American Journal of Botany, Botanical Gazette, Plant Physiology, Botanical Review, Evolution, Journal of Paleontology, Paleobiology, Quaternary Research, Journal of Molecular Evolution, Evolutionary Theory, Systematic Zoology, Genetical Research, Life Sciences, American Journal of Physiology, American Journal of Human Genetics, Genetics, Journal of Theoretical Biology, American Biology Teacher, Journal of the American Chemical Society, Journal of Biological Chemistry, Accounts of Chemical Research, Chemical Reviews, Biochemistry, Biochemical and Biophysics Research Communications and Annals of Biochemistry, Inorganic Chemistry, Journal of Chemical Education, Astrophysical Journal, Astronomical Journal, Astronomy Quarterly, Sky and Telescope, Icarus, Physical Review (A, B, C, D), American Journal of Physics, Foundations of Physics, International Journal of Theoretical Physics, Reviews of Modern Physics, Physics Teacher, Physical Review Letters, Annals of Physics, Bulletin of Geological Society of America, Journal of Geology, Geology, Journal of Geological Education, American Journal of Science, Science, Proceedings of the NAS.

After pre-testing our questionnaire on ten journals in the fall of 1982, we made two mailings to editors during 1983. Except for a few telephone call followups in January of 1984, the study was completed during 1983. We requested editors to report on submissions during the previous three years (1980-1983). We sent editors a check sheet asking them to report some basic information about the journal (number of years as editor, number of articles submitted and published)

and information about the number of articles dealing with substantive, empirical, or theoretical scientific creationism topics that had been submitted, reviewed, rejected or published during the previous three years.

In case the editor was not familiar with the scientific creationism "model", we included a list of topics commonly found in scientific creationism journals such as the *Creation Research Society Quarterly*. To be sure that the article dealt with substantive creationist ideas, rather than articles *about* creationism, we asked editors to list topics covered in articles submitted on scientific creationism. Any editor reporting submission of creationist articles was contacted by telephone; in some cases the article in question merely concerned the creation/evolution controversy. Journal editors and editorial assistants were all cooperative and helpful.

Some editors were precise about the total number of submissions on all topics (e.g., "1154"); some were general (e.g., "ca. 600"). We took the midpoints of estimates to provide a conservative estimate of over 45,000 submissions to these 68 journals each year (135,000 for the 3 year period). Almost 26,000 articles per year were actually published for a total of approximately 78,000 during the period of our study. Five journals reported the submission of a total of 18 scientific creationism articles during the three-year period of the survey: two science education journals, two anthropology journals, and one biology journal (Table 1). The articles were unevenly distributed; one of the education journals received twelve of the 18 submissions. The biology journal and the other science education journal received one submission each; one anthropology journal received one submission.

TABLE 1
Results of journal editors survey

	Number of Submissions	Number of Rejections	Number Published
Journal A	1	1	0
B	1	1	0
C	1	1	0
D	3	3	0
E	12*	9	0
Total	18	15	0

* 3 articles still under review

sion, and the other anthropology journal received three. None of the submitted articles has been published, although three of the twelve submitted to the education journal are still under review.

Reviewer comments regarding rejected articles complained about poor presentation ("ramblings. . ."; "no coherent arguments. . ."; "high-school theme quality. . ."; "tendentious essay not suitable for publication anywhere. . ."; "more like a long letter than a referenced article"), and failure to follow accepted scientific canons ("no systematic treatment. . ."; "does not define terms. . ."; "flawed arguments. . ."; "failure to acknowledge and use extensive literature on particular questions. . .").

As indicated above, we included the *American Zoologist* because of its open policy on submission of abstracts. To the best recollection of the editor, no papers had been delivered on empirical evidence for scientific creationism during the time period of the survey.

Our first study showed that some creation scientists perform science well enough to be published in standard scientific journals. A small number of these are quite productive, but apparently only in their non-creationist specialties. Our second-study showed that the miniscule number of submitted articles advocating scientific creationism (18 out of 135,000) do not appear to have been written by professional scientists. From the reviewer's comments, it appears as if laymen rather than professional scientists are submitting the few articles that have surfaced during the last three years. Why don't the professional scientists among the creationists publish empirical, experimental, or theoretical evidence for scientific creationism? One answer to this question can be found by comparing the scholarship found in "in house" creationist science sources to that found in "mainline" scientific sources.

Among other differences, there is a difference in the application of logic. Scientific creationists view the creation/evolution controversy as having only two alternatives: evolution or their Biblical literalist view of creation. Oddly, if conveniently, origin stories of all other human cultures are defined as *evolutionary* (Morris, 1975). Given this dichotomy, arguments *against* evolution are arguments

for creation. Most of the "scientific" evidences "for" creation presented in Gish, Bliss, and Bird (1981) and other scientific creationism sources are of this type: the second law of thermodynamics prohibits evolution, thus creation must have occurred. By their definition, there are no intermediate "kinds." Evolution is impossible; therefore creation must have occurred. If you are wrong, then I am right.

As part of the argument against evolution, much is made of anomalies allegedly "incompatible" with evolution but "compatible" with special creation, ignoring the vast amount of observations compatible with evolution. In what Dutch has called the "residue fallacy," a phenomenon that evolution "cannot explain" is used to imply that the whole scientific system is suspect (Dutch, 1982a). One anomaly, of course, does not make a whole theory fall. Probably the best anomaly in the scientific creationists' arsenal is the existence of polonium halos, a "minor mystery" in Judge Overton's words, of which the scientific creationists are quite proud. Gentry (1982a) claims that the existence of Po halos in granite, coalified wood, mica, and other substances indicate that such materials were formed suddenly, under cool conditions, an interpretation supporting special creation. These observations, however, have alternative explanations within normal physical science, and are therefore not unambiguous evidences for Special Creation (Dutch, 1982b; Hashemi-Nezhad, Fremlin, and Durrani, 1979).

Creationist scientists regularly extrapolate from mainline scientific publications to conclusions which support their perspective. All scientists extrapolate to some degree from observation to conclusions, but creationist extrapolations regularly border on the extreme. Many "proofs" of special creation involve extrapolations of rates of change, often taken from evolutionary sources. Thus one source gives a rate of deposition of meteoritic dust on the moon (Peterson, 1960); if one extrapolates from this rate, and if one assumes that the moon and earth are billions of years old, the moon should be covered with hundreds of feet of dust, not just a few inches (Morris, 1974; Kofahl and Segraves, 1975; Barnes, 1982; see Awbrey, 1984, for cri-

tique). If one extrapolates the rate of erosion of land masses from the current rate, then all the continents would be washed away if the world were billions of years old (one must ignore well-established principles of isostasy, origenics, and tectonics). In another example, by assuming a constant rate of oil seepage, a young age for the earth's crust was calculated from a *Science* article discussing the relationship between oil seepage and oceanic pollution (Anonymous, 1975; citing Blumer, 1972). Nothing in the *Science* article hinted at this Special Creation application of its results. Readers of scientific creationist literature are familiar with the "living mollusk which was tested by Carbon 14 . . . the reading showed it had been dead for 3000 years" (Chick, 1976, citing Keith and Anderson, 1963). The original article did indeed describe this occurrence, and use it to argue that riverine mollusks (as opposed to lacustrine or marine molluscs) should not be used for carbon 14 dating. The authors of the original article are not rejecting Carbon 14 dating, but recommending ways in which its use might be improved.

Occasional claims are made for "positive proof" of creation, rather than extrapolations, but not much exists in terms of specifics. The dinosaur tracks of the Paluxy River, Texas, are accompanied by some erosional features claimed to be human tracks (Weber, 1981). If these were true human tracks, then this would be evidence compatible with the creationist model, and most difficult for evolution to accommodate. Some creationists even admit that the better tracks are man-made carvings (Neufeld, 1975; Morris, 1976). Natural erosional processes explain the rest (Cole and Godfrey, in press). The Paluxy River tracks are far from the "silver bullet" terminal refutation that creationists think they are.

We found some cases in which articles written by creationists, with no reference to scientific creationism, were published in mainline journals, but the arguments therein later surfaced elsewhere as "evidence" for the scientific creationist model in in-house publications. These articles present a phenomenon or principle derived through acceptable scientific methodology that, with some stretching, can form the *base* for extrapolations sup-

porting scientific creationism. For example, debates recently took place in scientific journals about the significance of the orientation of petrified wood in Yellowstone National Park (Fritz, 1980; Coffin, 1983; see also Retallack, 1981 and Yuretech, 1981 for comments). The issue concerns in part whether certain formations are composed of trees in situ or trees transported by water from many areas. No mention is made in the scientific journals about the source of water being Noah's Flood, but this is the scientific creationist interpretation (Kofahl, 1977).

Similarly, Robert V. Gentry recently called attention to his polonium halo research which supports a young earth model, although there is little in the original, published sources that would suggest that the articles promote creationism. A letter by Robert V. Gentry in *Physics Today* (1982a) lists articles that discuss his hypothesis. The original articles offer only the vaguest suggestions that this research might be used elsewhere to support scientific creationism. In an article in *Nature* (Gentry, Cristy, McLaughlin, and McHugh, 1974), he asks "Do Po halos imply that unknown processes were operative during the formative period of the earth?" He makes no statement about special creation here, however, and in fact goes on to posit another kind of explanation: "Is it possible that Po halos in Precambrian rocks represent extinct natural radioactivity and are therefore of cosmological significance?" Later in the article (p. 566) another hint is offered: "Just as important as the existence of a new type of lead is the question of whether Po halos which occur in a granitic or pegmatic environment . . . can be explained by accepted models of Earth history." In the *Physics Today* letter and in a Bible-Science Newsletter (1982b) he is explicit about this work being "published evidence for Creation." Articles of this sort are likely what creationists refer to as "masked" literature. "Whenever these articles or books (sent to standard scientific journals or secular book publishers) have creationist implications, however, they must be "masked" in order to get them published in secular outlets. So far, at least, all frankly creationist articles or books are simply rejected out of hand by such publishers" (Morris and Parker, 1982 p. 268).

The phenomena described in this "masked" creationist literature usually fits accepted theory, and can be viewed as evidence for creationism only by going considerably beyond the data. Whether or not water is responsible for particular geological phenomena is a legitimate issue; that this therefore implies a world-wide flood that covered Mt. Everest with 22 feet of water (Whitcomb and Morris, 1961) is a conclusion which any editor would reject as unsupported. Perhaps this is what creationists mean by their inability to publish "frankly creationist works. If so, it is understandable. We found no evidence for "out of hand" rejections. The articles appeared to have been rejected on their lack of merit. Although we did not survey our editors as to *whether* they would ever publish a "frankly creationist" article, several volunteered that they would, if it met their standards of quality; one editor added, "and [I would] look forward to some interesting letters to the editor."

We think the reason why creationists who are competent scientists in their own fields do not publish empirical, experimental, or theoretical evidence for creation in standard journals has more to do with the difficulty of justifying such a model scientifically than with a conspiracy of editors. Paul A. Bartz, editor of the Bible-Science Newsletter, questions rhetorically in an editorial, "So what future is there for the creation scientist who submits a clearly creationist but completely scientific paper for publication in an evolutionist-dominated publication?" (Bartz, 1983, p. 3). The answer is that if such an article can actually be written, it has as good a chance of getting published as any other "completely scientific paper." The authors will have to avoid "you're wrong, so I'm right" logic, reliance on anomalies for evidence, and unreasonable extrapolations from observations. Mostly, they will have to construct testable (i.e., rejectable) questions, and give up reliance on the occasional miraculous intervention. If creationists can overcome the styles of argument which they utilize, and avoid unreasonable leaps beyond what the data allow, they have no less an opportunity to be published in mainline journals as other scholars. But when only 18 articles are submitted to 68 journals in three years, and

those articles are submitted apparently by persons not skilled in established scientific methodology and theory, it is inappropriate to invoke censorship. To be published, one must first submit, and scientific creationists are apparently not submitting manuscripts.

It is difficult to accept "surreptitious" literature as establishing a body of empirical, experimental or theoretical science. Outside of creationist sources, therefore, there is no "scientific" creationism. The reason for this is not a conspiracy against scientific creation or scientific creationists, but the scientific shortcomings of the model itself.

We have two additional points. First, there are many epistemologies; science and religion are two. Science is the best procedure human beings have produced to answer questions about the nature of the physical universe. Science is a powerful tool, but it is not a procedure for answering all the questions people wish to ask. Similarly, religion, revelation, or other ways of knowing may be superior for solving certain other human problems. The "problem" of scientific and religious conflict is resolved by many who appreciate the separate realms in which the different epistemologies are best suited. In this, the scientific creationists err, by attempting to overextend one epistemology into an inappropriate realm. Christian religions not based on Biblical literalism long ago made peace with evolution (Frye, 1983).

Second, even though there is no evidence for scientific creationist claims, the movement has had and continues to have an inordinate influence on science education in the United States (Gould, 1982; Futuyma, 1983; Moyer, 1983). A major focus of this effort concerns textbooks, which in most pre-college classrooms *are* the curricula. The proportion of a biology text devoted to evolutionary ideas and evidences has fluctuated through the years (Skoog, 1979; Gould, 1982; Nelkin, 1982). Pre-Scopes books contained more evolution than post-Scopes books. After Sputnik, and increased concern about science education, federal money was put into NSF for science curriculum and textbook development. The evolution-based BSCS books encouraged publishers to include evolution in their books, and evolution began reappearing in American textbooks in

the late 60's. The response was short-lived, however, because in the 70's the coverage of evolution in textbooks declined or the treatments were diluted. This is largely due to pressure from creationists and the religious right wing upon Texas and California, two large states which have state-wide adoption of textbooks (Lewin, 1984a). Because of the size of these markets, publishers tend to cater to their wishes. What sells in Texas, therefore, is published for the rest of the country as well. On March 12, 1984, the Texas Attorney General responded to a request from a legislator and issued an opinion that a controversial Texas Board of Education rule was unconstitutional. The rule required that any textbook which dealt with evolution "shall identify it as only one of several explanations of the origins of humankind. . ." and also that "each textbook must carry a statement on the introductory page that any material on evolution is presented as theory rather than fact." No other scientific theory was singled out for this special treatment; this consideration figured in the Attorney General's decision. Since it was left with the prospect of defending itself against a threatened lawsuit without the assistance of the office of the Attorney General, the Texas Board of Education voted on April 13, 1984 to repeal the rule.

The effect of this repeal is uncertain. Texas will have adopted science textbooks for the next six years in November of 1984, unless a proposed one-year delay was enacted. Publishers will not have had time to revise their books before November (assuming they care to); thus books sold outside Texas as well as inside Texas will continue to include a watered-down coverage of evolution. Future

editions of textbooks will bear watching. The recent events in Texas *may* bode well for an improvement in science textbooks. Publishers are no longer *required* to dilute the coverage of evolution, but this does not mean they will therefore *strengthen* it. If evolution is *not* covered in the textbooks, there is a slim chance, indeed, of evolution being covered in the classroom. On the other hand, there continues to be considerable opposition to evolution in many parts of the country, and the easiest strategy for teachers is to simply not teach evolution at all, and avoid the controversy, regardless of what is in the textbook.

Although it is relatively easy for one who is versed in the methods, philosophy, and history of science to dismiss the claims of scientific creationists, many science teachers in secondary schools and community colleges find such dismissal not possible. These science teachers are faced with community campaigns for the teaching of scientific creationism by influential persons, some with scientific credentials, who repeatedly claim there is as much, and equally as good, scientific evidence for scientific creationist concepts as there is for evolution. Teachers, school administrators, and lay persons on school boards are hard pressed to deal effectively with these claims. Support from university-level scholars is often crucial to these disputes, but it is not always offered. Objective documentation of the fallaciousness of the scientific creationist claim that their views are based upon scientific evidence provides "ammunition" for these people. We hope the results of our study will be useful for those who directly confront the creationists.

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