PERSPECTIVES on Science and Christian Faith

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Articles In this issue . . .

"The fear of the Lord is the beginning of Wisdom."
Psalm 111:10

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Guest Editorial: Without a Memory

A discussion meeting of the British Society for the History of Science[1] was convened in London in 1992 specially to discuss the theme of "Science and Religion." A major focus of the discussion was the important new book, *Science and Religion: Some Historical Perspectives*, by John Brooke.[2] As one of the invited speakers I tried to address one particular aspect of the subject, and I am glad for this opportunity to repeat some of the remarks I made at that meeting. These concern the value of *historical* perspectives for contemporary discussions on science and religious belief. There are, of course, many scientists who have little time for history. If the aphorism is true that a culture without its history is like a man without his memory, science can ill afford such a cavalier attitude toward the past. It is my conviction that the history of science has a crucial role to play in the current debate involving Christian theology. This is so whether or not the historical research is conducted by scholars with an explicit Christian commitment, an outstanding example being Geoffrey Cantor's recent study of Michael Faraday.[3]

There are, of course, many scientists who have little time for history. If the aphorism is true that a culture without its history is like a man without his memory, science can ill afford such a cavalier attitude toward the past.

So what specific values are there in historical perspectives? First, and at the most trivial level, good history of science can correct common inaccuracies. These include the well-known myths of Bruno's "martyrdom" for science and of Galileo's torture. Similarly exposed are the legends of clerical opposition to the use of chloroform anaesthesia and of the demolition of Bishop Wilberforce by Huxley at the British Association debate in 1860. There are many more.

Secondly, history of science can demythologize popular paradigms that are seriously deficient. Correcting errors like those just mentioned may seem to be simply a matter of putting the record straight. Sometimes it is, but, apart from a certain lurid media-appeal, the survival of these flawed stories is due in large part to their conformity to popular paradigms as to what the "science and religion" relationship *should* be. The classic case is the conflict model enshrined in those most notorious pieces of pseudo-history by J. Draper[4] and A. D. White.[5] My first encounter as a young scientist with White's book led to deep suspicion; the book did not describe any scientific attitude I had ever met and its thesis seemed inherently improbable. Only later was a measure of historical understanding able to suggest not only where White was wrong but also why he had been able to promote such a bizarre view of science and religion.

However, history of science is not only, or chiefly, engaged in the demolition business. It can also, thirdly, suggest alternative perspectives for today. Thus a "Darwinian perspective" that understood Darwinism in its genesis and historical context is highly relevant to the "creationist" debate today and could take much heat out of the argument. Then again, a sound understanding of the mechanical philosophy of the 17th and 18th centuries would show how such a worldview did *not* inevitably lead to an abrogation of moral responsibility for the environment. Such an insight would be an eye-opener to certain post-modernist writers who seem to think that the only route to such responsibility lies in a retreat to a prescientific and organismic view of the universe.

Fourthly, historical insights can help to expose the limitations of science. I do not refer here to that perverse obsession with denigrating science on all possible occasions that once marked the

effusions of a minority of historians (most of whom were blissfully ignorant of the actual practice of science). I refer rather to the more mature and responsible analysis of the nature of science that marks much modern historical study. In particular, such analysis discloses the slow transformation of science into mere scientism, the latter, for the Christian, being the real enemy: an elevation of science to the status of universal panacea and of nature as an object of worship. Few, however, are aware of the distinction between science and scientism, as witnessed by many contemporary discussions. Historical insights can be enormously helpful here.[6] Science *per se* can never claim to have had these extravagant values attributed to it.

However, science is not value-free. Writing of those who restricted values to theology and facts to science, John Brooke observes (in a masterpiece of understatement), "had they been more familiar with the history of science, the proponents of that neat division of labor might have found it difficult to sustain."[7]

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Fifthly, history can demonstrate that the relationship between science and religion is not a static one. If Mrs. Thatcher could observe that "there is no such thing as society," John Brooke can aver "there is no such thing as *the* relationship between science and religion."[8] That matters very much in an age when past stereotypes are often taken as normative for today. To ignore the changing relationship is to deny the possibilities of creative dialogue, a process to which Christians in Science and its associated journal *Science and Christian Belief* remain totally committed. I am sure the same is true in North America of ASA and *Perspectives*.

In the sixth place, historical studies have surely demonstrated that science has a human face. Its practitioners are and always have been fallible, creative people who reflect the values and attitudes of their own cultures. To realize that simple fact is to turn your back on scientism: the misnamed scientific humanism of a past generation, and the ghosts of logical positivism that seem to haunt theology even more than science. Incidentally, "the humanization" of science *via* its history has considerable educational value for those seeking at school or elsewhere to attract and hold potential students of science.

Finally, I have to enter a *caveat*. Although it is commonly supposed that scientific research *ought* to be independent of the ideological position of the scientist, historians will often claim that this is not so, and manifestly not so in the more remote past. They are right. Unquestionably science has often been a manifestation of all kinds of "non-scientific" ideas. However, to assert that it *always* must be so and that scientific activity can *always* be reduced to sociological categories is to go beyond the facts and is a supposition incapable of proof. This kind of speculative reductionism is an open invitation to circular argument and can give history a deservedly bad name among scientists. Historians, like everyone else, do their cause no service by gross exaggeration.

What is now needed is a new generation of historians of science capable of following the truth as dispassionately as their scientific colleagues believe themselves to be doing, unafraid of where their inquiries may lead them. For the Christian, the use of history for apologetic purposes is surely as legitimate as arguments based on anything else (nature, aesthetics, moral imperatives

etc.). But such history must be marked by honesty, integrity painstaking attention to detail and a scrupulous regard for alternative interpretations. Nothing else is worthy of the Lord of nature who is also Lord of history.

— Colin Russell
Professor of History of Science and Technology, The Open University, England
and Chairman & Vice President of Christians in Science

NOTES

[1]Held on May 27, 1992, at the Science Museum, London.
[2]Brooke, J. H., *Science and Religion: Some Historical Perspectives*, Cambridge University Press, 1991.
[3]Cantor, G., *Michael Faraday: Sandemanian and Scientist*, Macmillan, Basingstoke, 1991.
[4]Draper, J. W., *History of the Conflict Between Religion and Science*, H. S. King, London, 1875.
[5]White, A. D., *A History of the Warfare of Science with Theology*, Macmillan, London, 1896.
[6]A good recent example is Hakfoort, C., "Science Deified: Wilhelm Ostwald's Energeticist World-view and the History of Scientism," *Annals of Science* (1992), 49, 525-544.
[7]Brooke (1991), p. 337.
[8]Brooke (1991), p. 321.

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From the Editor

We preface this issue with **Colin Russell**'s cogent editorial (above) on the importance of the history of science for those seeking to interpret the modern scientific enterprise from a Christian point of view.

Our first paper features biologist **Raymond Grizzle**'s complementarian approach to relating theology and science. He chooses the "lightening rod" topic of creation/evolution to illustrate his method. We are warned against developing *direct* cross-category comparisons, e.g. the scientific concept of "stasis" with the theological description "special creation."

Korean solid state physicist **Seung-Hun Yang** then traces the tortured response of American evangelicals and Seventh-day Adventists to Willard Libby's development of radioactive dating in the late 1940's. Yang's story offers a latter-day example of settling a scientific question in theological terms.

Dick Fischer offers the first paper in a two-part series which seeks to identify "historical Adam" based on current scientific information and the biblical record.

In our first Communication, **Edwin Yamauchi** provides archaeological and geological context for a number of representative Old Testament references to six metals important in the ancient world. **Joseph E. Spradley** concludes this section with a description of his experiences teaching science at four institutions in the Middle East and Africa. The success of these stints carried out over three decades of enormous social and political upheaval should encourage the next generation of sabbatical holders to continue the tradition represented by the Spradley family.

Two Essay Reviews lead the Book Review section. In the first review **Mark A. Kalthoff** examines Ronald L. Numbers's important new work *The Creationists*. **Richard Bube** then considers James E. Loder's and W. Jim Neidhardt's *The Knight's Move*. It is ironic that Neidhardt's work would appear just prior to his death in July, 1993. We will miss his valued contributions to *Perspectives* and the ASA, his wise counsel, and his engaging sense of humor which so often tempered the strains of intense discussion.

- J. W. Haas, Jr.

A Conceptual Model Relating Theology and Science:

The Creation/Evolution Controversy as an Example of How They Should *Not* Interact

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A foundational premise of modern science is that its descriptions can only consist of natural causes: that is, God cannot be a part of scientific descriptions. In this paper I describe a conceptual model relating theological and scientific descriptions that takes a complementarian viewpoint compatible with this foundational premise of modern science. The model presents theology and science (using biological evolutionary theory as an example) in a side-by-side fashion, stating that inquiries in each discipline should influence the other. However, this model's major contribution is its prohibition of direct comparisons between theological and scientific descriptions which present us with mutually exclusive alternatives. This prohibition is designed to eliminate the potential for theological descriptions to become a part of science, and to prevent attempts at the misguided use of scientific descriptions as "evidence" against the existence of God.

> Although much remains obscure, and will long remain obscure, I can entertain no doubt, after the most deliberate study and dispassionate judgment of which I am capable, that the view which most naturalists entertain, and which I formerly entertained — namely, that each species has been independently created — is erroneous. I am fully convinced that species are not immutable; but that those belonging to what are called the same genera are lineal descendants of some other and generally extinct species, in the same manner as the acknowledged varieties of any one species are the descendants of that species. Furthermore, I am convinced that Natural Selection has been the main but not exclusive means of modification. (Darwin, 1859.)

And so, Charles Darwin concluded the introduction section to his first edition of *On the Origin of Species*. In the several hundred pages that followed, Darwin argued his case for evolution,[1] and against the immutability of species, as well as against views other than his own of what causes evolutionary changes. In the passage quoted above, Darwin indicated that in his day the most widely held alternative position to biological evolution was the "immutability of species," or "stasis," which means that species only change in relatively minor ways over time.[2] The theological counterpart of this view was known as "independent" or "special" creation. Nearly all scientists were theistic at that time, and a fairly literal interpretation of the first two chapters of Genesis had provided for some much of the theoretical basis for biology. Hence, Darwin used both "immutability" and "independent creation" interchangeably. In so doing, he mixed theological and

This essay is dedicated to the late W. Jim Neidhardt.

scientific descriptions (at least by today's standards), implying to some that evolution and God's creative activity were mutually exclusive alternatives.

Copernicus, Kepler, Galileo, and Newton freed the physical sciences (especially astronomy and physics) from some of the constraints put upon them by previous philosophies, including religion (Hummel, 1986; Lindberg and Numbers, 1987). Darwin's theory was in essence an attempt to accomplish the same thing for biology;[2] and it has, of course, largely been successful. But this does not mean that Darwin's theory — nor the theories of Copernicus, Kepler, Galileo, and Newton — were attempts to do away with religion, to make God irrelevant to humanity. This was, however, the conclusion drawn by some with respect to the new theories of astronomy during and after the middle ages, and it also has been the conclusion drawn by many with respect to Darwin's theory.

Philosophers, theologians, and scientists have argued that science in no way eliminates religion, or does away with humanity's need for God (see review by Ratzsch, 1986). Indeed, there is much ongoing philosophical research in this area by those who hold the view that both science and theology should be interacting disciplines (see Russell, 1990). Nonetheless, the mistaken notion that religion has been replaced in some way by science (especially evolutionary theory), or at least is in danger of having this happen, seems widespread today. Such a view is held by many agnostic or atheistic scientists (e.g., Wilson, 1980; Provine, 1988) and "recent" or "young-earth" creationists,[3] though they arrive at their similar conclusions from two very different starting points. Atheistic scientists typically argue a "God of the gaps" view of science and religion, whereby God has really only been needed to fill in the gaps of knowledge in scientific descriptions.[4] Recent creationists argue that a reasonable and fairly literal interpretation of Scripture precludes the magnitude of evolutionary changes described in biological evolutionary theory.[5] Hence, evolutionary theory and theology become alternative, mutually exclusive descriptions of the world.

In no way do I aim to summarily dismiss either of these viewpoints by implying that the above brief appraisal does full justice to the complex nature of these positions.[6] I do, however, wish to sharply disagree with both. I think the evidence for the evolution of species and the antiquity of the earth is overwhelming, yet I fully submit to the authority of Scripture. Therefore, I seek a middle ground where my views are influenced by both science and theology.

The purpose of this paper is to present a conceptual model that formalizes my view of how scientific and theological descriptions are potentially related. The major contribution of the model is that no direct comparisons of a mutually exclusive nature should be allowed between theological and scientific descriptions. This means, in the case of biological evolutionary theory, that only fully naturalistic descriptions can be posed as alternatives for direct comparison. Terms such as "stasis," or perhaps "spontaneous generation," should be substituted for "creation" as proper, directly comparable, scientific alternatives to biological evolution.[7] In other words, it should be "evolution vs. stasis," not "evolution vs. creation." In essence, then, what I am proposing is one way in which theology and science should *not* usually interact. I will expand upon this restriction and briefly discuss some of the implications of the model.

Conceptual Model of Scientific and Theological Descriptions

Figure 1 (next page) is a three-dimensional conceptual model showing a "side-by-side" relationship between scientific (with the emphasis on biology) and theological descriptions. The model is mainly based upon some of the views of Ramm (1954), Bar-

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bour (1966), Bube (1971), MacKay (1974, 1982), Polkinghorne (1983), Peacocke (1984; 1991), Van Till *et al* (1990), among others. It is "complementarian"[8] and it includes "levels" of explanations. However, the levels that science and theology occupy are constructed as side-by-side "categories" in order to emphasize their partnership in describing the world.[9] This is the only direct departure which I am aware of from the above authors, who generally view theology as the "highest" level of inquiry. I departed from their model of science and theology as I understand it because it *can* imply (though it does not necessarily) that lower-level descriptions should in some way be subordinated to theology, and I do not hold this viewpoint. Hierarchic levels based on complexity, however, are shown as imbedded within the science category; levels of theological descriptions are not shown. These levels within categories

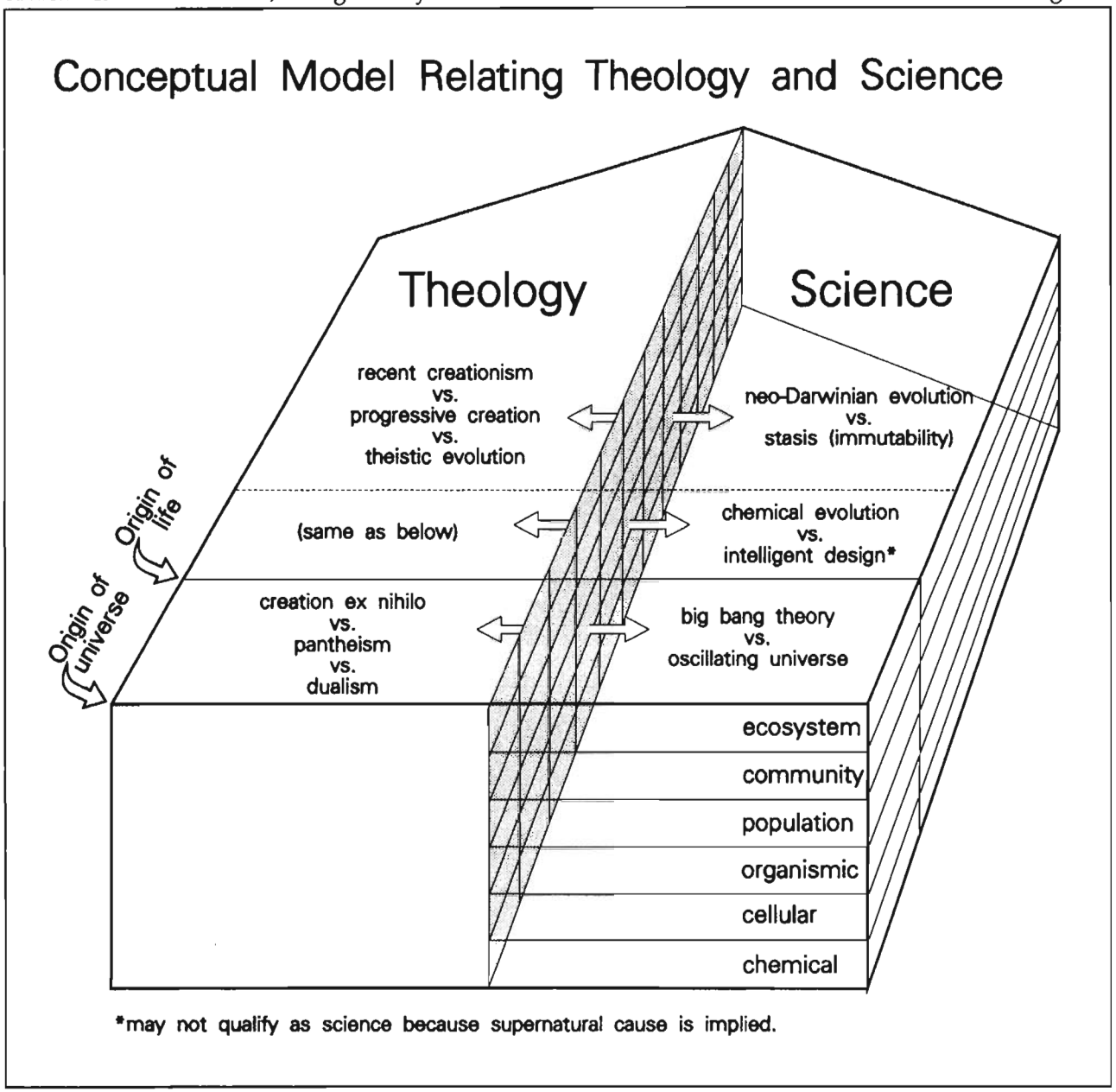

Figure 1. Conceptual model showing side-by-side relation between science and theology. The hierarchical vertical levels shown for science are based on complexity, and the emphasis is on biology. Some alternative theories within biological science and theology are listed. The double arrows indicate the desirability of interactions between science and theology, but the sieve-like boundary between science and theology categories indicates that no direct comparisons should be made between the two (see text for details).

are not discussed further because they are not directly relevant to the present paper.

The side-by-side, partnership aspect of the model follows from my belief that all human knowledge is personal knowledge, held by fallible persons. In an essay on the insights of Michael Polanyi, Walter Thorson (1981, p. 132) nicely summarizes Polanyi's perspective (which I hold):

> The important fact that a divine revelation is the real *source* of our knowledge does not eliminate the purely epistemological problems of communication, interpretation, and comprehension, nor does it impart a special status of rational certainty to our knowledge itself. We walk by faith; the truth is divine, but it is held by earthen vessels, human and fallible.

There will always be uncertainty in our pursuit of understanding, whether it be theological or scientific. The Holy Spirit may reveal the truths in Scripture to a Christian, but the person receiving that truth is still fallible. Thus, all theology is based upon an interpretation of Scripture, and it is tentative, as is our science. Furthermore, epistemologically both science and theology are similar in many respects (Wyatt and Neidhardt, 1991).

There will always be uncertainty in our pursuit of understanding, whether it be theological or scientific. The Holy Spirit may reveal the truths in Scripture to a Christian, but the person receiving that truth is still fallible. Thus, all theology is based upon an interpretation of Scripture, and it is tentative, as is our science.

This view leads me to the conclusion that some amount of interaction between theological and scientific input is the best way to arrive at tentative conclusions concerning topics that touch upon both categories. Obviously, then, the "categories" in the model are not to be viewed as "compartments" where there are no interactions between theology and science. Rather, I view the categories of theology and science as "complementary" with some amount of potential interaction.[9] So, there is a sieve-like boundary between the theology and science categories in the model. The arrows crossing categories show that interactions between descriptions are possible and desirable. However, the sieve-like boundary also indicates that there should be no direct comparisons of theological and scientific descriptions in the sense of mutually exclusive alternatives.

Time is represented as an arrow providing the outside boundaries of the entire model. This is meant to indicate that both kinds of descriptions are imbedded in time. The dashed lines at the bottom of the model indicate the status of time prior to the origin of the universe, which is, of course, unknown. Also, there is no intention to imply anything about space-time-matter relationships as addressed in the theories of physics.

Major events in time are shown along the left side of the model. The dashed line above the "Origin of life" event indicates that biological evolutionary theory is primarily only directly concerned with events occurring after the origin(s) of living things. The actual origin(s) of life is in the realm of "chemical evolution," which is a field of inquiry that has largely developed in the last thirty or so years.[10] Biological evolutionary theory is primarily concerned with the "origins" of species from pre-existing species and their subsequent modifications and adaptations.

Discussion of the Model

As indicated, the disallowance of direct, cross-category comparisons is the major contribution of the model. For example, no "creation" description can be directly compared with a scientific description. I am not aware of explicit statements by others that this should be the case.[11] I arrived at this position mainly because of the pervasive and negative results of taking either a "theology-first" or "science-first" position and immediately crossing categories (with respect to the model), as I briefly discussed in the first paragraphs of this paper. I suspect that much of the confusion surrounding evolutionary theory is the result of this practice. Hence, my position is that direct comparisons of mutually exclusive, alternative descriptions should occur *when possible* within a single category, either science or theology. This can generally be accomplished by "converting" a theological description to a "scientific" form and then comparing it with the appropriate scientific description, and vice versa. Cross-category comparisons must be made at some point, but they will usually not be of a mutually exclusive nature. Rather they will be meant to potentially provide modifications of both descriptions. Some well-known examples of alternative descriptions within each of the two categories are shown in Figure 1. Stasis, or the immutability of species, is a mutually exclusive,

alternative scientific theory to evolution, and it is very similar to the theological description "special creation," as mentioned above. However, it differs from special creation in one very important point — it does not contain any reference to a supernatural cause.

This points to the crux of why I argue against direct, cross-category comparisons of mutually exclusive descriptions. As discussed above, the modern view of science is that its descriptions must be restricted to natural causes.[12] This is a fundamental, but apparently often overlooked aspect of modern science. I emphasize this because I think the implications of this restriction have not been fully appreciated, especially by Christians. A major implication of this fact with respect to the evolution issue, is that no matter what may become of biological evolutionary theory, no scientific replacement for it could include God or any other "creator." All concepts of creation obviously include a creator (e.g. the God of Christianity), so all concepts of creation are *a priori* outside the realm of science. A direct comparison of evolution with creation is, in other words, a direct comparison of a scientific description that is restricted by definition to natural causes, with a description that contains a supernatural cause. If the comparison resulted in rejection of evolutionary theory, then a supernatural cause would, at least by implication, be transported into the realm of science, and this is not acceptable by modern standards. Such a result might not be required logically, but such a possibility is really what is being contested by all "either/or" groups involved in the evolution controversy. In essence, direct, cross-category comparisons also have allowed atheistic scientists (e.g., Provine, 1988) to indirectly answer the "unanswerable" and "unscientific" question "Does God exist?" — and their answer has been a resounding "NO!" This model is aimed at preventing this kind of reasoning.

Implications of the Model and Conclusions

Gould (1987) has argued that biological evolutionary theory is really "fact," and the "theory" is to be found in the mechanism of natural selection. Most biologists do not seem to agree fully with his position, because the word "theory" is still usually attached to the word "evolution." Nonetheless, Gould makes some interesting and useful points, and he argues forcefully that there can be little doubt among reasonable individuals who have surveyed the available information that biological evolution has occurred and is occurring. I feel that Gould has been too free with his use of the word "fact," but I am inclined to agree with his conclusion — that a reasonable evaluation of available information leads to an acceptance of biological evolution. In particular, if no theistic alternatives (i.e. all descriptions involving a creator) to biological evolution are allowed (as I have argued herein), then acceptance of biological evolution seems inescapable.

I believe God was ultimately responsible for every new species that has arisen, and God is ultimately responsible for the continuous "maintenance" of every organism on earth. But God cannot be a part of my scientific descriptions. If evolution is not valid, then what other scientific alternative do we currently have?

I arrive at this conclusion based on a consideration of only one important area of factual information — the fossil record. The fossil record indicates that only a small percentage of the plant and animal species that have existed on earth are now alive. The vast majority of plant and animal taxa have gone extinct. If the only alternative scientific descriptions now available are stasis and evolution, then how could stasis be valid? Is there no organic connection between extinct and extant taxa? The concept of stasis can persist in light of the fossil record, if the fossil record is *only* a record of God's many independent creative actions. In other words, if stasis is correct, then we have arrived at the boundary of science every time a new taxon (species or genus or family or whatever level it is assumed represents the limits of biological change) appears in the fossil record. We have arrived at such a boundary because the only description left includes God. I believe God *was* ultimately responsible for every new species that has arisen, and God *is* ultimately responsible for the continuous "maintenance" of every organism on earth. But God cannot be a part of my scientific descriptions. If evolution is not valid, then what other scientific alternative do we currently have?

The opening to this paper was a quote from Charles Darwin, followed by my criticism of him for

mixing theological and scientific terms. I would like to end this essay with another quote from Darwin, one with which I have no quarrel because Darwin clearly separates his theology and science. In fact, it's one of the best examples of science and theology in partnership of which I am aware.

> There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved. (Darwin, 1860). ❋

ACKNOWLEDGMENTS

This essay is a direct result of interactions with college students in an evolution course I recently taught. I thank them for making me seriously examine the perceptions of those who have not had the opportunity or need to extensively examine the controversy surrounding evolutionary theory. Dan Ensley drew Figure 1 and provided valuable advice on modifications to it. I am also grateful for the thoughtful reviews of an early draft of the manuscript provided by Richard Bube, Wilbur Bullock, Jim Neidhardt, Del Ratzsch, Charles Hummel and David Wilcox. Their comments and those of two anonymous reviewers provided me with a wealth of information to ponder. The manuscript in its present form differs from some of their suggestions and I, of course, am fully responsible for its contents.

NOTES

[1] I define biological "evolution" as the theory stating that the organisms alive on earth today are descended from organisms previously living on earth, most of which have gone extinct. This is my understanding of what is generally meant by the word evolution to most biologists today, and I think it is the essence of Darwin's understanding of the word. I am aware of a variety of other ways in which the word has been used, but in all cases herein, I use "evolution" in the sense stated above.

[2] Neal Gillespie (1979) reviewed the prevailing scientific views during Darwin's time, noting that most naturalists had all but abandoned the notion that God had independently created each species. So, Darwin's assessment of the opposition would seem to be a bit exaggerated. However, Gillespie pointed out that the concept of special creation still lingered in subtle but important ways among those who doubted it. He argued that Darwin's aim was to put biology on the same naturalistic (positivistic) basis as the rest of the sciences. In other words, Darwin needed to soundly remove God from scientific descriptions. *On the Origin of Species* was instrumental in doing this. And today, *all* of science, by convention and definition, excludes God from its descriptions (Ratzsch, 1986; also see note 12 below). This is a critical component of my argument herein — God cannot be a part of today's scientific descriptions. This essay is essentially a consideration and extension of this crucial point (see Grizzle, 1992 for further comments on this foundational premise of modern science).

[3] The major points of "recent creationism" for the present essay include the belief that the entire biosphere was created less than about 10,000 years ago, and only minor changes have occurred in species over time. The concept of "progressive creation" (Pun, 1982) is not dealt with herein. I appreciate the usefulness, and in many senses what I believe to be the validity, of this concept. However, because it includes a creator, I feel that most scientists would consider the concept non-scientific. See Wilcox (1986) for a review of creation concepts.

[4] This is essentially the same view that many held during the Middle Ages, and it accounts for the strong reactions by some Christians to the new discoveries in astronomy at that time (Barbour, 1966). It is also an extreme of the "science-first" position described by Bube (1986).

[5] Young-earth creationists represent an extreme of the "theology-first" position described by Bube (1986).

[6] See discussions of variations in principles of biblical interpretation employed by young-earth creationists, the role of values in decision making, etc. in Ratzsch (1986) and Nelson (1986).

[7] I recognize that my choice of the word "stasis" is problematic. David Wilcox (personal communication, 1992) pointed out that "stasis" might be viewed as being in some sense similar to the concept of punctuated equilibrium (Eldredge and Gould, 1972), an alternative to Darwin's "gradualism" (see Avers, 1989 for brief review). He also noted that unlike the term "creation," the term "stasis" does not explain the origins of species. So, the scientific utility of "stasis" is questionable. First, there is no intention to equate stasis with punctuated equilibrium. I use stasis to simply mean that species do *not* change over time, whereas punctuated equilibrium addresses rates of change over time, obviously assuming that species *do* change over time. The second objection to the use of stasis points to an interesting implication of the model, and I discuss this more fully in the section entitled "Implications of the Model."

[8] The concept of "complementarity" is indeed complex. Ratzsch (1986) provides a brief overview, noting major positions. Haas (1983a, b) and Sharpe (1991) provide critical reviews of some aspects of complementarity. I do not want to push this term too heavily here because the concept carries a lot of "negative baggage" for some. Nonetheless, I feel strongly that many aspects of complementarity are useful and valid, providing helpful insights into how scientific and theological descriptions are potentially related (Grizzle, 1992). As Richard Bube stated:

> We may indeed debate whether one should say that science and theology are complementary, but it does not appear that there is any debate that scientific descriptions are often complementary to theological descriptions of the same events. If this were not the case, what other options do we have? (1983, p. 241-242.)

[9] The explicit "side-by-side" relationship of science and theology was suggested by Evans (1991). However, many have argued this view or something similar. For example, Torrance (1982; especially see the figure on p. 95 in Neidhardt's (1989) review of some of Torrance's views) and Whitehouse (1981) seem to present a non-hierarchical, partnership-like relationship between theology and science. Figure 12 in Hummel (1986) implies a partnership relationship of some kind. Polkinghorne (1991) outlines some guidelines for interactions between science and theology. See Russell (1990) for an interesting review from the perspective of a personal odyssey of some of those currently working on science/theology relations.

[10] Standard evolution texts (e.g., Futuyma, 1986; Avers, 1989) give only brief treatments of the origin of life. See Thaxton et al. (1984) for a critical assessment of current thinking on the topic.

[11] Richard Bube has indicated (personal communication, 1992) that this is essentially his position.

[12] Ratzsch (1986) provides a good overview of the philosophy of science from a Christian perspective, and notes the restriction of scientific descriptions to natural causes as a fundamental characteristic of science as generally practiced today. Gilkey (1986) emphasizes this characteristic of science in his essay on creationism and science. However, there is not unanimous agreement that this should necessarily be a restriction

put upon science. For example, Geisler (1984) explicitly argues against this restriction. The recent suggestion that "intelligent causes" should be allowed in science is also relevant to this restriction, at least by implication (see Thaxton, 1990). Nonetheless, it *is* true that science today can only include natural causes in its theories. Hence, I think it is fundamentally important that so long as this be the case, those involved in science/theology dialogue explicitly recognize the restriction and consider its implications. See also comments on note 2.

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Radiocarbon Dating and American Evangelical Christians

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Radiocarbon (C-14) dating has several implications for Christianity, particularly in terms of the interpretation of the first part of Genesis. Since its advent in the mid-20th century, it has been one of the central topics in the creation-evolution controversy. As of the mid-1940s, radioactive dating had not attracted serious attention from the majority of evangelicals. Since the invention of the C-14 method and the appearance of evangelical professionals in this field, however, American evangelicals have divided themselves into two groups. One group has been made up of fundamentalist evangelicals, who accepted the global effect of Noah's flood and a young earth and rejected radioactive dates. The other, non-literalist group of evangelicals accepted some kinds of evolutionary uniformitarian hypotheses and radioactive dating. The Seventh-day Adventists and the American Scientific Affiliation were central forums in the controversy regarding radioactive dating during the first decade after the invention of the C-14 dating method. Then the controversy spread out into wider evangelical circles. This paper traces the reactions of Seventh-day Adventists and American evangelical Christians toward C-14 dating.

Among several radioactive dating methods, the radiocarbon (C-14) dating method (which was invented by Willard Frank Libby of the University of Chicago in the late 1940s) occupies a special position in archaeology and ancient history, as well as geology, because it can give the absolute age of those carbonaceous archaeological findings that were not older than the half-life of C-14.[1]

This method also drew special attention from Christian scholars because of its effect on biblical interpretation. C-14 dating received special attention from evangelical Christians who emphasized the authority and reliability of the Bible, because it could date the age of organic remains of ancient plants, animals and men in terms of the biblical chronology. In particular, the C-14 dating method is important in the study of the Old Testament, since it professes to supply absolute dates for events within the past forty thousand years, which covers the apparent periods of Old Testament history.[2]

Since the revival of scientific creationism in the early 1960s, one of the most important events has been the on going debate over the validity of C-14 dating. The apparent contradiction between C-14 dates and the literal interpretation of Genesis has split the evangelical Christians of the United States into two factions: one, fundamentalist evangelicals who attempted to fit scientific findings into the literal interpretation of the Bible; and two, other evangelicals who felt that the Bible does not contain an absolute chronology of earth history.

This essay will trace the reactions of both of these groups in the United States to C-14 dating, focusing particularly on the response of the Seventh-day Adventists (SDA), the American Scientific Affiliation (ASA), the Creation Research Society (CRS) and the

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Institute for Creation Research (ICR) — groups demonstrating particularly sensitive responses to C-14 dating and its implications. Although the Adventists regard themselves as evangelicals, some hesitate to include them in a list of evangelical Christians because of their strong commitment to the writings of Ellen G. White, the Adventist prophetess. But during the twentieth century the Adventists played a very important role in the formulation of the so-called "scientific creationism" in the United States, influencing evangelical Christian responses to the idea of a young earth. Therefore, in order to understand the relationship between Christians and C-14 dating, we must include the SDA in our discussions.

Seventh-day Adventists

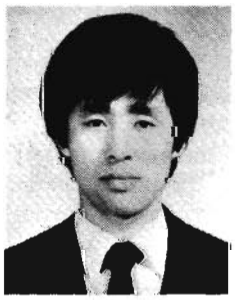
Seventh-day Adventists' opinions on C-14 dating and the age of the earth have varied somewhat over time. In his 1923 book *The New Geology* and in other publications, George McCready Price, an Adventist geologist, framed the so-called "flood geology" theory, which greatly influenced fundamentalist evangelicals as well as the Adventist scholars. Most orthodox SDA members accepted the Pricean flood geology and therefore criticized C-14 dating. One of the first Adventist critics of C-14 dates was Robert W. Woods, a college physics teacher, who criticized not the technical process of C-14 activity measurement but the assumptions by which the dating results were interpreted.[3] He conceded that C-14 dating was accurate to 4,500 years, but said that dating beyond this was extrapolation beyond the accuracy controls of the method. Thus he said that the method was good as far back as shortly after the flood, which seemed to be the practical limit of historical dating.

To Woods, if the assumptions of C-14 dating were accepted, the C-14 method was capable of measuring some 20,000 years into the past. However, this is the case only if certain conditions are met. First, the rate of the formation and decay of C-14 has always been the same. Woods admitted that no method had been found to accelerate or retard the radioactive decay of an atom. However, the assumption that the rate of formation for C-14 has been the same for long ages past was, to Woods, not certain. Such an assumption presumes that: (1) The rate of cosmic-ray activity has always been the same as it is at present; (2) The magnetic field of the earth has always been the same as it is now; and (3) The nature of the upper atmosphere has always been the same as now.

Another figure was Lester E. Harris, an Adventist biologist. While not a major figure in the creationist debate, he did demonstrate the possibility of contamination in C-14 dating samples.[4] In addition to the criticisms raised by Woods concerning the level of C-14 and the constant influx of cosmic radiation in the atmosphere, Harris argued that it would be virtually impossible to know whether the C-14 sample was free of foreign carbon-containing material.

One of the most interesting and controversial defenses of a young earth was raised by Robert V. Gentry, an Adventist geophysics professor at Columbia Union College, who published several scientific articles in authoritative journals on the pleochroic halo and its implications.[5] Pleochroic halos are produced in minerals such as mica when they are bombarded by alpha particles from radioactive nuclei enclosed in the mineral. Gentry argued that these halos indicated that some of the Precambrian rocks were created suddenly and recently. He used radiohalo evidence to prove the youth of the earth, Noah's flood, and the uncertainty of C-14 dating.[6] His pleochroic halo argument was widely cited by flood geologists in evangelical circles. Ironically, many Adventist scholars gave little credence to Gentry's findings, some even opposing them.[7]

In the late 1960s, orthodox Adventists relaxed their attitude toward the C-14 method. Even Price, a major critic of C-14 dating, admitted the validity of C-14 dates for the post-diluvian period,[8] assuming



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that the C-14 method might be reasonably accurate up to the flood. Yet he continued to believe that the environment of the pre-flood era was totally different from the present one and argued that the present conditions of cosmic radiation from outer space did not prevail before the flood. Although he sometimes accepted the antiquity of the earth by subscribing to the gap theory,[9] on the whole he never went against his teacher, E.G. White, throughout his long life.

Since the late 1930s, Price's disciples in both evangelical and Adventist circles actively sought to establish organizations committed to strict creationism.

Since the late 1930s, Price's disciples in both evangelical and Adventist circles actively sought to establish organizations committed to strict creationism. While they faithfully followed Price's flood geology, some of them modified his arguments concerning the age of the earth and life on earth. Although even in the 1980s the majority of orthodox Adventists still accepted Woods' critique of C-14 dating,[10] some scholars appeared who were much bolder than their predecessors in accepting the C-14 method. The apparent consistency of results achieved by many different, often independent dating methods was recognized as a serious problem by some Adventist scholars. It is worth noting that most of them were trained as professional geologists or geochemists.

Beginning in the late 1950s, some scholars in the Geoscience Research Institute (GRI), an affiliate of Andrews University and Loma Linda University, objected to a rigid young earth interpretation and accepted C-14 dating. The GRI was founded in 1958 to meet the realistic needs of the SDA church: to defend their doctrines in regards to natural science and to meet the demands of Adventist science teachers for qualified earth scientists in the church. Within a year, the church selected a student of Price's, Frank Lewis Marsh, who held a Ph.D. in biology from the University of Nebraska, and P. Edgar Hare, a chemist. In 1961 it also added Richard M. Ritland, a comparative anatomist. In spite of age differences the three men at first worked together in reasonable harmony. But the harmony was broken the next year, because, while Marsh believed in the young earth and the global flood, Hare and Ritland insisted the old earth and the local effect of Noah's flood. Marsh could not understand why both men supported radioactive dating methods that placed "Creation Week hundreds of millions of years ago" in apparent direct contradiction to the Bible and Ellen G. White.[11]

In 1962, in an unpublished paper entitled "Problems and Methods in Earth History," Ritland pointed out that multiple catastrophes, not just Noah's Flood, had structured the surface of the earth.[12] Hare's argument came from his research. From his studies on amino-acid dating in marine shells, which were based on changes in proteins, Hare claimed that life had been on earth for much longer than a few thousands years. Hare originally developed the amino-acid dating method to undermine the credibility of C-14 dating, but to his surprise the results he achieved were consistent with C-14 dates.[13] He confessed frankly to church leaders:

> I am beginning to wonder if our whole approach to this problem is in error. We have been taught for years that almost everything in the geologic record is the result of the flood. I've seen enough in the field to realize that quite substantial portions of the geologic record are not the direct result of the flood. We also have been led to believe by men like Marsh and Burdick that the evidence for the extreme age of the earth is extremely tenuous and really not worthy of any credence at all. I have tried to make a rather careful study of this evidence over the past several years, and I feel the evidence is not ambiguous but that it is just as clear as is the evidence that the earth is round.[14]

But the struggle of Hare and Ritland for "liberalizing" the GRI came to an end when they left the institute.

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The GRI's view on C-14 dating after the 1970s was represented by its new director, physicist Robert H. Brown. Brown ardently believed that life on earth was not older than 10,000 years and "originated within six consecutive rotations of the planet," and that the earth "experienced a universal destruction as portrayed in Genesis 6-8." But because C-14 dates for the age of life on earth contradicted the "testi-

mony given by Moses and Ellen G. White," he regarded C-14 dates as incorrect. Interestingly, though, he accepted other radioactive dates showing the antiquity of the earth.[15]

Later, Brown's attitude toward C-14 dating became more flexible. Beginning in the late 1970s, he proposed a new interpretation of C-14 dates rather than a total rejection of them. According to his recent papers, C-14 dates could agree with historical dates if some of the environmental factors of the antediluvian world were taken into account: the variation of cosmic ray intensity, geomagnetic field strength, water vapor concentration and C-14 dilution by the biosphere carbon. He admitted that if the premise and method of C-14 dating were sound, C-14 dates were acceptable up to about 2,000 B.C. At the same time he postulated that more carbon dioxide was present in the atmosphere prior to the flood, and that the prediluvian biosphere contained eight times as much nonradioactive carbon and 1/100 to 1/1000 of the present value of C-14.[16] Later, Brown's view of the age of the earth changed. He openly advocated an old earth but argued for recently created life, and concentrated on a compromise between biblical chronology and C-14 dating, trying to extend the biblical time-scale and correct C-14 dating.[17] There were similar attempts in the early 1960s by Henry F. Pearl, who tried to reduce both the age of the Bristlecone pine and C-14 dates to adjust them to the biblical chronology.

Although both Pearl and Brown gave comprehensive arguments, neither gave enough scientific evidence to support their arguments, nor could they explain the dates obtained by other dating methods.

Although both Pearl and Brown gave comprehensive arguments, neither gave enough scientific evidence to support their arguments, nor could they explain the dates obtained by other dating methods.[18] Brown's compromising approach to radioactive dating has appeared in several issues of *Origins*, a GRI journal founded by Brown and edited by Roth.[19] By accepting the antiquity of the earth, Brown clarified a topic which E.G. White had kept silent on, as Price did. He was still within the orthodox SDA's line. Brown's position is well discussed by M. Couperus.[20]

Under the direction of Brown and his successor, Roth, the GRI devoted itself to holding fast to flood geology and criticizing C-14 dating. Those who did not accept the great flood would find no footing in the GRI and should leave the institute. Today, with only a few exceptions, the SDA holds fast to flood geology and literal interpretations of Genesis days.[21]

Today, with only a few exceptions, Seventh-day Adventists hold fast to flood geology and literal interpretations of Genesis days.

The strongest professional defense of the C-14 method by an Adventist scholar was offered by R. Ervin Taylor, director of a radiocarbon dating laboratory at the University of California at Riverside.[22] After reviewing various dating experiments, he suggested that C-14 dating was reliable. He emphasized that the C-14 dates were supported and confirmed by many other methods such as obsidian hydration, thermoluminescience, archaeomagnetic data, the potassium-argon method, fission track dating, dendrochronology, varve dating, fluorine diffusion and archaeological sequences.[23] Based on C-14 dating, Taylor tried to reinterpret the biblical chronology.[24]

Even Ross Barnes admitted that literal interpretations of Genesis are incompatible with scientific dates.[25] M. Couperus said that Christian faith "should not be affected by views on the age of our planet, be it young or old."[26] Geraty held the same line as Taylor and Couperus.[27] But most of those who accepted C-14 dates and the antiquity of the earth did not represent the Adventist camp, which still advocates the literal interpretation of the Bible.

The American Scientific Affiliation

The first major controversy on C-14 dates among American evangelicals occurred in the ASA (American Scientific Affiliation). The ASA was formed in 1941 to serve as a principal forum of evangelical Christianity to "promote and encourage the study of the relationship between the facts of science and the Holy Scriptures."[28] The ASA influenced other evangelical institutions, such as Wheaton College,[29] the Inter-Varsity Christian Fellowship (IVCF),[30] the Evangelical Theological Society (ETS)[31] and the Moody Institute of Science (MIS), affiliated with the

Moody Bible Institute.[32] Besides these organizations, the ASA contributed to the founding or development of other Christian organizations in other fields of study.[33]

Since the publication of its first results in 1947, the C-14 dating method raised controversy in the ASA.

Since the publication of its first results in 1947, the C-14 dating method raised controversy in the ASA. The ASA membership had a mixed reaction to radioactive dating until the early 1950s, when advocates of radiometry began to dominate. As shown in the discussion of a paper by Monsma, the responses of key members to geologic ages and the flood varied until 1949. Monsma himself accepted the flood and seemed "to deplore the acceptance by Christians of the ideas of geologic ages." In addition, Monsma said, "so temporarily, I think possibly [the days in Genesis 1 were] at least very short periods of time." Paul Bender, a physics professor of Goshen College, seemed to have the same opinion as Monsma. But F. Alton Everest, Peter W. Stoner, (a professor of mathematics and astronomy at Pasadena City College and a supporter of the day-age theory), Russell L. Mixter (a zoology professor of Wheaton College), Delbert Eggenberger (a research chemist of Armour and Company), Cordelia Erdman (a geology instructor of Wheaton College), and especially J. Laurence Kulp were quite dubious about a recent creation and a cataclysmic deluge.[34]

But this period of confusion did not last long. Right after the announcement of the C-14 dating method by Libby, J.L. Kulp, (a Ph.D. in chemistry) from Princeton University and an assistant professor of Columbia University prepared the way for C-14 dating to be assimilated into evangelical Christian circles. Studying at Libby's dating laboratory at the University of Chicago, Kulp mastered C-14 techniques. He returned to Columbia University to establish his own C-14 laboratory, and pioneered the various applications of C-14 dating to geology. He eventually became one of the nation's top authorities in C-14 dating.[35]

Kulp played an important role in converting ASA members to C-14 dating. Although Kulp himself did not leave many writings about his role in the ASA, articles of that time revealed his influence.[36] The first article was presented in a symposium on *The Age of the Earth*, and appeared in the proceedings, which Kulp edited. In these proceedings, Kulp added many brief editorial comments to all of the papers presented, and finally in his own paper showed the validity and limitations of the assumptions of radioactive dating. At the end of his paper, Kulp discussed the basic requirements, the effective range, and some applications of C-14 dating. Bearing in mind the criticism from some conservative Christians of radioactive dating methods, he pointed out that "(a) The half-life will not be the limiting factor.... (b) [Enriching C-14] has been done successfully. (c) The matter of addition or subtraction must be considered with each find as a special case."[37]

Another article showing changes in ASA members' attitudes toward radioactive dating and flood geology was Kulp's paper on "Deluge Geology" in the *Journal of the American Scientific Affiliation* (*JASA*) (1950). This paper was an open attack on the young earth and flood geology theories and their proponents, and played an important role in orienting the ASA toward accepting radioactive dates and refuting flood geology. Kulp pointed out the basic errors of flood geologists, discussing their ignorance of recent scientific discoveries associated with C-14 dating.[38] Henry M. Morris wrote a rebuttal to the piece, trying to answer the various arguments, but the *JASA* editors did not publish it.[39]

In his own article attacking flood geology, Kulp pointed out that the proponents of flood geology lacked a formal education in geology.

What made Kulp so important in the ASA? The key was his professional background in geology, specifically geochemistry. As Kulp stated in Monsma's 1949 article in *JASA*, "Over the last fifty years there have been practically no Christians in the field of geology." He was trained as a chemist before he felt that "the Lord wanted me to go into geology." He said, "Most of us do not understand enough geology to appreciate the geologist's method of securing geological data."[40] In his own article attacking flood geology, Kulp pointed out that the proponents of flood geology lacked a formal education in geology.[41] In his discussion of Monsma's article, Kulp used his geological knowledge to persuade other ASA members to accept C-14 dating. In contrast to a confident Kulp, those who opposed him (who were not professional geologists) had to be very careful

in presenting their opinions in geological matters. For example, to a question raised by Cordelius Erdmann, Monsma said, "I would not dare to answer that question because I am not a geologist." Bender also said, "I am not a geologist, but have been interested in geology for some time..."[42]

Kulp's paper "Deluge Geology" was only the beginning of Kulp's rebuttal of flood geology and the idea of a young earth. In a paper presented at the 1949 Los Angeles Convention of the ASA, Kulp argued that "the theory that a relatively recent universal flood can account for the sedimentary strata of the earth is entirely inadequate to explain the observed data in geology."[43]

In a paper presented at the 1949 Los Angeles Convention of the ASA, Kulp argued that "the theory that a relatively recent universal flood can account for the sedimentary strata of the earth is entirely inadequate to explain the observed data in geology."

Kulp's role was also prominent in the Sixth Annual Convention at Shelton College in 1951. In a paper presented at the Convention, Roy M. Allen, a metallurgist, summarized the conditions that complicated the accuracy of radioactive dating, and then criticized the uncertainty of radioactive dates. But in the discussion session, Allen's paper was attacked by Kulp. Kulp, after pointing out the author's lack of geological training, refuted Allen's criticisms one by one. In addition to his total commitment to contemporary geology, young Kulp's partisanship and power of persuasion contributed to converting the ASA to acceptance of C-14 dating and the doctrine of the old earth and human antiquity.[44]

What other factors helped Kulp in his mission to convert the ASA? One was the fact that since its first decade, the ASA had many active scientists working in fields related to radioactive dating, such as geology, archaeology and anthropology.[45] Besides Kulp, there were already several other professional geologists (Gedney, Eggenberger and Erdman), archaeologists (MacRae), anthropologists (Buswell), and biologists (Mixter and Tinkle). They all had been trained in the contemporary scientific traditions. B. Ramm summarized the intellectual atmosphere of the ASA in the early 1950s, which was generally accepting of current scientific ideas. In supporting Kulp in his criticism of flood geology, Ramm said, "If uniformitarianism makes a scientific case for itself to a Christian scholar, that Christian scholar has every right to believe it, and if he is a man and not a coward he will believe it in spite of the intimidation that he is supposedly gone over into the camp of the enemy."[46] The ASA was ready to follow scientific evidence rather than a strictly literal interpretation of the Bible.

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Kulp lined up his allies within the ASA and played an active part in the background to ensure that "the ASA's publications gave neither aid nor comfort to flood geology."[47] Kulp served for a term as a member of the Executive Council of the ASA, replacing Edwin Y. Monsma, a believer in recent creation and a cataclysmic deluge, in 1948. Though he eventually dropped out the ASA, "not because it had become liberal, but because it was too conservative for him," Kulp widely influenced the ASA to accept radioactive dates, and the antiquity of the earth and life on earth. With the emergence of Kulp, supporters of the young earth and flood geology were gradually isolated within the ASA.[48]

The Genesis Flood

In the 1950s, through the influence of Kulp and his followers, ASA members began to split into two groups: non-literalist evangelicals and fundamentalist evangelicals. In the 1960s, there was increasing evidence of personal and organizational factions among evangelical Christian circles. To fundamentalist evangelicals, the great flood and the age of the earth and life were incompatible with C-14 dates. In reaction to the shift in the ASA towards acceptance of the idea of an old earth and uniformitarianism, a revival of flood geology and the idea of a young

earth and life occurred in evangelical Christianity in the early 1960s.

In reaction to the shift in the ASA towards acceptance of the idea of an old earth and uniformitarianism, a revival of flood geology and the idea of a young earth and life occurred in evangelical Christianity in the early 1960s.

The most significant sign of this revival was the publication in 1961 of *The Genesis Flood* by Whitcomb and Morris, supporters of Pricean flood geology. *The Genesis Flood*, which began in 1957 as Whitcomb's dissertation, was completed by the addition of several technical chapters by Morris. As an Old Testament teacher at Grace Theological Seminary, a fundamentalist institution in Indiana, Whitcomb was deeply distressed by Ramm's *The Christian View of Science and Scripture* (1954) which contained what he deemed an unbiblical notion of the local flood. Ramm's book, as Whitcomb confided to Morris, provided him a direct motivation to write the 450-page dissertation on *The Genesis Flood:* "Even if I had no other reasons for wishing to write a dissertation on Creation and the Flood, Dr. Ramm's book would be sufficient incentive for me."[49]

In this book the authors summarized the basic assumptions of C-14 dating: (1) the constant concentration of C-14 in the carbon dioxide cycle; (2) the constant cosmic ray flux on a scale of centuries; (3) the constancy of the C-14 decay rate; (4) no alteration of dead organic matter with respect to its carbon content by any activity, biologic or otherwise; (5) the constant amount of carbon dioxide in the ocean and atmosphere; (6) the constant reservoir of oceanic carbon, and (7) the equilibrium between the rate of formation and the rate of decay of C-14 atoms.[50] The authors of *The Genesis Flood* argued that all of these assumptions are highly questionable "in the context of the events of Creation and the Deluge." They maintained that any correlation between the C-14 dates with known historical chronologies "is limited only to some time after the Flood and Dispersion." Libby says: "The first shock Dr. Arnold and I had was that our advisors informed us that history extended back only 5,000 years.... in fact, it is at about the time of the first dynasty in Egypt that the last historical date of any real certainty has been established."[51] In order to refute the assumptions of C-14 dating, Whitcomb and Morris quoted academic writings of the C-14 dating experts who significantly contributed to creating or refining C-14 technique.[52]

The reaction within Christian circles to *The Genesis Flood* was mixed, ranging from high praise to severe criticism. Several Christian magazines praised *The Genesis Flood* for its defense of Genesis, while scientists, including ASA members, criticized the book for its total attack on contemporary science. Most of the evangelicals who accepted the gap and day-age theories did not heartily accept flood geology and the idea of a young earth, recognizing that the main arguments of flood geology on the whole were incompatible with their theories. Whitcomb, in a letter to Morris, expressed his embarrassment that practically everyone he knew accepted either the gap or day-age theory, "even though they seem to be happy about our position on the Flood!"[53]

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In contrast to the critical response of non-literalist evangelicals, however, many fundamentalists and fundamentalist institutions heartily accepted *The Genesis Flood*. Soon after its publication, the authors were invited to numerous meetings. Morris, who had a prestigious scientific background, was particularly forced to adapt a jetset lifestyle in order to meet nation-wide speaking engagements. Baptists invited him most frequently, but conservative Presbyterian, Lutheran, Reformed, Episcopalian, Wesleyan, Mennonite and even Pentecostal institutions heard his flood geology and his arguments for a young earth. Moreover, Tennessee Temple College, Biola College, LeTourneau College, Bob Jones University and Los Angeles Baptist College and Seminary all invited him to become a faculty member.[54] Such an explosive reception of *The Genesis Flood* by fundamentalists was an explicit sign of the revival of flood geology.[55] Actually, this book was the impetus for the creation of organizations such as the Bible-Science Association, the Creation Science Research Center, the Creation Research Society

(CRS) and the Institute for Creation Research (ICR). Among these, the CRS and the ICR were the most prominent in spreading the ideas of flood geology and a young earth, which were the most distinct features of the so-called "scientific creationism."

Creation Research Society

The organization most critical of C-14 dating was the CRS. It was started in 1963 by a group of strict creationists who were disappointed by the changing position of the ASA. Walter E. Lammerts, a geneticist and devout Missouri Synod Lutheran, led this group, and in its second year, the CRS began publishing the *Creation Research Society Quarterly* (*CRSQ*).[56] Philip B. Marquart stated, "If the ASA had remained true to the doctrines and principles on which it was founded, the Creation Research Society would never have been necessary."[57] The CRS was "committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution), both of the universe and the earth with its complexity of living forms."[58]

CRS members' arguments against the C-14 method were essentially not very different from the early arguments of the Adventists.[59] In 1966, Melvin A. Cook, a Mormon metallurgist and professor at the University of Utah, criticized the assumption of C-14 equilibrium in the biosphere. This assumption states that a dynamic equilibrium has existed in the earth's reservoirs of carbon for several tens of thousands of years. Cook denied the existence of this equilibrium: "the rate of decay of radiocarbon shows that C^{14} may not be in steady state in the atmosphere."[60] In 1970, Robert L. Whitelaw, a professor of mechanical engineering at Virginia Polytechnic Institute, presented more quantitative arguments on the nonexistence of equilibrium among the major carbon reservoirs.[61] Later Henry M. Morris, director of the ICR, pointed out that for the time-period prior to dynamic equilibrium, the C-14 age would be much larger than true ages if calculated from the equilibrium model.[62] It is notable that Libby had already recognized the lack of equilibrium and regarded the difference between the production rate (18.8) and the disintegration rate (16.1 ±0.5) as an experimental error: "The agreement seems to be sufficiently within the experimental errors involved, so that we have reason for confidence in the theoretical picture set forth above."[63]

The next critique concerned the possibility of the contamination of C-14 samples. It was stated thoroughly by Robert E. Lee, an Assistant Editor of the *Anthropological Journal of Canada*, in a paper published in *CRSQ*. Lee pointed out the possibility of contamination in the whole dating process, from collecting samples in the field to the final measurements in the laboratories.[64] To him, foreign organic matter could possibly intrude into old material. Charcoal and peat, frequently favorable samples for C-14 dating, were noted for their ability to absorb foreign substances. In fact, Bolton Davidheiser, a zoology Ph.D. from Johns Hopkins University and later a biology professor at Westmont College and Biola College, also pointed out that C-14 dating seemed to be much more reliable when the materials tested were from areas with dry climates, such as Palestine and Egypt.[65]

Philip B. Marquart stated, "If the ASA had remained true to the doctrines and principles on which it was founded, the Creation Research Society would never have been necessary."

The third critique concerned the variation of the earth's magnetic field intensity over time. The first person who systematically investigated this was Thomas G. Barnes, a physicist and member of the steering committee of the CRS. According to his study, the magnetic field of the earth decays exponentially. Based on figures from 1835 to 1965, he calculated the half-life of the magnetic field of the earth to be 1400 years. The greater the magnetic field, the less the cosmic ray influx. If the magnetic field in the past was many times stronger than it is today, there would have been less cosmic ray entering the atmosphere, and consequently less C-14 would have been produced. Therefore, any C-14 dates taken from samples from that time period would appear older than they really were.[66] Although some evangelical scholars opposed Barnes' view, his arguments widely influenced conservative Christian circles.[67]

Although Robert Woods accepted the constancy of decay rate, Don B. DeYoung, a Grace Brethren physicist, also reported variations in the half-life of several radioactive elements under various physical and chemical stimuli or human and natural influences.[68] DeYoung pointed to industrialization as a human factor. Since the Industrial Revolution, coal, oil and gas have been burned in quantity, and the carbon dioxide produced in the process has been

liberated into the atmosphere. Although the Industrial Revolution was less than two centuries old, Morris pointed that the effect of this carbon dioxide must be taken into account in C-14 dating.[69] Another human factor was the release of neutrons by nuclear reactors and nuclear weapons. These released neutrons increased the amount of C-14 in the atmosphere.[70]

As for natural factors, Bolton Davidheiser cited volcanic activity, which usually adds a huge amount of carbon dioxide to the atmosphere. Davidheiser argued that within the past 50,000 years large amounts of nonradioactive carbon dioxide have been released into the atmosphere by volcanic activity.[71]

Flood geologists also presented another natural factor: the changing state of vegetation on the earth. According to them, in the past there was much more extensive and vigorous vegetation than now. Thus there would have been significantly more carbon dioxide in the atmosphere.[72] The flood geologists presented a great flood that occurred 4,000 to 5,000 years ago and a radically different environment in the prediluvian period as possible explanations for C-14 dating errors. Therefore, they argued that C-14 dates older than 5,000 years would be highly suspect[73] and concluded that organisms alive before or immediately after the flood would contain much less C-14 than present organisms and therefore would appear to be older than they really are.[74]

The Institute for Creation Research

The Institute for Creation Research (ICR) was founded in 1972 by Henry M. Morris. Through numerous publications, popular talks and lectures and public debates, the ICR greatly influenced evangelical thought. From its start, as would be expected from the founder's background, the ICR adhered strictly to the doctrines of flood geology and recent creation, and, hence, the C-14 dating method was severely criticized.[75] Among ICR publications, *Critique of Radiometric Dating* (1973) and *Scientific Creationism* (1974) became the prototype for ICR critiques on C-14 dating. The ICR's criticism was not much different from what appeared in *CRSQ* and *The Genesis Flood*.

Recently the ICR built a C-14 dating lab in Santee, CA. This lab seems to be the first C-14 dating facility run by an evangelical Christian organization committed to testing the C-14 dating assumptions and presenting their own data regarding C-14 dating. The C-14 dating project is led by Gerald E. Aardsma, a nuclear physics Ph.D. from the University of Toronto and a research coordinator for the ICR. Aardsma has published a monograph, *Radiocarbon and the Genesis Flood* (1991).[76] In addition to his specialization in radiocarbon technology, Aardsma was also "committed to the doctrine of Biblical inerrancy, including literal six-day creation and the global cataclysmic deluge." He wrote that he is "in full agreement with the ICR tenets, convinced that true science must conform to Bible revelation."

Aardsma did a complete analysis of the published data, "showing that the usual steady-state assumption in a radiocarbon dating is invalid." He insisted that all previous radiocarbon dates would be reduced, "bringing them much closer to the Biblical chronology." From the equation describing the radiocarbon buildup, however, he determined the date of the great flood to be 12,000 BC! Although these data "should not be accepted until he or someone else has made a much more critical analysis of the assumptions and correlations used in dendrochronology," to our surprise, Morris recognized that "his study has real merit and should be made available to the wider readership. " It is not easy to predict exactly the function of Aardsma and his C-14 lab. Without doubt, however, Aardsma's research will contribute to broadening the intellectual horizon of fundamentalist evangelicals.[77]

Reaction of Non-Literalist Evangelicals

One of the most crucial events since the late 1970s was the debate which was triggered by Davis A. Young's two books, *Creation and the Flood* (1978) and *Christianity and the Age of the Earth* (1982).[78] Young is a geology professor at Calvin College and a leading member of the geologic section of the ASA. Young flatly opposes the idea of a young earth and flood geology. Rejecting the fundamentalists' criticisms on the antiquity of the earth, Young pointed out that the decay rate of radioactive elements is constant, that dating elements are not lost or gained during geologic time, and that the original amount of daughter element has been determined with reasonable accuracy.[79] He also refuted the flood geologists' critique of the C-14 dating method. But his argument for C-14 dating was not as thorough as his evaluation of the age of the earth, that being the primary aim of the book.[80] Young, as a Bible-believing evangelical, successfully found shelter in the day-age theory. He harmonized belief in the Bible with his geologic knowledge through the day-age theory: "There is biblical evidence to indicate that the days of Genesis 1 were long periods of indeterminate length, con-

sistent with the day-age hypothesis, ..."[81] He has played an important role in defending radioactive dating and an old earth in evangelical circles since the 1970s.

Why C-14 Dating?

The numerous critiques raised by strict creationists have not been taken seriously by the secular scientists and even some evangelicals, such as ASA members. Why was this so? The key factor was the ready availability of the gap and day-age interpretations of Genesis 1. In fact, most evangelicals, and even Adventists who refuted the flood theory and the idea of a young earth, could accept one of these interpretations without seriously compromising evangelical tenets. For example, Edwin K. Gedney, Peter W. Stoner and Davis A. Young accept the day-age view.

The second reason was the overwhelming number of practicing scientists who accepted C-14 dating. Most strict creationists, with the exception of G.E. Aardsma at the ICR, were not technical experts on the C-14 dating method, not having advanced degrees in geochronology, geochemistry, or radiometry. If we were to compare the backgrounds of those critics of the C-14 method who published in *CRSQ* with those who supported C-14 dating (such as Kulp, Gedney, Taylor, Hare and Young, etc.), the contrast would be very evident.

Third, with few exceptions,[82] "serious" criticism about the C-14 method appeared mainly in religious journals. Major religious journals criticizing the C-14 method include *CRSQ* (published since 1964), *Origins* (published since 1974 by the Seventh-day Adventists) and *Impact Series* (published since 1972 by the ICR). All of them are conservative or fundamental publications. Among them, *CRSQ* is the most prominent in criticizing the C-14 method, publishing more than 25 critical papers to date. In addition to journals, most of the religious books critical of C-14 dating were written by fundamentalist evangelicals[83] and published by religious publishers, and their distribution was limited to Christians.

The fourth reason is the conservative bent of established science. Since C-14 dating was introduced on a wide scale in the 1950s, it quickly replaced the older dating methods. Once accepted, "adjustments were made to achieve internal order in the radiocarbon chronology! Once that comforting operation was completed, a feeling of security enveloped the exponents and their followers."[84] As Flint and Rubin stated, "the consistency of the group of dates under consideration is such as to justify the assumption that all are accurate."[85] Borrowing terminology from Kuhn,[86] C-14 dating is enjoying a normal science status in an evolutionary paradigm. Within a normal science, only minor corrections or improvements of a theory, or puzzle solving activities are done. "Once a structure of belief is internalized, it is very resistant to change, regardless of the empirical evidence for or against that structure."[87]

Besides the above-mentioned reasons, there may be other possibilities: the wide spread acceptance of evolutionary ideas, the status of the inventor as a Nobel laureate, and the lack of an alternative method comparable with the C-14 method.

* * * * * *

The controversy over the C-14 dating method has not yet been settled. By the late 1940s, radioactive dating was not taken seriously by evangelicals. Although there might be some trace of internal tension, there was not much strife over it among Christians. But the emerging influence of J.L. Kulp in the ASA caused a split in the evangelical Christian community: one group included evangelicals who accepted radioactive dating and the antiquity of the earth and life on the earth; and the other was made up of fundamentalist evangelicals who believed in the global flood and a young earth. Largely because of Kulp's influence, supporters of flood geology and a young earth found themselves increasingly isolated within the ASA. Eventually this change within the ASA resulted in several reactions among fundamentalist evangelicals, including the publication of *The Genesis Flood* and numerous other materials along the same lines, and the founding of the CRS, the Creation Science Research Center, and the ICR — all are evidence for a revival of scientific creationism since the 1960s.

In the late 1950s the Adventists had no Kulp. Although Hare did try to fill a similar role, he failed to persuade major Adventist scholars. Many orthodox Adventists remained critical toward C-14 dating. They joined the CRS in their activities and contributed to the *CRSQ*, even after starting their own journal, *Origins*. But in the late 1950s, R. Ritland and P. E. Hare opened fire on the tenets of the fundamental creationists. They indirectly challenged the authority of the writing of Ellen G. White, the founder of the Adventist church. Unlike the ASA, however, the community of orthodox Adventist scientists did not split, due to the strong doctrinal bonds of the church. ❋

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NOTES

[1]For the original technical papers, see W.F. Libby, "Atmospheric Helium Three and Radio Carbon from Cosmic Radiation," *Physical Review* 69 (1946): 671-2; E.C. Anderson, W.F. Libby, S. Weinhouse, A.F. Reid, A.D. Kirshenbaum and A.V. Grosse, "Natural Radiocarbon from Cosmic Radiation," *Physical Review* 72 (1947): 931-6. For the history of C-14 dating, besides Libby's several original papers, see R.E. Taylor, *Radiocarbon Dating — An Archaeological Perspective*, Ch. 6; "Genesis and Prehistory: Conflicting Chronologies," *Spectrum* 3/4 (1974): 32-35.

[2]John C. Whitcomb and Henry M. Morris, *The Genesis Flood* (Phillipsburg, NJ: Presbyterian and Reformed Publishing Co., 1961) p. 370.

[3]Robert W. Woods, "How Old Is The Earth?" *Signs of the Times*, (April 7, 1953) pp. 8-9, 15.

[4]Lester Harris, *In the Beginning* (Nashville, TN: Southern Publishing Association, 1964) pp. 6-7.

[5] Robert V. Gentry, "The Antiquity of Life and Carbon-14," *The Youth Instructor* 114 (October 22, 1968): 9-11, 20; "Extinct Radioactivity and the Discovery of the New Pleochroic Halo," *Nature* 213 (1967): 83-85; "Radiohalos in a Radiochronological and Cosmological Perspective," *Science* 184 (1974): 62-66.

[6] Robert V. Gentry, "The Antiquity of Life and Carbon-14," *The Youth Instructor*; Harold W. Clark, *The Battle Over Genesis* (Washington, D.C.: Review and Herald Publishing Association, 1977) pp. 130-140.

[7] Robert H. Brown, "A Critique: Criticism of Points Raised in ... Five Minutes with the Bible and Science," Supplement to the *Bible-Science Newsletter*, October 1975 (Mimeographed). It was cited by M. Couperus, in "Tension Between Religion and Science," *Spectrum* 10(4) (1980): 82.

[8] G.M. Price, *The Time of the End* (Nashville, TN: Southern Publishing Associations, 1967) p. 114.

[9] G.M. Price, "In The Beginning," *The Forum*, Vol. I (1946): 9-10.

[10] For example, see Ross O. Barnes, "Time and Earth's History," *Spectrum* 3(1) (1971): 43.

[11] Ronald L. Numbers, *The Creationists: The Evolution of Scientific Creationism*, (New York: Alfred A. Knopf, 1992) Ch. 14.

[12] R.M. Ritland, "Problems and Methods in Earth History," unpublished manuscript which was cited in R.L. Numbers, *The Creationists*, Ch. 14.

[13] P. E. Hare, "Amino Acid Dating — A History and Evaluation," *Masca Newsletter* (University of Pennsylvania) 10(1) (1974): 4-7.

[14] R.L. Numbers, *The Creationists*, Ch. 14.

[15] For a brief summary of Brown's view by the late 1960s, see his two chapters, "Radioactive Time Clocks" and "Radiocarbon Dating" in Harold G. Coffin, *Creation: Accident or Design?* pp. 273-316. Also see R.L. Numbers, *The Creationists*, Ch. 14. By the mid-1970s, Brown was still quite critical of C-14 dates: See R.H. Brown, "C-14 Age Profiles for Ancient Sediments and Peat Bogs," *Origins* 2(1) (1975): 6-18.

[16] Robert H. Brown, "Radiocarbon Dating," in H.G. Coffin, *Creation: Accident or Design?* (Washington, D.C.: Review and Herald Publishing Association, 1969) pp. 299-316.

[17] R.H. Brown, "C-14 Age Profiles for Ancient Sediments and Peat Bogs," *Origins* 2(1) (1975): 6-18; *Origins* 6(1) (1979): 30-44; *Origins* 10(2) (1983): 93-95; Brown's symphathetic review of R.E. Taylor's *Radiocarbon Dating: An Archaeological Perspective* in R.H. Brown, *Origins* 14(1) (1987): 29-30. And in a recent article Brown tried to correlate C-14 ages with the biblical time scale: R.H. Brown, *Origins* 17(2) (1990): 56-65.

[18] For Pearl's position, see Henry F. Pearl, "Letter To Hackett," (March 11, 1976). Originally Pearl presented this view in his master thesis in 1963(?). For an assesment of Brown's argument, see Ross O. Barnes, "Time and Earth's History," *Spectrum, 3(1) (1971): 29-47.*

[19] To see Brown's changing attitude toward C-14 dating, see R.H. Brown, "The Interpretation of C-14 Dates," *Origins* 6(1) (1979): 30-44; "Implications of C-14 Ages vs. Depth Profile Characteristics," *Origins* 15(1) (1988): 19-29; "Correlation of C-14 Age with the Biblical Time Scale," *Origins* 17(2) (1990): 56-65.

[20] M. Couperus, *Spectrum* 10(4): 82-83.

[21] For the inner political dynamics of the Adventist church and the GRI, see R.L. Numbers, *The Creationists*, Ch. 14.

[22] R. Ervin Taylor, "Genesis and Prehistory: The Conflicting Chronologies," *Spectrum* 7(3/4) (1974): 33-34.

[23] R.E. Taylor, "Concordances Between Radiocarbon and Racemization-based Dating of Bone," Carnegie Institution of Washington Conference: *Advances in the Biochemistry of Amino Acids*, Warren, Virginia, October 29-November 1, 1978. It was cited by Molleurus Couperus in "Tensions Between Religion and Science," *Spectrum* 10(4) (1980): 84. Taylor recently published comprehensive review on the C-14 dating: R.E. Taylor, *Radiocarbon Dating: Archaeological Perspective* (Orlando, FL: Academic Press, 1987) 212 p.

[24] R.E. Taylor, "Genesis and Prehistory," *Spectrum* 3/4 (1974): 29-36.

[25] Ross O. Barnes, "Time-and Earth's History," *Spectrum* 3 (Winter 1971): 43-44.

[26] Molleurus Couperus, "Earth's History," *Spectrum* 3 (Winter 1971): 5; "Tensions Between Religion and Science," *Spectrum* 10(4) (1980): 81-84.

[27] Lawrence T. Geraty, "The Genesis Genealogies as an Index of Time," *Spectrum* 6(1/2) (1974): 5-18. See also p. 83 of Couperus' article of 1980 in *Spectrum*.

[28] See the first constitution of ASA (May 1942). It was cited in F. Alton Everest, *The American Scientific Affiliation: Its Growth and Early Development* (1986) p. 118.

[29] As shown in "The American Scientific Affiliation Membership List—August, 1946," several faculty members of Wheaton College, such as biologist Russell L. Mixter, geologist Cordelia Erdmann, chemists Marion David Barnes and Roger J. Voskuyl, and archaeologist George R. Horner participated in the ASA.

[30] For the relationship between the ASA and the IVCF, see C. Stacey Woods, "Inter-Varsity Christian Fellowship and the Role of the American Scientific Affiliation," (*Journal of the American Scientific Affiliation (JASA)* 8(4) (December 1956): 11-14.

[31] Burton L. Goddard, "The E.T.S., History and Purpose," *JASA* 7(3) (September 1955): 5-8; "Biennial A.S.A.—E.T.S. Convention of 1957," *JASA* 9(4) (December 1957): 3.

[32] For the relationship between the ASA and the Moody Institute of Science, see Henry M. Morris, *A History of Modern Creationism* (San Diego, CA: Master Book Publishers, 1984) pp. 142-143.

[33] For example, Christian Association for Psychological Studies, Christian Legal Society, Christian Medical Society, Institute for Advanced Christian Studies and Institute for Christian Studies. See F. Alton Everest, *The American Scientific Affiliation: Its Growth and Early Development* (1986) p. 148.

[34] Discussion of the paper of E.Y. Monsma, *JASA* 1(3): 20-26. For the hostility toward recent creation and a cataclysmic

deluge, see H.M. Morris, *A History of Modern Creationism*, p. 134.

35 For a brief biography of J.L. Kulp and his role in the ASA, see R.L. Numbers, *The Creationists*, Ch. 9.

36 For example, see the discussion session of E.Y. Monsma, "Some Presuppositions in Evolutionary Thinking," *JASA* 1:15-30 (June 1949); J.L. Kulp, "Deluge Geology," *JASA* 2(1) (1950): 1-15.

37 Members of the American Scientific Affiliation, *A Symposium of "The Age of the Earth,"* edited by J.L. Kulp, 1948.

38 J.L. Kulp, *A Symposium of "The Age of the Earth,"* pp. 1-15.

39 H.M. Morris, *A History of Modern Creationism*, p. 137.

40 E.Y. Monsma, *JASA*, pp. 20-21.

41 J.L. Kulp, *A Symposium of "The Age of the Earth,"* pp. 1-2; B. Ramm also pointed out a lack of geological training in flood geologists: Bernard Ramm, *The Christian View of Science and Scripture* (Grand Rapids, MI: Wm B. Eerdmans Pub., 1954) p. 126.

42 E.Y. Monsma, *JASA*, p. 24.

43 J. Lawrence Kulp, "Deluge Geology," *JASA* 2 (1949) 15.

44 In contrast to Allen's criticism, Eggenberger, Holland and Erdman already accepted radioactive dating. See other papers appearing in the *JASA* in the early 1950s: Delbert Eggenberger, "Methods of Dating the Earth and the Universe," *JASA*, 3 (March 1951): 1-3; H.D. Holland, "Recent Concepts of the Origin and Evolution of the Earth," *JASA* 4 (December 1952): 23-28; Cordelia Erdman, "Stratigraphy and Paleontology," *JASA* 5(1) (March 1953): 3-6; Roy Allen, "The Evaluation of Radioactive Evidence on the Age of the Earth," *JASA* 4 (December 1952): 11-20.

45 See "The American Scientific Affiliation Membership List—August, 1946," *The Yearbook of the ASA* (1946); "The American Scientific Affiliation Membership List—August, 1948," *The Yearbook of the ASA* (1948); "The American Scientific Affiliation Membership List—November 1950," *JASA* 2(4) (December 1950) Appendix; "Directory of the American Scientific Affiliation," *JASA* 5(4) (December 1953): pp. 19-29.

46 B. Ramm, *The Christian View of Science and Scripture*, p. 171.

47 R.L. Numbers, *The Creationists*, Ch. 9.

48 H.M. Morris, *A History of Modern Creationism*, p. 137.

49 J.C. Whitcomb, "A Questionnaire on Creation and the Flood," (1955); J.C. Whitcomb to H. M. Morris, October 8, 1955; both in the Whitcomb papers. All this was cited in R.L. Numbers, *The Creationists*, Ch. 10.

50 J.C. Whitcomb and H.M. Morris, *The Genesis Flood*, pp. 371-372.

51 W. F. Libby, "Radiocarbon Dating," *American Scientist* 44 (January 1956): 107.

52 See footnotes in *The Genesis Flood*, pp. 370-377.

53 J.C. Whitcomb to H.M. Morris, June 19, 1961, Whitcomb Papers. It was cited by R.L. Numbers, *The Creationists*, Ch.10.

54 R.L. Numbers, *The Creationists*, Ch.10.

55 Reception of *The Genesis Flood* was shown in its sales record, now in its 35th printing in May 1991!

56 The first inner-core steering committee of the CRS included the following: T.G. Barnes, C.L. Burdick, D.T. Gish, J.J. Grebe, R.L. Harris, J.W. Klotz, W.E. Lammerts, K.W. Lisenmann, F.L. Marsh, E.Y. Monsma, J.N. Moore, H.M. Morris, W.H. Rusch, H. Slusher,W.J. Tinkle, D.A. Warriner, W.L. Webb, and P. A. Zimmerman. Among these, Harris, Klotz, Lammerts, Marsh, Monsma, Morris, and Tinkle were members of the ASA.

57 Philip B. Marquart, Letter to the Editor, *JASA* 15(3) (September 1963): 100.

58 *Creation Research Society Annual* (1965), inside front cover.

59 Actually, many contributors to the *CRSQ* (*Creation Research Society Quarterly*) were Adventists.

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74 H.M. Morris and J.C. Whitcomb, *The Genesis Flood*, p. 377.

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80 D.A. Young, ibid, Ch. 10.

81 D.A. Young, ibid, Ch. 11, p. 160.

82 For examples, Robert E. Lee, "Radiocarbon: Ages in Error," *Anthropological Journal of Canada* 19(3) (1981): 9-29; Harold S. Gladwin, "Dendrochronology, Radiocarbon, and Bristlecones," *Anthropological Journal of Canada* 14(4) (1976): 2-7.

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In Search of the Historical Adam: Part 1

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Human beings appear to be related by common ancestry that extends back in time 100,000 years or more. If Genesis has accurately presented the surrounding environment in the beginning chapters, and if weight is given to recent archaeological findings, Adam's niche in time and space is about 5000 to 4000 BC in Southern Mesopotamia, thus precluding his being the progenitor of the entire human race. The garden of Eden probably required irrigation via a canal network to sustain Adam and his immediate family. Although Adam may very well have been specially created by God, intermarriages between the covenant line of Adam and the indigenous populations assure even Adam's descendants a link to the distant past. All this can be deduced not only from archaeological finds and ancient cuneiform tablets, but from clues in the Scriptures as well.

For those who believe Genesis is historically accurate, Adam and Eve were *de facto* historical figures, not symbolic representations concocted by Moses or some other source. Indeed, the historicity of the covenant couple is implied in the New Testament as well. It is the purpose of this series of two articles to show that Adam appears to have actually been an historic personality who had a moment and a place in history. Furthermore, a specially created Adam dictated by the Scriptures is entirely compatible with this thesis.

Bible interpreters have had a propensity to conclude that the Genesis text confers upon Adam the distinction of being the biological head of the entire human race. The Bible does position Adam as the first "man" (I Cor. 15:45), but what definition is to be applied? Could Adam have been the first hominoid or hominid, an *Australopithicine* perhaps; or first of the genus Homo, such as *Homo habilis* or *Homo erectus*? Was Adam first of the archaic *Homo sapiens*, first of the modern *Homo sapiens*, the first Caucasian, or was he the first of a Near East people from which present-day Jews, Arabs, and some others have derived? Remember, Adam was a unique person who could have lived only once.

Small amounts of secular history were incorporated in Luke and Acts. As a result, readers many centuries removed have had minimal trouble determining when and where the events took place. In the beginning of Genesis also, sufficient peripheral information is recorded to give us a fairly accurate historical perspective. We are told just enough about the culture of Adam's day that we can get some idea as to his approximate time frame. The genealogies in Genesis 5 and 11 are especially helpful in pinpointing Adam, both in time and place. (The secular surroundings of Adam and his kin will be explored in the second article in this series of two, to be published in the March 1994 issue of *Perspectives*.)

Mitochondrial Eve

The "Eve hypothesis" was developed from pioneering work in mitochondrial DNA published by Wilson and Sarich in 1987. According to them, and subsequent researchers, there is evidence that all human beings have descended from one common female genotype who lived in Africa about 200,000 to 100,000 years ago.[1]

Support for the "out of Africa" model can be derived from the morphological diversity seen among black Africans today. African peoples must therefore be very ancient, since presumably more time should be required to produce such diverse populations from common stock.

Researchers at the Natural History Museum in London prefer the "out of Africa" model. It is believed that only there *Homo erectus* gave rise to modern humans. They spread throughout Europe and Asia, displacing whatever remnant populations they may have encountered in their migrations.

A number of distinguished paleontologists disagree, and have published data suggesting a co-mingling between ancient and more modern peoples. Their evidence supports "regional continuity," meaning that local populations of archaic ancestors eventually begat modern types. An analysis of human fossils found in Israel and Africa, when compared with older *Homo erectus* remains, led researchers to place *Homo erectus* directly in the line of hominids that culminated in modern man. *Science* reported:

> These modern-looking fossils all date to about 100,000 years and appear at the end of a sequence of fossils that stretches back to 400,000 years ago, which seem to show a gradual transition from their *Homo erectus*-type forebears to early modern humans.[2]

What unity there is among contending parties was summed up:

> In spite of the contention, all parties can agree on one thing. The proto-human fossil record begins in Africa, with a species now called *Homo erectus*. After evolving in an African homeland, all concur, *Homo erectus* migrated to Europe and Asia about 1 million years ago. But after that, comes the Great Divide in paleoanthropology.[3]

Although two theories are competing for prominence, what has been generally agreed upon by both molecular biologists and paleoanthropologists is that all humans are biologically connected, as evidenced by our DNA signatures[4] (and confirmed in Acts 17:26). When and under what circumstances ancient "Eve" got here is still an open question.

The temptation among some Bible apologists has been to postulate that Adam must have lived at a similar early date as mitochondrial Eve, and thus the origins issue is seemingly resolved. The problem with this idea is that even if the Bible was accommodating (and it isn't), how do you explain the various precursors predating that point in history, such as *Homo erectus*? Can they just be swept under the rug?

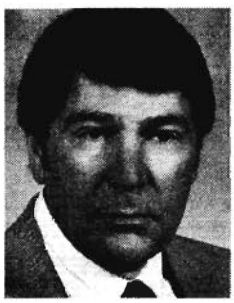
According to the Bible, Adam was the first to have a covenant relationship with the Creator, the first to be accountable, the first to sin and suffer the consequences, and the first in the line of promise leading to the Savior. That does not necessarily mean, however, that Adam was the first biped with an opposable thumb and a cranial capacity of 1300 to 1400 cubic centimeters.

Adam — Ancient or Recent?

Placing Adam's time frame in the distant past infers the Genesis record must have omitted the names of hundreds of generations who supposedly lived between Adam and Abraham. The rationale is that the word "begat" does not necessarily mean "the immediate father of," so the named patriarchs in Genesis 5 and 11 would be only a representative sampling.[5]

The elasticity of Hebrew grammar can be seen to permit genealogical stretching. The Hebrew word *"ben"* for "son" can also mean "grandson," "children," or even "descendant."[6] Jesus is called "the son of David," for example (Matt. 1:1). Conversely, the word *"'ab"* for "father" can mean "ancestor." So the means for accommodation are in place, and many Bible scholars have taken this path.

These interpreters point out inconsistencies in Bible genealogies by comparing Old Testament authors with New Testament authors, and then say-



Dick Fischer received his Bachelor of Science degree from the University of Missouri in 1961. He recently attained his Master's degree in theology from Evangel Theological Seminary in Virginia, and he is listed in the 1992 edition of Who's Who in Theology and Science. *This series of two articles has been excerpted from a manuscript that he declares has been ten years in the making. It carries an ominous working title:* The Origins Solution: An Answer in the Creation-Evolution Debate.

ing, for example: "Aha! Matthew dropped three relatives out of Jesus's lineage that are clearly listed in II Kings (Ahaziah, Joash, and Amaziah)."[7]

Thus these inconsistencies and allowances in Hebrew grammar are seen as somehow establishing a precedent which makes the genealogies in Genesis 5 and 11 and in Luke 3 fair game, and therefore, expandable at will. Like many other devices, this one will not stand up to scrutiny.

Seth has to be the immediate son of Adam (Gen. 4:25). The identical phraseology which sets Adam's age at the birth of his son, Seth, is repeated from Seth to Noah (Gen. 5:3-29). If there are no intermediate generations from Adam to Seth, then that should indicate the same thing down the line.

In Jude 1:14, Enoch is "the seventh from Adam," inhibiting additional unnamed patriarchs for the first seven generations. Methuselah died near the time of the flood, presumably before the rain started. That ties in the age of the patriarch at his death with the date of the flood, thereby precluding any additions of time between Methuselah and Noah.

Thus these inconsistencies and allowances in Hebrew grammar are seen as somehow establishing a precedent which makes the genealogies in Genesis 5 and 11 and in Luke 3 fair game, and therefore, expandable at will. Like many other devices, this one will not stand up to scrutiny.

So if there is no space to stick in hundreds of generations from Adam to Enoch, and Enoch's son, Methuselah, died in the year of the flood (assuming a recent flood), that is the *coup de grace* to the expanding genealogies method. Inserting additional time or generations is not a workable proposition from Adam to Noah.

The idea that Noah or Shem would have recorded ten forefathers, detailing the age of each at the birth of their first son, or son of the line of promise, and the age at death, while omitting hundreds of intermediate generations, is beyond reason. There is no justification for postulating intermediate, unnamed generations in Genesis 5. Even if it were theoretically possible to insert extra generations, the specific language used giving the age of the father at the birth of each succeeding son prohibits inserting more *time*. So it is a moot point. Archer maintains:

> ... for even allowing the numerous gaps in the chronological tables given in Genesis 5 and Genesis 10 it is altogether unreasonable to suppose that a hundred times as many generations are omitted in these tables as are included in them.[8]

More importantly, the background information surrounding Adam and his generations to Noah, and from the flood to Abraham, is far too modern in description to have happened at such an early period in man's history.

More importantly, the background information surrounding Adam and his generations to Noah, and from the flood to Abraham, is far too modern in description to have happened at such an early period in man's history. How would livestock raising and farming (Gen. 4:2) have come before hunting and gathering? Could sophisticated musical instruments (Gen. 4:21) predate simple bone flutes? How could metal working (Gen. 4:22) have preceded the Neolithic (late Stone Age) period? It serves no useful purpose to render the Genesis account incredible in order to extend a hermeneutical helping hand the Bible can do without.

Why force something that isn't there? If we believe paleontologists, anatomically modern humans go back some 100,000 years; archaic *Homo sapiens* first appeared about 300,000 years ago; and hominids of some description can be traced back 2.5 million years with precursors to 4 million years ago. And if we trust the biblical text, Adam fits best at about 5000 to 4000 BC. Schroeder addresses this issue in *Genesis and the Big Bang*:

> For the Bible scholar, it is not an easy task to accept as reality that for the past 100,000 years there existed animals such as hominids and that the skeletons of these ancient animals are near replicas of those of modern man. But the fossil evidence is abundant and irrefutable. It is folly, no it is counterproductive, to close one's eyes to this fact.[9]

Of course, a figure like 100,000 years ago for the emergence of anatomically modern humans may undergo revision in the future, but barring any drastic

changes, there really is no comfortable niche for Adam any time before communicative bipedal creatures had already commenced on planet Earth. What became of *them* is the real issue.

These creatures either died out, leaving the world devoid of humanity until Adam was created, or else they left progeny who were busy populating the earth when Adam arrived on the scene. Adam either evolved or was nonexistent — notions the Bible rejects — or else he was inserted, so to speak, into the train of humanity. This is the solution we will explore.

A Time for Adam

The task of finding some place to inject Adam into human history can be simplified if we let the Bible do the talking. References to tents, farming, and raising livestock suggest that Adam was not a cave dwelling hunter-gatherer.

Archaeologists place the beginnings of modern man 10,000 years ago with the advent of farming techniques.[10] Adam's placement at roughly 5000 to 4000 BC from the Genesis genealogies, combined with the mention of farming, makes this a compatible time frame.

Lamech, a descendant of Cain, had three sons by his two wives (Gen. 4:19-22). Jabal "was the father of such as dwell in tents, and of such as have cattle." A second son Jubal, "was the father of all such as handle the harp and organ."

In just eight generations counting Adam, there are tents, livestock, and musical instruments; not caves, wooly mammoths, and hand axes. For many reasons, we can conclude that Adam was not contemporary with the "Flintstones." A wealth of Stone Age artifacts have been uncovered giving silent testimony to a culture long disappeared at this point. So where does Adam fit in the history of man? The next verse is explicit.

In Genesis 4:22, one of Cain's descendants, Tubal-cain, was "an instructor of every worker in brass and iron." The Hebrew word for "brass" also means "copper," and copper tools were not in use before 10,000 years ago. Although iron smelting would be out of the question, there is evidence that bog iron was beaten into rudimentary tools, and iron was known as far back as 4000 BC,[11] or else what may have looked like iron could have been tin. Copper and tin together make bronze, and the Bronze Age is identifiable in history, starting about 3000 BC.[12]

That is the proverbial smoking gun. Adam belongs after the old Stone Ages, near the threshold of the Bronze Age, in a period called the Chalcolithic, when traditional stone tools were being gradually augmented by crude copper implements. Adam's descendants saw the dawning of the Bronze Age.

> In the initial period of the Middle Eastern civilizations, from about 3000 BC, there was a truly remarkable development of metallurgy. This is seen in the beginning of the Bronze Age, when alloys of arsenic and copper, or tin and copper (in both cases known as bronze), came into being ... [13]

Stone tools would have been of little use to Noah when he needed to construct a massive watertight ark. Metal tools suitable for such an undertaking would have only been available if the pre-flood patriarchs lived in the period of what archaeologists call "modern man;" that is, after 10,000 years ago. The Stone Age periods may not have completely passed by Adam's day, but apparently human history was well into the Bronze Age by the time of Tubal-cain and Noah. And a late entry for Adam puts him in the company of unrelated indigenous populations.

Why Cain Feared for His Life

Cain's lament in Genesis 4:13-14 highlights the issue of whether Adam was alone or not. By murdering Abel, only Cain and his parents were left. Cain's first words upon hearing the Lord's punishment were out of fear that someone would kill him. Is it likely that his immediate worry was that his parents would retaliate, or that he would be tracked down and killed by future and thus far unborn generations from Adam? Cain would have had a whole world in which to hide.

God answered Cain's plea by providing a sign for him (Gen. 4:15). Cain's anxieties were justified as evidenced by the Lord taking action to quiet his fears. We have no way of knowing what that sign or mark was, but evidently it was necessary. From Cain's point of view, the entire human race would have reached a dead end at that point — unless there were other human beings about.[14] There must have been potentially hostile tribes of men in the vicinity. Cain was aware of it, and the Lord's action attested to his justifiable fear.

> And Cain went out from the presence of the Lord, and dwelt in the land of Nod, on the east of Eden. (Genesis 4:16)

Throughout the Bible the "land of Canaan" or the "land of Egypt" refers to an area populated by

those particular peoples; such as Canaanites and Egyptians. Why have Bible interpreters not considered that the "land of Nod" might well have been populated by "Nodites," who were minding their own business before Cain arrived, and might have been the very ones Cain feared? In Hebrew, *"nod"* means "wandering." This would be an apt designation for a band of nomads who might have been in the area at the time, *"nod"* being simply a form of the word, "nomad."

Removing the Shackles of Prejudgment

Once we hold up to scrutiny the traditional assumption that Adam was the first human, and consider the probability that other human beings were already living in Adam's proximity, previous pitfalls in the Genesis narrative disappear. Passages that had obscure meanings become clear. The "Nephilim" or "giants" in Genesis 6:4 may now be identified as prehistoric, or pre-Adamic — not in Adam's line of descendants, or ancestry.

If we can shed our preconceptions, we may view Genesis from a new perspective. Yes, the early chapters are lacking an abundance of details. Paleontologists also differ over the course of man's descent due to sparse fossil evidence of early hominids. And it is too early for gene research to give us a conclusive picture.

Nevertheless, if we can cast off the shackles of prejudgment, we can examine the Genesis text with a view toward what may not be entirely provable, but is certainly possible, plausible, and, if I may be so bold, indeed probable.

The Image of God

> So God created man in His own image, in the image of God created He him; male and female created He them. (Genesis 1:27)

What does it mean to be created in God's image? "The ancient Orient shows us with ever increasing clarity that the purpose and function of an image consists in representing someone," Edmond Jacob writes in *Theology of the Old Testament*. "An image, that is to say a statue of a god is the real presence of this god ... "[15]

In that context, Adam would have been God's representative to the world, and an already populated world to boot. Humbert raised another possibility; that man was given the same "physical outward appearance" as the deity.[16] However, the human physique has a certain functionality necessitated by our physical environment that is not required by a Creator-God.

By using the term "God's image," the writer of Genesis may have been alluding to the inner essence of us which is an integral part and yet unseen — our soul, or our spirit. That may not have been an altogether unique feature. We are in the dark with respect to Adam's neighbors, even though Adam was apparently infused with something which gave him a kind of kinship with the deity.

Who is the "them" referred to in Genesis 1:27? It has been argued that the plural "them" should be applied to generic man, and not exclusively to Adam and his generations. But most Bible scholars believe this passage applies solely to Adam and Eve, and their descendants who came under the Adamic covenant. This is expressly implied in Genesis 5:1-3:

> This is the book of the generations of Adam. In the day that God created man, in the likeness of God made he him; male and female created he them; and blessed them, and called their name Adam, in the day when they were created. And Adam lived an hundred and thirty years, and begat a son in his own likeness, after his image; and called his name Seth.

It is true that traditionally most Bible scholars have thought all of humanity started with Adam. This stand has been taken, however, with a certain nonchalance for not only the fossil record and the genetic evidence, but even the qualifiers in the Scriptures themselves. Adam was created, and then Eve, but it is unwarranted to presume ancient precursors are encompassed by Genesis 1:27.

Adam, as God's chosen, was the first man capable of achieving God's kingdom, and that was passed down through his generations until Christ's sacrifice at the cross changed the equation and brought a new covenant. Presumably any outsiders in Adam's day would have been outside the covenant, and unable to enjoy this unique status, which included the hope of redemption through (1) the Adamic bloodline, (2) the discipline of self righteousness, and (3) the ritual of animal sacrifice.

As the first type of Christ, Adam may have had a similar mission. Adam's task was probably to bring the word of God's kingdom to the polytheistic heathen living all around him. We can only guess. We can never know with certainty what it was Adam was supposed to have done, or could have done had he not yielded to Satan's odious deception so early on.

A Place for Adam

In terms of place, Southern Mesopotamia is clearly indicated by the Bible. The rivers, Hiddekel (Tigris) and Euphrates, the cities of Erech and Ur (and much more we will explore in depth) all point to this region— a region that came to be called "Sumer." Jacquetta Hawkes describes it in *The Atlas of Early Man*:

> The fourth millennium in Sumer is one of the most remarkable passages in human history. Already at its beginning old settlements such as Eridu, Uruk, Ur, Lagash and Nippur had become substantial towns and from 3500 BC they waxed into cities. The citizens now included large numbers of specialist artisans — potters, carpenters, makers of mudbrick, coppersmiths — and fine sculptors too.[17]

Identifying the various cultures which have flourished in the Near East has been done with meticulous care made possible by years of carefully compiled archaeological data. The earliest identifiable people belong to the Neolithic Natufian culture, which was spread from Palestine to Syria, and date from about 12,500 to 10,500 years ago, clearly a pre-Adamic date. The oldest city identified with Natufian culture was Jericho.[18]

In 1961-1963, the excavation at Catal Huyuk in south-central Turkey was excavated in the early 1960s. It was dated from 6500 to 5400 BC, and supported the concept of regional areas of Neolithic development instead of a single nuclear area, such as a city.

> Contrasts among Jericho, Catal Huyuk, Jarmo, and Umm Dabaghiyah — all about 6000 BC — suggest a considerable regionalization within widely scattered Neolithic communities of the Near East.[19]

In the Tigris and Euphrates floodplain, the ancient cultures leading to the development of Sumerian, Babylonian, and Assyrian civilizations can be traced from late Neolithic villages of around 5500 BC to towns and urban areas of the highly developed Sumerians of 2500 BC.

The Hassuna culture takes its name from the mound of Tell Hassuna in northwestern Iraq, and dates to 6000-5250 BC. Numerous agricultural villages have been unearthed in Iran, Turkey, and Palestine that were contemporary with the Hassuna.

The coarse pottery wares identified with the Hassuna were gradually replaced by the remnants of the Samarra culture, starting about 5500 BC. At Tell-es Sawaan in Iraq alabaster female figurines were discovered, along with ornaments of turquoise, carnelian, greenstone, and copper. The presence of widely disparate materials in one location indicates trading practices, and shows that trade routes had already been established by that time.[20]

Dating from 5500 to 4700 BC, the Halaf culture succeeded, but overlapped the Samarran. Halafian ceramics have been discovered from the Mediterranean coast to Iran, though the Tigris-Euphrates region south of Baghdad may have been uninhabited at this early date.

From similarities in pottery shards and other artifacts, the highly developed Sumerian, Babylonian, and Assyrian civilizations that flourished in the third and second millennium periods can be traced to the late Neolithic villages of around 5500 BC. There is no break that one would expect to see if there had been a catastrophic termination of mankind and a subsequent renewal, a theory that is popular among "gap" proponents.

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Located four miles from the ancient city of Ur is the small archaeological mound of al-'Ubaid. The settlements in southern Mesopotamia dating from 4500-3500 BC are collectively assigned to the Ubaid culture. Whether or not pre-Ubaid sites exist in southern Mesopotamia is a subject of controversy. Some archaeologists believe that fluctuations in the level of the Persian Gulf may have erased any traces of earlier settlements.

The origin of the Ubaid culture is unknown. The Halafians were flourishing in the north at about the same time Ubaidan farmers began to settle the southern delta of the Tigris and Euphrates rivers. The climatic conditions seem unlikely for a Garden of Eden until the advancement of irrigation could bring

its blessing of water to the area. This began to happen during the Ubaid period.

By 3500 BC, the Ubaidans were living in townships from Mesopotamia to Syria to Turkey. The subsequent flood at the time of Noah could have wiped out the Ubaidans, although there is some evidence the Sumerian culture may have derived from the Ubaidan. Broken pieces of pottery show subtle transition from Ubaid ware to Uruk ware. This is more indicative of gradual change through the influence of friendly contact with neighboring cultures than it is of a foreign invasion and replacement by conquest. Yet some archaeologists prefer the displacement model, and believe the Sumerians were a discrete population.

The purpose of designating these ancient populations as Halafian, Ubaidan, or Sumerian is primarily to place them in time and place context, and need not necessarily imply ethnic differences. The flood must have devastated Southern Mesopotamia, leaving behind ruined cities which the next generations of Sumerians could build on and repopulate. Whether Ubaidan fathers had Sumerian sons is unknown.

The flood must have devastated Southern Mesopotamia leaving behind ruined cities which the next generations of Sumerians could build on and repopulate.

When it comes to identifying candidates who may have been enjoying the Tigris and Euphrates region prior to Adam's creation, there are two or three choices depending on the precise date of Adam's arrival. We can select the earlier Halafians, the Ubaidans, or the later Sumerians, although the Ubaidans seem the most likely:

> About 4500 BC the region was settled by people who came to be called Ubaidans. They in fact settled most of the sites where the great cities of Sumeria [Sumer] were to grow — including Ur (where Wooley found their remains under the silt of the flood). Later they spread up the valley, succeeding the Halafians and becoming the first people to dominate the whole of Mesopotamia.[21]

The harsh, arid conditions might have caused the Halafians to make only brief appearances in the south, or maybe they never got there at all. The first inhabitants of the Tigris and Euphrates basin that can be readily identified are the Ubaidans, succeeded by the Sumerians.

Flood deposits have been found at key Southern Mesopotamian city sites; Kish, Shuruppak, Erech, and Lagash that center around a 2900 BC time frame.[22] However, both Ubaidan and Sumerian artifacts have been found at levels dated earlier than that. The Sumerians re-established their civilization after the flood, and rebuilt or resettled previously established city sites.

Conceivably Halafians could have been living in the vicinity of Eden when Adam was placed in the garden. But Ubaidan pottery has been found at the lowest levels of excavated cities in Southern Mesopotamia, and the Ubaidans best fit the most likely time frame. Adam and his generations likely were surrounded from the beginning, or became surrounded by first Ubaidan, and then Sumerian culture.

Irrigating the Garden

> And every plant of the field before it was in the earth, and every herb of the field before it grew: for the Lord God had not caused it to rain upon the earth, and there was not a man to till the ground. But there went up a mist from the earth, and watered the whole face of the ground. (Genesis 2:5-6)

Genesis 2:5-6 is a useful passage to use in demonstrating that Bible interpretations which exclude pertinent extra-biblical data can produce dubious opinions and perplexing conclusions. From this verse, Henry Morris argues for a "vapor canopy" over the early earth, and reasons:

> In the original world, however, there was no rainfall on the earth. As originally created, the earth's daily water supply came primarily from local evaporation and condensation.[23]

Morris reaches this conclusion solely on his reading of the biblical text, deducing that rain doesn't come until the flood, notwithstanding the fact that no one has discovered any place in the world where mist or fog naturally oozes out of the ground in sufficient volume to water humans, livestock, and crops. We would also be left to wonder what furnished the rivers in Genesis 2:10-14 with water. Were the Tigris and Euphrates not supplied by snow melt and rainfall as they are today?

In their well known *Commentary on the Old Testament*, Keil and Delitzsch explain Genesis 2:5 as follows:

> The creation of the plants is not alluded to here at all, but simply the planting of the garden in Eden.

They too slide down the slippery slope to a woeful opinion. This was "dependent upon rain," they decide, and conclude that the mist or vapor in Genesis 2:6 was the "creative beginning of the rain itself..."[24] So even though the Bible states in the previous verse "for the Lord God had not caused it to rain," nevertheless, rain it was, according to this respected Bible commentary.

So which is it, rain or no rain? The answer can be sought in the *Cambridge Encyclopedia of Archaeology* pertaining to ancient Mesopotamia:

> The culmination of these prehistoric advances is to be found in the 'Ubaid period of the sixth and fifth millennia, when the earliest settlements are known from Sumer. This area was characterized by the very great fertility of its alluvial soil and — outside local areas of marsh and lagoon, where a specialized fishing, hunting and collecting economy could have been practiced — an extremely arid environment that necessitated the use of irrigation for successful agriculture.[25]

Could "an extremely arid environment" be described as a place where the "Lord God had not caused it to rain?" Could a "mist from the earth" that "watered the whole face of the ground" refer to a land "that necessitated the use of irrigation for successful agriculture?"

It seems "there was not a man to till the ground" for an uncomplicated reason. No one had irrigated the desert soil; thus no plowing had been done, so no crops could be grown.

Driver suggests irrigation:

> Provision [is] made for the irrigation of the garden. The reference is implicitly to a system of canals, such as existed in Babylonia ...[26]

The Septuagint offers further assistance. In the Greek text the word is not "mist," but "fountain." The RSV uses "stream." Certainly the words "fountain" and "stream" better describe an irrigation canal than a vapor canopy. It seems "there was not a man to till the ground" for an uncomplicated reason. No one had irrigated the desert soil; thus no plowing had been done, so no crops could be grown.

Even before the first cities began to appear on the Mesopotamian plain, sizeable settlements such as Jericho were being supplied by irrigation.

> The biblical city of Jericho, a center for salt trade, flourished during the seventh millennium BC in the desert near the north end of the Dead Sea. Water diverted from a spring nourished its fields.[27]

In Genesis 2:8, "And the Lord God planted a garden eastward in Eden; and there He put the man whom He had formed." "And a river went out of Eden to water the garden ... " (Gen. 2:10).

It is unlikely that a river, synonymous with "brook" or "creek," is intended. Water falls on the ground, trickles into streams, and flows to rivers, which empty in the sea — the exact opposite of what the verse states. The purpose of irrigation canals is to carry water from the rivers to the ground — precisely what the verse states. There were no "rivers" in Babylon (Psa. 137:1), only canals. In other words, there was a place called Eden, out of which a canal ran eastward to irrigate the garden, where God placed Adam.

What cries out for attention, though, is this: How could Eden be identified and named as a place distinct from the garden if there was no citizenry?

We know that Southern Mesopotamia was laced with a canal network, the remains of which can still be seen today as lines in the desert. Canals obviously required people to dig and maintain them. What cries out for attention, though, is this: How could Eden be identified and named as a place distinct from the garden if there was no citizenry?

Take any place — London, England, for example. Was there ever a time when London was unoccupied? Well, yes, but no one could have called it "London" then. The principle is the same concerning Eden. Isaiah speaks of the Lord making the wilderness of Zion "like Eden" (Isa. 51:3). Eden was apparently a place for people, and had to have people before it could be called "Eden."

Who lived in Havilah (Gen. 2:11,12), and who mined the gold there? Driver places Havilah "most probably" in the northeast of Arabia on the west

coast of the Persian Gulf, south of Egypt, and adds, "The gold of Arabia was famed in antiquity."[28] Also, the remains of mines have been found in the Egyptian Nile Valley that were active over 30,000 years ago.[29] There may be other ways to explain this verse, but the implications are that gold mining preceded even Adam's Fall!

We may not know who was living in "the whole land of Ethiopia" (Gen. 2:13), but sewing needles and stone vessels for grinding grain into meal were found at el-Badari along the Nile dating to slightly earlier than 5000 BC.[30] This was about the same time that Hassuna and Nineveh were established beside the Tigris (biblical Hiddekel) in the region later known as Assyria.

Enuma Elish — An Early Creation Epic

The first people who can be clearly identified as likely descendants of Adam are the post-flood Semitic Accadians. Most authors believe that an influx of Semites[31] from the early third millennium BC were known by the Sumerians as "Martu."[32] The Accadians apparently learned their writing skills from the Sumerians, and began to record their own versions of history in their own language using the same cuneiform technique.

One of the early creation epics was written in Accadian or Babylonian cuneiform and is called Enuma Elish. It has been compiled from tablets found at Ninevah, Ashur, and Kish.[33] According to legend, father Ea (second in the early Accadian Trinity) begat the heroic Marduk who slays the rebellious Tiamat. Thereupon:

> *He split her like a shellfish into two parts:*
> *Half of her he set up and cield it as sky ...* [33]

(For a shadow of this see Psa. 89:9,10 and Isa. 51:9.) The one who "contrived the uprising" was the evil Tiamat's commander-in-chief, Kingu:

> *They bound him, holding him before Ea.*
> *They imposed on him his guilt and severed his blood (vessels).*
> *Out of his blood they fashioned mankind.*[34]

In this account, the blood of Kingu was used, but in another legend the blood is mixed with clay.[36] Although somewhat gory in describing the mode of their creation, the Accadians also seemed to be aware they were not alone in the world. Frequent references are made to the "black-headed" people.[37]

The "black-headed" was a reference to the Sumerians who supplanted the Ubaidans, or conceivably, it could be a reference to some other race of people. But regardless of who they were, they were not Semites (or Adamites) judging from Accadian poetry.

> *May he shepherd the black-headed ones, his creatures.*
> *To the end of days, without forgetting, let them acclaim his ways.*
> *May he establish for his fathers the great food-offerings;*
> *Their support they shall furnish, shall tend their sanctuaries.*
> *May he cause incense to be smelled ... their spells,*
> *A likeness on earth of what he has wrought in heaven.*
> *May he order the black-headed to re[vere him],*
> *May the subjects ever bear in mind their god,*
> *And may they at his word pay heed to the goddess.*
> *May food-offerings be borne for their gods and goddesses.*
> *Without fail let them support their gods!*
> *Their lands let them improve, build their shrines,*
> *Let the black-headed wait on their gods.*
> *As for us, by however many names we pronounce, He is our God!*[38]

Evidently the Semitic Accadians thought of the "black-headed" as a separate people, racially distinct, and polytheistic as regards to religion. The light-skinned, dark-haired Sumerians best fit this description, and they spoke an unrelated language long before the Tower of Babel incident.

Early Adamite populations must have lived in relative isolation at the beginning since they developed a language entirely unlike the Sumerian language. But by the time the Sumerians learned to write, some of the earliest names recorded were Semite (or Adamite), demonstrating the close contact between these two cultures very early on.

Adam's Bride

After naming the animals of the garden, there was still something missing, "but for Adam there was not found an help meet for him" (Gen. 2:20).

A search can easily be implied by the words, "was not found." A search for a helpmate to be both wife and companion would be ridiculous if the world at that time contained only birds, beasts, cattle, and creeping things — but what if one or more settlements of humans were already in the vicinity?

Available females must have been nearby, one of which Adam could have chosen for his wife. We can deduce that from archaeological history. From

the Bible we can conclude that none was suitable, so Adam had an operation resulting in Eve. As confirmation of an act of special creation for the first covenant couple, Genesis 2:21-23 gives us a graphic description. Paul confirms this mode of origination. "For Adam was first formed (*plasso* in the Greek), then Eve" (1 Tim. 2:13).

Apparently Adam was created biologically compatible with the neighbors outside the garden. But God's desire was for Adam's wife to be distinctive, just as Adam was. By fashioning Eve out of Adam, this allowed them both to enjoy 900 or more years of wedded bliss. We are free to speculate about the origins of Cain's wife, or Noah's wife, but not about Eve.

The Bread of Life

Adam was banished from the garden after the Fall. "In the sweat of thy face shall thou eat bread..." and, "...the Lord God sent him forth from the garden of Eden, to till the ground from whence he was taken" (Gen. 3:19,23).

Could we believe the first man on earth already knew how to use fire, construct an oven, plant and harvest grain, mill it, and prepare the flour for baking? If not, then we may conclude that Adam was not the first man in the biological sense.

Prehistoric men were hunters of wild game and gatherers of fruits and berries. Farming and domesticated livestock were later developments. Paleontologists have uncovered evidence that ancient peoples harvested wild wheat as far back as 9000 BC. It took a genetic crossing of goat grass and "emmer" to produce bread wheat. The earliest evidence of wheat cultivation was found in the ancient oasis of Jericho and is dated at 8000 BC.[39]

Wheat, and therefore bread, appears to have been in use 3,000 years before Adam. So we have two choices. We can either deny the anthropological data; or allow that these agricultural developments predate Adam. If we choose the second option, at his inception, therefore, Adam must have been surrounded by people already familiar with growing grain when he was inserted into human history.

In the second article of this two-part series, we'll examine the culture that surrounded the early Adamites in Southern Mesopotamia at around 5000 to 4000 BC and discuss early cuneiform writings and inscriptions that speak about an historical figure that could have been Adam of Genesis. In addition, we'll look at the Sumerian king lists of early pre-flood rulers, which begin with "Alulim," the probable equivalent of Adam. Eridu, the oldest city in Southern Mesopotamia, dating to about 4800 BC, is the most likely place to have been Eden, the original home for Adam and his kin. Even the word "Eden" apparently was derived from the Sumerian "edin," meaning "plain," "prairie," or "desert." "Enoch," the city Cain built in the pre-flood period corresponds with "E-anna(k)," a Sumerian and Semite post-flood site. ✱

NOTES

[1]Ann Gibbons, "Mitochondrial Eve: Wounded But Not Dead Yet," *Science* (14 August, 1992), 873.
[2]Ibid., 875.
[3]Ibid., 875.
[4]James Shreeve, "Argument Over A Woman," *Discover* (August 1990), 52-59.
[5]Robert C. Newman and Herman J. Eckelmann, *Genesis One and the Origin of the Earth* (Grand Rapids: Baker Book House, 1977), 111.
[6]Lloyd R. Bailey, *Genesis, Creation, and Creationism* (New York: Paulist Press, 1993), 130.
[7]Paul H. Seely, *Inerrant Wisdom: Science & Inerrancy In Biblical Perspective* (Portland: Evangelical Reform, Inc. , 1989), 17.
[8]Gleason L. Archer, *A Survey of Old Testament Introduction* (Chicago: Moody Press, 1974), 203.
[9]Gerald L. Schroeder, *Genesis and the Big Bang* (New York: Bantam Books, 1990), 175.
[10]John E. Pfeiffer, *The Creative Explosion* (New York: Harper & Row, Publishers, 1982), 121.
[11]From an exhibit in the Smithsonian Institute in Washington D. C., July 25, 1993.
[12]Jacquetta Hawkes, *The Atlas of Early Man* (New York: St. Martin's Press, 1976), 63.
[13]John Gowlett, *Ascent to Civilization* (New York: Alfred A. Knopf, Inc., 1984), 180.
[14]Dick Fischer, "The Bible Proves Creationism is Wrong," *The Washington Post* (August 17, 1986), C4.
[15]Edmond Jacob, *Theology of the Old Testament* (New York: Harper & Brothers Publishers, 1958), 167.
[16]Ibid., 167.
[17]Hawkes, *The Atlas Of Early Man*, 64.
[18]Amihai Mazar, *Archaeology of the Land of the Bible* (New York: Doubleday, 1990), 36.
[19]C. C. Lamberg-Karlovsky, and Jeremy A. Sabloff, *Ancient Civilizations: The Near East and Mesoamerica* (Menlo Park: The Benjamin/Cummings Publishing Company, Inc. , 1979), 79.
[20]Ibid., 99.
[21]Hawkes, *The Atlas of Early Man*, 63.
[22]Lloyd R. Bailey, *Noah: The Person and the Story in History and Tradition* (Columbia: University of South Carolina Press, 1989), 36.
[23]Henry Morris, *The Genesis Record* (San Diego: Creation-Life Publishers, 1976), 84.
[24]C. F. Keil, and F. Delitzsch, *Commentary On The Old Testament* (Peabody, MA: Hendrickson Publishers, 1989), 77-78.
[25]Andrew Sherratt, ed., *The Cambridge Encyclopedia of Archaeology* (New York: Crown Publishers, Inc., 1980), 113.
[26]S. R. Driver, *The Book of Genesis* (London: Methuen & Co. Ltd., 1938), 39.

[27]George, Constable, Ed., *The Age of God Kings: TimeFrame 3000-1500 BC* (Alexandria: Time-Life Books, 1987), 10.
[28]Driver, *The Book of Genesis*, 39.
[29]Pierre M. Vermeersch, Etienne Paulissen, and Philip Van Peer, "Palaeolithic chert exploitation in the limestone stretch of the Egyptian Nile Valley," *African Archaeological Review* (1990) 8: 77-102.
[30]Hawkes, *The Atlas of Early Man*, 47.
[31]"Semites" is the term archaeologists and historians use to denote not only descendants of Shem, but also descendants of Japheth, Ham, or any of Adam's line in the pre-flood period (if a person such as Adam ever existed, or there was ever an event such as the Flood.) Thus, Canaanites spoke a "west semitic" language, notwithstanding Canaan was the son of Ham, according to the Bible. One might think "Hamites" would have communicated in a "hamitic" tongue. But the secular world does not recognize the Bible as being historically accurate. Therefore, "Semites" are universally recognized. "Adamites," "Hamites," and "Japhethites" are not, shall we say, "politically correct."
[32]Samuel Noah Kramer, "Sumero-Akkadian Interconnections," *Genava*, n. s., 8 (1960), 272-273.
[33]James B. Pritchard, *Ancient Near Eastern Texts Relating to the Old Testament* (Princeton: Princeton University Press, 1955), 60-72.
[34]Ibid., 67.
[35]Ibid., 68
[36]Alexander Heidel, *The Babylonian Genesis* (Chicago: The University of Chicago Press, 1942), 56.
[37]Pritchard, *Ancient Near Eastern Texts Relating to the Old Testament*, 70.
[38]Ibid., 69.
[39]John Wiester, *The Genesis Connection* (Nashville: Thomas Nelson Publishers, 1983), 187.

Communications

Metal Sources and Metallurgy In the Biblical World

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There are numerous intriguing references to metals and to metal technology in the Old Testament.[1] Some important field studies during the last thirty years shed new light on these subjects. Let me first cite a number of these biblical references, and then review the geological and archaeological evidence for the following metals: copper, tin, bronze, iron, gold, and silver. The following references are cited from the NIV Version.

Genesis 2:10-12a: "A river watering the garden flowed from Eden, and from there it divided; it has four headstreams. The name of the first is the Pishon; it winds through the entire land of Havilah, where there is gold. The gold of that land is good.[2]"

Genesis 4:22: "Zillah also had a son, Tubal-Cain, who forged all kinds of tools out of bronze and iron.[3]"

Numbers 21:9: "So Moses made a bronze snake and put it up on a pole. Then when anyone was bitten by a snake and looked at the bronze snake, he lived."

Deuteronomy 3:11: "Only Og king of Bashan was left of the remnant of the Rephaites. His bed was made of iron and was more than thirteen feet long and six feet wide. It is still in Rabbah of the Ammonites."

Deuteronomy 8:9: "A land where bread will not be scarce and you will lack nothing; a land where the rocks are iron and you can dig copper out of the hills."

Judges 1:19: "The Lord was with the men of Judah. They took possession of the hill country, but they were unable to drive the people from the plains, because they had iron chariots."

1 Samuel 3:19-20: "Not a blacksmith could be found in the whole land of Israel, because the Philistines had said, 'Otherwise the Hebrews will make swords or spears!' So all Israel went down to the Philistines to have their plowshares, mattocks, axes and sickles sharpened."

1 Samuel 17:5-7: "He (Goliath) had a bronze helmet on his head and wore a coat of scale armor of bronze weighing 5,000 shekels [78 to 156 pounds]; on his legs he wore bronze greaves, and a bronze javelin was slung on his back. His spear shaft was like a weaver's rod, and its iron point weighed 600 shekels [about 15 pounds]. His shield bearer went ahead of him."

1 Kings 10:11, 14-16: "Hiram's ships brought gold from Ophir ... The weight of the gold that Solomon received yearly was 666 talents [about 25 tons], not including the revenues from merchants and traders and from all the Arabian kings and the governors of the land. King Solomon made 200 large shields of hammered gold; 600 bekas [about 7 ½ pounds] of gold went into each shield."

Ezra 1:7, 9-11: "Moreover, King Cyrus brought out the articles belonging to the temple of the Lord, which Nebuchadnezzar had carried away from Jerusalem and had placed in the temple of his god ... This was the inventory: gold dishes 30, silver dishes 1,000, silver pans 29, gold bowls 30, matching silver bowls 410, other articles 1,000. In all there were 5,400 articles of gold and of silver. Sheshbazzar

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brought all these along when the exiles came up from Babylon to Jerusalem."

Job 28:1-6,9-10: "There is a mine for silver and a place where gold is refined. Iron is taken from the earth, and copper is smelted from ore. Man puts an end to the darkness; he searches the farthest recesses for ore in the blackest darkness. Far from where people dwell he cuts a shaft, in places forgotten by the foot of man; far from men he dangles and sways. The earth, from which food comes, is transformed below as by fire; sapphires come from its rocks, and its dust contains nuggets of gold ... Man's hand assaults the flinty rock and lays bare the roots of the mountains. He tunnels through the rock; his eyes see all its treasures."

Isaiah 44:12: "The blacksmith takes a tool and works with it in the coals; he shapes an idol with hammers, he forges it with the might of his arm. He gets hungry and loses his strength; he drinks no water and grows faint."

Ezekiel 22:18, 19-21: "Son of man, the house of Israel has become dross to me; all of them are the copper, tin, iron and lead left inside a furnace. They are but the dross of silver ... As men gather silver, copper, iron, lead and tin into a furnace to melt it with a fiery blast, so will I gather you in my anger and my wrath and put you inside the city and melt you. I will gather you and I will blow on you with my fiery wrath, and you will be melted inside her."

Ezekiel 27:12: "Tarshish did business with you [Tyre] because of your great wealth of goods; they exchanged silver, iron, tin and lead for your merchandise."

Daniel 2:32-33: "The head of the statue was made of pure gold, its chest and arms of silver, its belly and thighs of bronze, its legs of iron, its feet partly of iron and partly of baked clay."

Anthropologists and archaeologists of the Near East have become accustomed to speaking of various stone ages (Paleolithic, Mesolithic, Neolithic), and of using the following parameters: Chalcolithic (i.e. copper) Age (4000-3000 B.C.), Early Bronze Age (3000-2000), Middle Bronze Age (1500-1200), Late Bronze Age (1500-1200), and Iron Age (1200-), from the relative prominence of these respective metals.[4] But as we shall see upon a more detailed examination, these labels are rather misleading generalizations.

Copper

Copper (C_u) is a highly ductile and malleable metal. It occurs in 55 parts per million (ppm). It was probably the earliest metal used inasmuch as it can be cold hammered. It can also be annealed, or tempered, by being softened in an open fire at about 500°C and then slowly cooled. Copper's melting point is 1083°C. To smelt copper from malachite a temperature of only 700-800°C is sufficient. Egyptians of the Vth Dynasty (c. 2500 B.C.) were able to obtain this temperature by blowing into pipes. Bellows were first developed in Mesopotamia, and are not attested in Egypt until the XVIIIth Dynasty (15th to 14th centuries B.C.).

Copper occurs in carbonates such as green malachite and blue azurite. These ores were ground in slate palettes by Egyptians from the prehistoric era for use as eyeshadow. Copper also occurs in sulphides such as chalconite and covellite, and oxides such as cuprite and melaconite. Copper in its native state was used as early as the ninth millennium B.C. as in a piece found at a cave in Shanidar in Iran. Copper tubes were found at Çatal Hüyük (6000 B.C.) in Turkey. In Palestine, prehistoric copper was found at Tell Abu Matar near Beersheba. Though copper had to be imported into Mesopotamia, metallurgy developed rapidly there from 5500 B.C.[5]

One of the key sources of copper was the island of Cyprus. Copper's name, in Latin, *Cuprum*, is derived from *Cypros*, the name of the island. Copper was found in abundance along the pillow lava layers of the Troodos Mountains. These cupriferous sulphide ores yielded about 4 percent copper. This was extracted as early as the 18th century B.C. More than forty slag heaps totaling over four million tons have been identified. As three hundred kilograms of charcoal were needed to obtain one kilogram of copper, it has been estimated that over a period of 3,000 years, two hundred million pine trees were consumed in these endeavors.

Cypriote copper was exported to Babylonia.[6] The king of Cyprus wrote to the pharaoh of Egypt with a gift of ten talents of copper, promising two hundred more. In another letter he apologized that he could not send more copper:

> My brother should not take it to heart that I am sending herewith only five hundred pounds of copper — I am sending this solely as a present for my brother — because, my brother, it is so little. I swear that pestilence, the disease of my lord Nergal, was in the land, and has killed all the people of my land, so there was nobody to produce copper. So my brother should not take it to heart (that it is so little copper). Send back quickly your messenger together with my messenger, then I will send you, my brother, all the copper which my brother wants.[7]

Cyprus still remains a major source of copper. In the last sixty years, the island has produced a million tons of copper.

Other interesting ancient sources were the copper and turquoise mines of western Sinai, especially at Serabit el-Khadim.[8] These mines were worked during the Middle and the New Kingdoms (2000-1200 B.C.). There Egyptian texts at the temple of Hathor record the presence of "Asiatic," i.e. Semitic, miners, who left behind very important Proto-Sinaitic texts with twenty-seven signs. These, along with contemporary Proto-Canaanite texts, were the precursors of the Phoenician alphabet, the fountainhead of all alphabetic systems.[9]

As indicated in Deuteronomy 8:9, iron and copper were to be found in the land promised to the Israelites. Iron ore is relatively limited, and is to be found in the Ajlun region of Gilead to the northeast. It is perhaps significant that Og's iron bedstead, which was kept on exhibit in an ancient "Believe It or Not" museum in Amman, came from Bashan, in this very area.

Copper is found in some abundance in the Arabah Valley, stretching one hundred miles between the Dead Sea and the Gulf of Aqabah (called by the Israelis the Gulf of Elath). Extensive copper mining and refining were conducted here from as early as 2000 B.C. The famous archaeologist, Nelson Glueck, explored this area in the 1930s. From 1938 to 1940 he excavated the site of Tell el-Kheleifeh, which he identified as Solomon's port of Ezion-Geber. This site is just inland from the Gulf of Aqabah just across the Israeli-Jordanian border on the Jordanian side.

Glueck identified a large building (thirteen by thirteen meters) with two rows of holes as a large smeltery, and in books published in 1940 and 1959, interpreted the site as the "Pittsburgh" of Palestine. After criticism of this interpretation by Beno Rothenberg, Glueck conceded in 1965 that the holes were probably the remains of burnt-out logs.[10] The recent reexamination of the site by Gary Pratico has also cast doubt on its identification with Ezion-Geber, as Glueck had misinterpreted the pottery.[11]

Timna is a site in the Arabah where tourists were taken to see the so-called "Pillars of Solomon," a rather striking geological formation. A year after I had visited the site in 1968, Beno Rothenberg discovered an Egyptian temple dedicated to Hathor at the base of these pillars. Inscriptions were recovered from Seti I to Ramesses V (14 to 12th century B.C.). One of the most striking discoveries was a copper snake, which reminds us of Moses' brazen snake.

Rothenberg and his colleagues have investigated the area for two decades and have determined that the abundant evidence of copper mining and refining should be credited to the Egyptians, and not to Solomon (10th century B.C.). Though there is some evidence of renewed activity at the site in the 10th century,[12] this is credited by Rothenberg to Shishak, the Egyptian pharaoh of this period.[13]

In the Timna area, as early as the 4th millennium B.C. shafts and galleries were being used to extract the ores. The furnaces found in the area were cylindrical in shape, 24" x 24." There were numerous examples of tuyeres, the ceramic tubes through which air was pumped into the furnaces by bellows.[14] Experiments have indicated that pot bellows as depicted in Egypt could be sustained at a rate of sixty strokes per minute for up to thirty minutes to obtain the necessary temperatures.

Widespread trade in copper during the Late Bronze Age, especially from Cyprus throughout the Mediterranean is attested by texts. The vizier Rekhmire under Tuthmosis III (15th century) reported the importation of 108 ingots of copper, "Bringing Asiatic copper, which his Majesty carried off from his (Syrian) victory in the land of Retenu, in order to cast two doors of the temple of Amun." Reliefs in Egypt also depict men from Keftiu (Crete) bearing ox-hide ingots of copper (ingots which take the shape of ox-hides) as gifts to the pharaohs. Ox-hide ingots with Cypro-Minoan signs have been found as far west as the island of Sardinia. In Crete they have been found at numerous sites including Hagia Triada, Mochlos, and Zakro. They have also been discovered at Boghazköy in Turkey and at Tell Beit Mirsim in Palestine.[15]

Off the south central coast of Turkey George Bass and his associates investigated the Cape Gelidoniya shipwreck, discovered in 1960. This is the oldest shipwreck ever discovered, dated c. 1200 B.C. It carried a cargo of thirty-four copper ox-hide ingots, each weighing over fifty pounds. Also discovered were bronze tools, scrap metals, and tin ingots.[16] To the west of Gelidoniya at Kas another shipwreck was investigated by Bass in 1984. This also had been carrying tin.

The earliest copper alloy was made with arsenic. It was probably obtained as a by-product of the smelting of copper sulphides. This was a product which was quite comparable to bronze in hardness and utility. Its main disadvantage was the hazard of arsenic fumes released in the smelting process.

Some scholars would call this alloy arsenic bronze. This type of alloy was favored in Egypt until 2000 B.C. A remarkable hoard of cultic objects was found at Nahal Mishmar near Ein Gedi by the Dead Sea

in 1961. These included 80 scepters, 240 pear-shaped mace heads, and 20 chisels or axes, many of which were made of arsenic-copper.

Tin and Bronze

True bronze, an alloy of about 10 percent tin and 90 percent copper, was developed in some areas (such as Crete) after about 3000 B.C., but not in other areas (such as Palestine and Egypt) until after 2000. Such an alloy has a lower melting point than copper, and makes a more fluid melt for casting. Bronze is also much harder than copper. Many of the bronzes were used in the *cire perdue* (lost wax) process to make cultic figurines.[17] (The *cire perdue* process involves first filling a hollow with wax, then replacing it with metal.)

Tin (Sn = from Latin *stannum*; Greek *kassiteros*) is a soft metal, with a very low melting point (232°C). It is a very rare metal, occurring in only two parts per million. Tin is found as cassiterite (tin oxide) in alluvial deposits in areas of granitic rocks.

Old Assyrian (early 2nd millennium B.C.) texts of merchants in Cappadocia (eastern Turkey) speak of the transport of tin from Mesopotamia. Texts record that some 13,500 kilograms of tin were transported on 200 donkey loads from Ashur to Kanesh. Over a fifty year period, it has been estimated that about eighty tons of tin may have been shipped to the north from Mesopotamia.

Cuneiform texts from Mari on the Euphrates[18] record the storage of 500 kilograms of tin, and shipment to cities such as Ugarit on the Syrian coast,[19] to Dan and Hazor in Palestine,[20] and even to Captara, i.e. Crete.[21] Ingots of tin with Cypro-Minoan marks were found off the coast of Haifa in Palestine.[22] Also, as noted earlier, evidence of the transport of tin has been found in the Gelidoniya and Kas shipwrecks off the southern coast of Turkey.

Textual sources from Mesopotamia seem to indicate that the tin came from points to the east. Yet investigations of Iran have yielded no credible source of tin. Tin is found in Thailand, where a very early bronze technology was developed at Non Nok Tha and Ban Chiang in the 4th millennium B.C. Yet apart from an isolated cinnamon seed (perhaps from the Moluccas), there is no evidence of trade between ancient Mesopotamia and any ports further east than the area of Gujerat in northwest India. The actual source of tin for Near Eastern bronze still remains a mystery.

The biblical reference in Ezekiel 27:12 to Tarshish may indicate that tin ores were obtained from the Iberian peninsula. Tarshish, which is a name derived from the Phoenician word for "smelter" according to W. F. Albright, may be identified with the Phoenician colony of Tartessus.[23] Though scholars have doubted an early expansion to the western Mediterranean prior to the 8th century B.C., F. Cross has recently identified a Phoenician inscription from Nora in Sardinia as coming from the 11th century B.C.[24] This raises the possibility that the Tarshish ships of Solomon may also have traveled to Spain.[25]

James Muhly has argued that for the Late Bronze Age the Mycenaean Greeks obtained tin overland from Britanny in northwestern France and Cornwall in southwestern England. There is certainly evidence of trade overland in amber obtained from the Jutland area on the Baltic Sea for this period.

Iron

Iron (*Ferum*) is one of the most common of elements, occurring in one in 50,000 parts, or 4.2 percent of the earth's surface. Iron is found in such ores as dark red hematite, yellowish brown limonite, and black magnetite. Unlike copper, iron cannot be cold hammered. Iron ore can be reduced at 1100°C, but its melting point is 1540°C. Such temperatures were not achieved until the development of blast furnaces c. 1400 A.D., which were able to render iron in liquid form for casting. The earliest iron was probably a byproduct of copper smelting, as copper ores almost always contain iron. Chalcopyrite, for example, contains about thirty percent iron. When iron ore was smelted, what would be produced would be a spongy mass of iron, slag, and cinders which has to be hammered to remove the slag and air bubbles. This was so-called wrought iron. Wrought iron was forged while still in its heated, soft, and ductile state.

Anthony Snodgrass has proposed that the east Mediterranean world turned to iron, not because of its superiority, but because the disturbances of 1200 B.C. so disrupted international trade that supplies of copper and tin were disrupted. During the first two or three centuries after 1200 bronze continued to be used for utilitarian purposes, though iron with its hardness and strength was used increasingly for weapons and agricultural implements.

Iron working is mentioned frequently in Hittite texts (14 to 12th century B.C.) of Anatolia. Classical traditions (Herodotus, Xenophon, Strabo) localized ironworking in northern Anatolia. The Black Sea coast has self-fluxing iron sand, which is eighty per-

cent pure magnetite. (Self-fluxing iron sand contains elements which promote the fusing of the metal when it is heated.) Other scholars believe that the Levant took the lead in developing iron technology. Texts from Alalakh in Syria refer to a batch of 400 iron swords. A fine example of iron technology is an axe blade in a bronze hilt found at Ugarit dated to 1400 B.C. From the Tutankhamen (14th century B.C.) tomb archaeologists recovered a ceremonial iron knife. Iron is also mentioned three times in Ugaritic texts.[26] Ironworking was then developed c. 1200 B.C. in Cyprus, from whence it spread to the Aegean.

Some of the earliest examples of iron, such as those mentioned in Homer, were prized items such as Iliad VI.48 and Odyssey XIV.324. Homer mentions only bronze swords and spearheads but no iron examples. It is true that among the forty-eight times iron is mentioned in the Homeric epics, some iron weapons such as axes and maces are included. The dramatic imagery of Odysseus' blinding of Polyphemus's one eye indicates that Homer (8th century B.C.) was familiar with the practice of quenching iron to develop steel.

> The blast and scorch of the burning ball singed all his eyebrows and eyelids, and the fire made the roots of his eye crackle. As when a man who works as a blacksmith plunges a screaming great ax blade or adze into cold water, treating it for temper, since this is the way steel is made strong, even so Cyclops' eye sizzled about the beam of the olive. (Odyssey 9.389-94, tr. R. Lattimore)

In Palestine there were relatively few iron sources. An iron mine at Timna in the Arabah dates back to 1100 B.C. Another ancient iron mine was uncovered at Magharat Warda in Transjordon. The iron bed of Og of Bashan was obviously a curiosity.[27] Though it is true that the key passage in 1 Samuel 3:19-20 does not specifically indicate that the Philistine technology was superior in iron metallurgy, and though some scholars think that too much has been made of this passage,[28] it is quite clear that the Philistines did have a clear advantage. As J. Muhly concludes, "Based on excavated evidence, it appears that the Philistines did have a monopoly of sorts on ironworking, as reflected in the passage from 1 Samuel."[29]

Agricultural iron objects have been found at numerous Israelite sites including Tell el-Ful (ancient Gibeah), Saul's capital, where an iron plow was discovered. The one iron weapon mentioned in Goliath's panoply was his iron spearhead. It is significant that as Muhly points out, all of the iron *weapons* have been found at Philistine sites, such as an iron knife from Tell Qasile and iron daggers from Tell el Farah south. The Old Testament mentions eighty-three bronze weapons as against only four references to iron weapons. It was only in the 10th century that iron weapons became more numerous than bronze weapons. Actual remains from the Aegean from the 11th to the 8th centuries B.C. include four bronze swords but over fifty iron swords, thirteen bronze spearheads but over fifty iron spearheads.[30]

One of the earliest examples of carburized iron or steel is a pick, which was discovered at Mt. Adir in Galilee in 1976.[31] This dates to the 13th to the 11th century B.C. Until men learned to carburize iron, that is add a certain percentage (.7 to 2 percent) of carbon, wrought iron was inferior to bronze. Carburization was achieved by heating and reheating the iron in a charcoal fire. This steel was then further refined by heating and then quenching in water. The supremacy of iron over bronze was not a sudden or a swift development. As A. Snodgrass concludes, "Certainly the old statements, often made in a deterministic vein — that the arrival of iron weapons explains the success of ancient conquests and migrations, that iron precipitated the decline of Egypt, and so on — seem today quite unjustified."[32]

Gold

Gold (Latin *aureum*, Greek *chrysos*), which is the first metal named in Scripture (Gen. 2:11), is a relatively rare metal, .004 ppm. Gold occurs in so-called "reef" formations in veins, or as alluvial (in waterborne sediment) gold. Most ancient gold was derived from the latter through placer mining. The legend of Jason's golden fleece may refer to the use of fleece to catch the grains of gold in a sluicing operation. Much gold is found as electrum, a natural alloy of gold and silver. The six Hebrew names given to gold in the Old Testament may reflect the varieties of its colors.

The largest supply of gold in antiquity was that obtained by the Egyptians from Nubia, the area to the south of Egypt. These fields were to be found in three main areas: (1) the gold of Coptos (Wadi Hammamat, Wadi Abbad), (2) the gold of Wawat (Wadi Allaqi, Wadi Cabgaba), and (3) the gold of Kush (from the Nile Valley between Wadi Halfa and Kerma).

In Nubia there are remains of more than 100 ancient Egyptian mines. The Egyptians sent some shafts to depths of nearly 300 feet in trying to extract reef gold. Their galleries extended up to 1500 feet into the hillside. The ores would be crushed with mills,

and then washed with water. Gold was refined through the process of cupellation. Gold melts at a temperature of 1063°C. To extract gold the ore would be heated in a cupella of clay with lead. The resulting dross of oxides would be absorbed by the porous cupella, leaving the nearly pure deposit of gold.

The Mereruka relief depicts goldsmiths blowing through long tubes to melt the gold, with others weighing and recording the gold. The dazzling gold metalwork of Egypt is most notably illustrated in some of the objects from Tutankhamen's tomb, discovered in 1922. His solid gold sarcophagus weighed 243 pounds. It has been estimated that there may have been a total of 400 pounds of gold objects in his tomb. And Tutankhamen was a relatively minor king who died at the age of eighteen. The abundance of gold in Egypt was internationally known. Tushratta, the king of Mitanni, in northern Mesopotamia, wrote to Amenophis II of Egypt (14th century), "Send gold quickly, in very great quantities, so that I may finish a work I am undertaking, for gold is as dust in the land of my brother."

As Mesopotamia was devoid of gold sources, it had to import gold.[33] But its technicians achieved extraordinary skill, as demonstrated by the exquisite gold objects which Leonard Woolley recovered from the royal graves of Ur, which date to the early 3rd millennium B.C. The later Persians, who obtained 360 talents of gold dust annually from India, produced outstanding works of gold and silver metallurgy.[34]

The reality of the gold of Ophir, which Solomon imported, has been confirmed by an ostracon found at Tell Qasile with the phrase, "Ophir gold for Beth Horon, thirty shekels." We are still not certain where Ophir was. Suggestions include east Africa, west Arabia, and India.

Solomon was not the only king who boasted in his gold. Assyrian kings speak of walls "covered with gold like plaster." An Assyrian king, Sargon II, seized six golden shields from Urartu, each weighing twelve times the weight of the shields Solomon hung in his palace.[35]

Another famous source of gold were the sands of the Pactolus River, which ran through the Lydian city of Sardis. This is what made the Lydian king Croesus (561-546) so wealthy. In 1968 excavators found nearly 300 crucibles for refining gold, thus lending substance to the ancient tradition. Among the very few gold objects which have been recovered from Sardis are a tiny gold ram and gold thread from a textile of the Roman period.[36] The Lydian king Gyges (687-652 B.C.) was credited by Greek tradition with the invention of our earliest coinage. Though Lydian electrum coins are among our earliest, we do not have coins that go back as early as the date of Gyges. Some scholars have therefore discounted the Gygian tradition. I have argued, on the other hand, that the early invention of coinage is a sound tradition.[37]

Silver

Silver occurs in .07 ppm. Its melting point is 961°C. Silver (Latin *argentum*; Greek *arguros*) is most plentifully found in galena, the principal ore of lead.[38] Lead sulphide ores will yield thirty to 300 ounces of silver per ton. In the roasting process the sulphur is eliminated as sulphur dioxide gas.

The Hebrew word *keseph* was used for silver or for money. In Mesopotamia people were paid an average of a shekel of silver or ¼ ounce for a month's wage. Based on a sexagesimal system, a mina or pound of silver was made up of sixty shekels; a talent, which was sixty minas, equaling 3600 shekels, would have weighed about sixty pounds. The later Old Testament books such as Ezra, Nehemiah and Chronicles refer to coins which may be interpreted either as the Persian gold darics or the Greek silver drachmas.[39] Egypt, though rich in gold, lacked silver, which explains why Egypt was slow to adopt coinage.

The most famous silver mines of antiquity were located twenty-five miles south of Athens near Laurion and Thorikos on the tip of the Attic peninsula. Here more than 2000 shafts were sunk; the deepest extended 386 feet.[40] These were of great significance in classical Athens, in particular as a bonanza in 483 B.C. enabled Themistocles to build a fleet of 200 triremes which he used to defeat Xerxes' fleet.[41]

The extensive Laurion galleries are never more than a meter high, and are often as low as sixty centimeters. They are only sixty to ninety centimeters wide. Slaves in chains would advance on hands and knees quite laboriously, perhaps taking ten hours to advance ten centimeters. The site of Thorikos has many mining and refining installations, including elaborate circular and rectangular sluices. There are an estimated two million tons of slag in the area.

The Old Testament speaks about the importance of silver from Tarshish (1 Kings 10:22; 2 Chron. 9:21;

insula from the Carthaginians in the 3rd century B.C. the Romans exploited the mineral resources of Spain, especially near Rio Tinto. These mines were worked by slaves under terribly harsh conditions as described by Diodorus Siculus:

> The slaves engaged in the operation of the mines secure for their masters profits in amounts which are almost beyond belief. They themselves, however, are physically destroyed, their bodies worn down from working in the mine shafts both day and night. Many die because of the excessive maltreatment they suffer. They are given no rest or break from their toil, but rather are forced by the whiplashes of their overseers to endure the most dreadful of hardships; thus do they wear out their lives in misery ... although they often pray more for death than for life because of the magnitude of their suffering.

A similar picture of extreme cruelty is given to us by Agarthacides (2nd century B.C.) of the gold mines in Ptolemaic Egypt.[42]

* * * * * *

Of the many references to metals and metallurgy, the earliest are problematic. One of the major difficulties in understanding some of the opening chapters of Genesis literally is the reference to Tubal-Cain as an artificer of "bronze and iron" (Gen. 4:22).[43] The difficulty is somewhat tempered by the fact that the Hebrew word *nehoshet* can be translated as either bronze or copper. (Greek *Chalkos* can also indicate either copper or bronze.) Some meteoric iron was used long before the Iron Age; about a dozen pieces are dated before 3000 B.C.

Many other references to metals and metallurgy have been confirmed and illustrated by archaeological discoveries. At times, however, the desire to correlate the archaeological materials with the Scriptural text have led to erroneous conclusions, as in the case of Nelson Glueck's interpretation of a building at Tell el-Kheleifeh as Solomon's smeltery.

Metals were among the many good things which God created. He declares, "The silver is mine, and the gold is mine" (Hag. 2:8). Because of man's corrupt nature, desire for such metals has led to greed and exploitation. Conditions in today's South African gold mines are probably not much better than they were in ancient mines.

But far more valuable than silver and gold is God's word (Ps. 19:10). We were redeemed not with silver and gold but with the precious blood of Christ (1 Pet. 1:18-19). God sends us trials so that our faith, "of greater worth than gold, which perishes even though refined by fire," might inspire us until we find ourselves in the city of God, which is paved with streets of gold (Rev. 21:21). ✱

NOTES

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3 The name Cain is cognate with Arabic *qayin* "smith." Cf. the name "Kenites," the Midianite tribe among whom Moses lived (Exod. 2:18). See J. F. A. Sawyer, "Cain and Hephaestus: Possible Relics of Metalworking Traditions in Genesis 4," *Abr-Nahrain* 24 (1986), 155-66.

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Four Experiences In Overseas Teaching

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Many opportunities exist for science teachers who wish to engage in Christian service overseas. These opportunities must be pursued with perseverance and require a high degree of flexibility, but they can also be rewarding in many different ways. My personal experience in this area has resulted from four such opportunities totaling nearly seven years overseas during 35 years of teaching physics and the history of science. These experiences were made possible by both personal and sabbatical leaves from Wheaton College, and by the assistance and support of my adaptable and adventurous wife, Marilyn.

A brief description of these overseas assignments will illustrate the wide range of opportunities available in either secular universities, both national and American sponsored, or Christian liberal arts colleges, both church related and independent. My experience has been with English-speaking institutions in the Middle East and Africa, including Haigazian College in Beirut, Lebanon (1965-68), Ahmadu Bello University in Zaria, Nigeria (1970-72), Daystar University College in Nairobi, Kenya (1988), and The American University in Cairo, Egypt (1991-92). Most of these settings have provided opportunities for Christian witness and service to students from both Christian and Islamic backgrounds. The problems and possibilities of Christian service in each of these diverse settings will be described.

Haigazian College

An interest in the Islamic world led to several applications to teach at colleges in the Middle East during my first six years of teaching at Wheaton College. After establishing contact with Haigazian College in Beirut, Lebanon, they offered a three-year contract beginning in 1965. Sponsored by the Armenian Evangelical Churches of the Middle East, Haigazian College had about 400 students, about half Armenian and half Arab, with about 20% Protestant, 50% Orthodox, 10% Catholic, and 20% Muslim and Druze. An optional chapel program provided an opportunity for an explicit Christian message, and there were no restrictions on individual Christian witness. The faculty of about 30 Christian teachers, mostly evangelical, included about 7 Americans and 2 Europeans.

My contract provided for round-trip transportation for the family on a three-year commitment and a salary some 25% less than my salary at Wheaton. After arranging an extended unpaid leave of absence, my wife and three small children joined me on a flight to Scotland, where we took delivery of a VW camperbus and proceeded to camp through Europe and Turkey for six weeks on our way to Beirut. My assignment as chairman of the Science Division was to complete the development of a four-year B.S. program in the basic sciences and mathematics with the help of about seven other science teachers on two floors of the six-story academic building. This goal was achieved, but my attention was divided by additional responsibilities in the last two years of my contract due to a request to serve as Acting President when the founding President of the College resigned. Experience abroad often involves more than would be expected at home.

Several unusual experiences revealed God's providence and protection during our three years in Beirut, at a time when this city was the jewel of the Middle East. At the beginning of our second year, the Lebanon-based Intrabank failed shortly after tuition receipts for the semester had been deposited. When I conferred with our semi-retired Armenian treasurer, he calmed my panic by informing me that he had switched our college accounts to a French bank in the preceding summer. However, our income was 10% short of our operating budget, and only by careful spending were we able to finish the year without debt. We finished the next year with a 10% surplus even after faculty salary increases

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of nearly 10%. During our second year in Beirut, noted theologian Dr. Bernard Ramm* joined us for a sabbatical year to teach Biblical studies and philosophy of science.

As we were planning commencement in June of 1967, the Six-Day War broke out and two days later Americans were evacuated from Beirut. We canceled commencement ceremonies with our first science graduates and Dr. Ramm scheduled as our main speaker, and were flown to Athens where we enjoyed three weeks as refugees before returning for summer session. In our last year in Beirut we were able to recruit Dr. Gilbert Bilezikian from Wheaton College to assume the presidency of Haigazian College for the next three years. After departing Beirut, we camped for seven weeks through Europe with four children in our camperbus, our youngest child having been born in Beirut two years earlier. Haigazian College struggled on through the war years and continues to survive in a difficult part of the world. For us it remains a pleasant memory.

Ahmadu Bello University

After two years back at Wheaton College, we learned of a need for a physics teacher at Ahmadu Bello University in Zaria, northern Nigeria, through Sudan Interior Mission contacts. We applied and were accepted on a two-year contract, so we secured a replacement at Wheaton College and arranged for another extended leave without pay. In the meantime our visas were delayed for two frustrating months, during which we were uncertain if we would have any job, but were finally able to leave for Nigeria in November of 1970. Our assignment was on a USAID project to help develop a School of Basic Studies at the freshman-sophomore level to prepare for degree studies. It was only after our arrival in Nigeria that the details of our contract were clarified, and we discovered that an adequate salary from the university would be supplemented by USAID in dollars at a level about equal to our Wheaton salary.

Ahmadu Bello University is a state-sponsored institution that was established by the British before Nigerian independence near the ancient walled-city of Zaria to extend higher education to the Hausa-speaking Muslims of Northern Nigeria. Although this region is about 95% Islamic, nearly a third of the students were from the smaller Christian tribes on the borders of the region. These tribes embraced Christianity under British rule to escape their traditional enslavement by the Hausas. Since they had accepted Western education more readily, they qualified for the university in greater numbers. The School of Basic Studies was established to accelerate the entry of Muslims into the British-type degree programs. The modern buildings of the university included both a mosque and a chapel, and the campus Fellowship of Christian Students was very active.

My assignment included the ordering and setting up of laboratory equipment for an introductory physics laboratory, preparing the curriculum in physics and mathematics, training laboratory assistants, and teaching the first classes. An initial enrollment of about 250 students in the School of Basic Studies was projected to increase eventually to about a thousand among nearly 4000 students in the university. About half of the faculty were Americans and British, and several of these along with a number of Nigerians were active Christians. The Fellowship of Christian Students conducted Bible studies, planned the Sunday chapel programs in which Christian faculty members were often asked to speak, and provided annual outdoor evangelistic services attended by many Muslim students. Unfortunately, the Muslim tolerance for these activities has been disrupted in recent years.

Although the university setting in the African savanna region was quite isolated from Western influences, it was not without its amenities. Good faculty housing was provided on the spacious campus, and our younger children attended the university staff school. Our older children attended a school for missionary children 150 miles away in Jos. The faculty-staff club included restaurant facilities and a welcome swimming pool where our family spent many pleasant afternoons. An adequate highway system made it possible to travel to many parts of Nigeria and several neighboring West African countries. Contacts with missionaries and the opportunities to visit a variety of different ministries were especially rewarding. Our family was not eager to leave Nigeria when it was time to return to Wheaton.

Daystar University College

When our children reached high-school age, it became increasingly difficult to go abroad for extended periods of time. Finally in 1988 we were free to accept an invitation to teach for a term at Daystar University College in Nairobi, Kenya, on a paid leave from Wheaton with housing provided by Daystar.

* *For more information on Bernard Ramm, see Spradley, Joseph, "Changing Views of Science and Scripture: Bernard Ramm and the ASA," PSCF, 44:1, pp. 2-8, March 1992.*

Serving as the only independent Christian liberal arts college in Africa, Daystar was founded by missionaries but is presently administered by Africans under an international governing council. It offers B.A. degrees in Bible, business and communications through Messiah College, and M.A. degrees in Christian ministries and communications through Wheaton College. In 1988 about 300 students were crowded onto a 1.5 acre campus near the center of Nairobi, with just over 20 faculty members including half Americans and half Africans. Recently a new campus has been started about 20 miles from Nairobi, and enrollment has increased to about 800 students.

Although Daystar does not currently have any science majors, it offers the basic science and mathematics courses required by Messiah College for the B.A. degree. I taught Physical Science 101 from a historical perspective with a liberal arts emphasis, and Mathematics 101 with an emphasis on probability and statistics for the needs of the non-science majors. Little equipment was available and most demonstrations had to be improvised, but the students were eager and appreciative. Students came from most of the countries in Africa, and many were preparing for Christian service and leadership back home. As the college grows it plans to introduce science majors and will need to recruit more science teachers. Nairobi is a pleasant place to live, with good churches and many opportunities for interesting sightseeing.

The American University in Cairo

During my sabbatical year in 1991-92, I responded to an advertisement for an opening at The American University in Cairo to teach a course called Scientific Thinking in their core curriculum. Although they wanted to fill a two-year contract, I was limited to a one-year sabbatical at half pay. They agreed to a one-year contract with salary, transportation and free housing that more than made up for the other half of my Wheaton salary. Our apartment was on the ninth floor of a new hostel built with USAID money on Zamalek Island in the Nile a short bus trip from the main campus in downtown Cairo. The hostel had a sparkling dining hall, lounge, exercise room, clinic and computer room around an open garden on the first floor, dorm rooms for international students on the next five floors, and 20 faculty apartments on the next four floors. It had central air conditioning and an excellent view of Cairo.

The American University in Cairo (AUC) was founded in 1919 by the son of American missionaries in Egypt and is governed today by a Board of Trustees consisting mostly of executives from American businesses operating in the Middle East. It offers majors in the liberal arts, sciences, engineering and management. Full-time students include about 3000 undergraduates and 600 graduates, of whom about 2600 are Egyptian. Nearly 250 full-time faculty members include 55% Egyptians and 30% Americans. Most of the students are Muslims, but a sizable minority are Coptic Christians and a surprising number of the faculty are Christians motivated by a sense of mission. The AUC campus consists of two square blocks in the center of Cairo near the Nile. In a crowded city, it is an oasis built around a nineteenth-century palace with a growing number of modern buildings, including the six-story science and engineering building.

My assignment as a Visiting Professor was in the core curriculum program of general education required by all students. My six-hour teaching load consisted of two sections per semester of the Scientific Thinking course taught from a historical perspective in lecture sections of up to 120 students each. Two other sections of the course were taught by a Harvard Ph.D. in the history of Islamic science who was an active Christian. We were assisted by a staff of seven recent AUC graduates who did most of our grading, record keeping, and student tutoring. Six of our staff were Muslims, including two "covered" girls who were my principal assistants and with whom I had many interesting discussions about the differences between Islam and Christianity. It was a congenial group to work with, and together with our families we enjoyed several day-tours and staff parties, including celebrations of Thanksgiving and Christmas. Egypt also offered many travel opportunities, including cruises on the Nile and retreats to ancient monasteries.

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All of our overseas teaching assignments have been richly rewarding adventures and provided high points in the recurring routine of a teaching career. Although they require a degree of sacrifice and effort, they have always provided worthwhile experiences and opportunities for extensive travel at minimum expense, usually with even greater financial benefits and savings than when we stay at home. We have especially treasured the international church experiences and friends that we have gained abroad. Our children had to make adjustments, but they all speak positively of their overseas living and traveling and were always able to return to friendships in Wheaton. In recent years, my oldest daughter and her husband lived in East Asia for seven years and she

in Singapore and Hong Kong. My youngest daughter, Susanna Smoak, taught for the last five years in Colombia, South America.

Most of my overseas teaching experiences have been in the Muslim world where an overt Christian witness is often restricted. Science teaching provides a non-threatening approach to Muslims, and the history of science makes it possible to present the contributions of both Islam and Christianity to the development of science, while at the same time warning about the dangers of mechanistic materialism devoid of spiritual values. Americans are usually associated with a Christian tradition, and their lives provide an evaluation of that tradition for better or worse. Even in the absence of an overt witness, serving our Muslim brothers is a worthwhile Christian calling, for even a cup of cold water can help to heal the bitter legacy stretching from the Crusades to Western imperialism.

Several by-products of overseas teaching can also be mentioned. Both local missionaries and Christian minorities can be greatly encouraged by the presence and friendship of Christians serving abroad. In these settings teachers are held in high regard and can have considerable influence. Teachers in American schools, especially in Christian colleges, often live sheltered lives which can be greatly invigorated and imbued with a world vision by overseas teaching experiences. These effects in the lives of teachers can also influence their students when they return to their home institutions. In this way the benefits of overseas teaching can be multiplied by challenging students at home as well as serving students abroad. ✱

Essay Review

The Chronicle of a Curious Hijacking

The Creationists, *by Ronald L. Numbers. New York: Alfred A. Knopf, 1992. Pp. xvii + 458. $27.50. Paperback: Berkeley: University of California Press, 1993, $15.00.*

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Ronald L. Numbers is William Coleman Professor of the History of Science and Medicine at the University of Wisconsin - Madison. American Scientific Affiliation members should know his name through the book he edited in 1986 with his colleague David C. Lindberg, *God and Nature: Historical Essays on the Encounter between Christianity and Science.* Interested and veteran ASAers will also know him because he has published articles in the ASA journal and written about the history of the ASA.[1] And historians of science undoubtedly know him as the editor of *Isis*, the prestigious journal of the History of Science Society, in which he has also published important articles related to science and religion.[2] But if by some remote chance these publications have not rendered "Numbers" a familiar name in the bibliographic vocabulary of historically attuned ASA members, his most recent book ought permanently to cement his name into the mental card catalogues of all. So significant, in fact, is *The Creationists* that the following bold proposal should be adopted immediately: The ASA executive council should limit ASA membership to those signing a statement affirming that they have read the book cover to cover. Better yet — prospective members must pass a test demonstrating that they have read the book *with comprehension*. No wait, even better still — before *anyone* (ASA member or not) be permitted to ramble on about, or join in on, the ubiquitous chorus of creation-evolution debaters, one must present to all interested parties a signed affidavit attesting to the thoughtful completion of Professor Numbers' painstaking study of the evolution of scientific creationism. This is an important book — not just because the subject is important, but also because of who the author is.

I first met Professor Numbers seven years ago. A naive young graduate student attending a summer conference on the history and philosophy of science in Madison, I was casting about for the right research topic to pursue for my doctoral dissertation. Ron welcomed me into his campus office and we talked for the better part of two hours about our research interests and about the history of creationism. Our conversation had started with a declaration of my desire to explore some dimension of the recent encounters between science and Christianity, perhaps something relating to the American creation/evolution controversy. I recall vividly the sober sincerity with which Ron posed his first questions:

"Is this subject something in which you have a personal stake? That is, do you possess strong convictions about the relevant issues?"

"Well," I replied in some vague way. "I certainly want to discover the 'truth'."

" ... and your own denominational heritage?" he queried.

"Missouri-Synod Lutheran."

"Perhaps, then, I should offer a word of caution..."

Ron proceeded to explain the risks of pursuing a research topic which holds a place in proximity to one's heart, heritage, or family. It could be uncomfortable. One might find out things he would like not to learn. It could slant one's perspective, hinder efforts at dispassionate objectivity, or even weaken one's faith. I should be careful, he suggested, perhaps avoiding altogether a topic that involves matters about which I have strong convictions.

I assured him that despite my family's Lutheran heritage, I had no special dedication to the denomination's perspective on creationism. Furthermore, I wondered, regardless of dangers inherent in writing about something to which one is close, is not the best history written by one with a deep and abiding personal interest in his subject? I thought Barbara Tuchman had correctly argued that "it is the quality of being in love with your subject that is indispensable for writing good history."[3]

Perhaps Numbers believed it incumbent upon himself to offer his preemptory cautions — not because he did not love his subject — but because he knew firsthand what could happen. Years earlier, advice like he had given me had not prevented his scholarly career from focusing upon subjects close to home; and, he had endured the consequences. Raised in a family of devout Seventh-day Adventists, Numbers is the son and grandson of ministers from the small sect. He learned from childhood, therefore, to revere as authoritative the teachings of the denomination's founder, Ellen G. White (1827-1915). For the serious Adventist this necessitated, among other things, strict attention to health concerns (especially diet) and unwavering belief in the recent appearance of life on earth as surmised from a literalistic rendering of the Genesis narrative.

While a graduate student at the University of California at Berkeley, Numbers took his first steps onto "the proverbial slippery slope toward unbelief." A public lecture on the fossils of Yellowstone Park sent him down the inexorable pathway toward the uncomfortable realization that Adventist recent creationism did not square with the evidences of modern geology. The story of his slide from fundamentalism to agnosticism in no small part paralleled his education in the history of science, the history of Adventism, the history of medicine and health reform, and the history of modern creationism, subjects that constitute the very warp and woof of his impressive scholarly output. Thus, instead of steering clear of personal topics — as he counseled this young graduate student to consider doing — Numbers has generated a bibliography which appears remarkably autobiographical.[4]

His first book, *Prophetess of Health: A Study of Ellen G. White* (1976), ignited "a full-blown historical debate within Adventism" as it "demolished" the received Adventist interpretations of Ellen White as the sect's divinely inspired prophetess. Numbers had set out not as a radical debunker, but rather "to discover the truth." Yet in the process he had opened a Pandora's box which affected not only his faith and family, but all of Adventism. His work demonstrated, however, the validity of the "historiographical law, [that] the skeptical believer produces the best historical scholarship."[5]

Numbers' skepticism did not degenerate into irreverence, however. When, a few years after our first meeting, Ron kindly welcomed me as his house guest for a couple of days, we went to his study where he showed me his library and the place where he was then working on his comprehensive history of modern creationism. Above his desk, the wall held one small framed poster dating from the 1940s which advertised an evangelistic meeting at which the featured speaker, one Raymond Numbers, would be addressing the topic, "God's Answer to Evolution: Are Men and Monkeys Relatives?" At first glance one might think, "What a quaint decoration — if your hobby is amassing Creationist paraphernalia." This Raymond Numbers, however, was no piously self-deluded Elmer Gantry; he was Ron's father. Numbers explained to me that this little poster served as a reminder — a reminder to treat creationists honestly and to treat them with respect. Ron had always respected his father.

The reminder worked. *The Creationists* is a genuine *tour de force* — an honest and respectful treatment of a sensitive subject. This is *the* book that stands apart from the ubiquitous axe-grinding of so many partisan observers of the so-called creation/evolution debate. The diligent obfuscation of debunkers and apologists alike has kept this controversy simmering at near boil-over for generations. No one even casually acquainted with the debates can elude the surfeit of friction-generating words churned regularly from pens and processors of the petulant protagonists.[6] Thus to chronicle the last century of their tempestuous crusading without being drawn deeply into the foray constitutes a masterful achievement.

Numbers' achievement emerges from his conviction that the historian performs his job best when he furthers understanding, rather than when he debunks or defends the objects of his investigation.[7] He explains in the book's introduction, "I am much more interested in how persons and parties *used* "science" and "pseudoscience" to further their ends than in judging whether they employed these labels appropriately by the standards of the 1990s."[8] Thus, instead of assessing the merits of creationists' arguments or bothering to engage with them himself, Numbers offers a meticulously thorough and flowing narrative in which the creationists bless, curse, delight in, and spurn, their opponents *and* one another. Indeed, if there is any validity to a warfare thesis, its merit lies in the psychological conflicts endured by earnest creationists striving to accommodate their Scriptures to science, and in the social

turmoil generated by their bickering amongst themselves and their challenging of the conventionally received boundaries between science and religion.[9] The resulting tales of earnest foibles, sincere belief, and occasional charlatanism emerge at times as gut-bustingly hilarious, at times as poignantly sad, but always as believably human.

Numbers' account focuses upon a train of events that collectively constitutes one of the most curious hijackings in American social and intellectual history. A century ago to be a "creationist" merely required one to believe that the physical world and its inhabitants existed as a product of divine action. Since then, many sane Christians have persisted in this belief and agree with Langdon Gilkey that the Christian doctrine of Creation "is merely stating the ultimate dependence of all finite existence on God."[10] Accordingly, a "creationist" would be anyone affirming this general doctrine. By the late twentieth century, however, the term had undergone a significant transmogrification. "Creationist" had come to denote someone who insists, among other things, that earth history be squashed into the past ten thousand years and that Noah's flood was global *and* of geologically catastrophic proportions. "The creationists" of Numbers' narrative — the bible scholars and credentialed scientists, the hucksters and scientific wannabees, whose efforts to snuff evolutionism and fan into flame the fires of their fundamentalisms — are those responsible for engineering this curious hijacking.

What follows in this review is only a sketch, not an exhaustive run-down of the story. Other reviewers have already made available fairly complete summaries.[11] Besides, when my opening proposal is adopted, everyone will have to read the book anyway. I offer the following synopsis only as a springboard for some concluding commentary. The book's first four chapters — which together serve as a sort of prologue to the real drama — use only twenty percent of the volume's ink. These sections, which review "creationism" from the "Age of Darwin" through the "Age of Bryan," introduce readers to the swirl of names and themes which comprised the lively creation-evolution exchanges before the arrival of modern flood geology. With the ideas of familiar figures like Louis Agassiz, Arnold Guyot, John William Dawson, George Frederick Wright, William Jennings Bryan, Arthur I. Brown, and Harry Rimmer lined up alongside those of lesser lights like Eleazar Lord, T. T. Martin, Albert Fleischmann, George Barry O'Toole, S. James Bole, and Alfred Watterson McCann, Numbers right from the start puts the lie to the popular assumption that if you've seen one creationist you've seen 'em all. Indeed, this constitutes one of the book's important themes. Despite contemporary pronouncements of creationists (like the crowd at ICR) insisting that creationism is really only one thing (viz. flood geology), the remarkable diversity of these early "creationists" indicates otherwise. Numbers' explanation of the various concordist schemes by which late-nineteenth and early-twentieth-century creationists harmonized their Bibles with geology and biology is laced with humorous anecdotes and corroborative detail. For instance, we learn that Harry Rimmer, whom Harold Hill identified in 1976 as "one of the foremost scientists of the century," did indeed have his own research laboratory. It contained, according to his wife, "a darkroom, a sink and running water, a microscope, centrifuge and test tubes." This humorous tid bit is typical of Numbers' style throughout. Rather than explicitly refuting or endorsing his subjects, he lets them do it to themselves.

Interestingly, what from our contemporary perspective stands out as most striking is neither the humor of their enterprises nor the bizarre diversity of creationists and their schemes, but the fact that young life/earth creationism, in which flood geology reigns as the governing paradigm, appears as the oddity. Numbers' chronicle portrays the so-called "gap" or "ruin and restoration" theory together with versions of the "day-age" theory as dominating early fundamentalist cosmogonical thought. Some conservative evangelicals even welcomed various evolutionary scenarios.

From whence, then, comes modern "creationism" of the "flood geology" brand? Enter the Seventh-Day Adventists and the chief architect of the "New Catastrophism," George McCready Price (1870-1963). Who could be better equiped than Numbers — former Adventist *wunderkind* and biographer of Ellen White — to spell out the Adventist origins of modern flood geology? We learn that Price, as a devout Adventist, believed in the divine inspiration and authority of Ellen White's alleged visions. Numbers explains, "If she [White] harbored any doubts about the correct reading of the first chapter of Genesis, they were erased during one of her visions, in which she was 'carried back to the creation and was shown that the first week, in which God performed the work of creation in six days and rested on the seventh day, was just like every other week'."[12] Unsatisfied with the day-age and gap theories, Price found a workable alternative in White's vision of Noah's flood as the central catastrophic event in earth history. Thus he imaginatively combined this "revelation" with his scant scientific knowledge — the sum of which was gained from a few elementary courses in a one-year teacher-training program — and voilá,

"flood geology" — an idea which according to Price solved "every major problem in the supposed conflict between modern science and modern Christianity" — was born.[13] Price set to work expositing flood geology, explaining his "Law of Conformable Stratigraphical Sequence," and eventually producing his 726-page *magnum opus, The New Geology* (1923).

Thus on the eve of the infamous Scopes Trial, Price's name was increasingly on the lips of fundamentalists, despite the fact that few non-Adventists really understood his position or knew of his primary indebtedness to a "prophetess" who had lived at the fringes of American Protestantism. Price claimed to be a real scientist; he opposed evolution; and his book made sense of the Bible by offering the uninitiated a plausible alternative to uniformitarian geology. These facts were good enough to persuade most fundamentalists — even William Jennings Bryan — that Price was one of them. But no credentialed geologists took him seriously. And, excepting Missouri Synod Lutherans, who were predisposed to embrace Price's flood geology by virtue of their ingrained literalist hermeneutics and devotion to the dogmatics of their own theological gurus, most evangelicals were too confused to choose between the varieties of creationism.[14] As Dudley Whitney, one of Price's non-Adventist followers, complained, most were "all mixed up between geological ages, flood geology and ruin, believing all at once, endorsing all at once ... A swell gang we are, trying to fight evolution when we can agree on nothing among ourselves except that evolution is wrong."[15] It was such internal discord that prevented the Religion and Science Association in the 1930s and later the Deluge Geology Society from mustering sufficient stability to forestall implosion. Indeed, it seemed that the infant mortality rate for science-religion organizations was staggeringly high. Apparently any person sufficiently committed to anti-evolutionism to join such a group, usually did so because of a similarly unwavering commitment to a favorite brand of creationism. The results were not especially salutary. Now by this point in the narrative, the reader understands why Numbers never got around to defining explicitly the term "special creationism" at the outset. Aside from the beliefs that evolution was bad and that divine creative activity was pretty "special," there was plenty of room for disagreement among biblical literalists.

So when in 1941 the American Scientific Affiliation appeared under F. Alton Everest's leadership, no smart bookie would have been inclined to bet on another science-religion organization surviving more than a decade. But Everest gingerly handled the various "bombs" that landed in his lap — like the formal invitation from members of the Deluge Geology Society to have the ASA close ranks with them. As a result of his shrewd leadership and the able energy of real evangelical scientists (i.e. real evangelicals who were real scientists) like J. Laurence Kulp, Russell Mixter, J. Frank Cassell, and Walter Hearn, the ASA lived on, despite its controversies. And there were controversies. Rather than detailing them, however, I recommend that ASAers interested in their group's early heritage turn right to Chapter Nine, "Evangelicals and Evolution in North America." Numbers proves his ability as a first-rate storyteller as he traces some of the highlights from the ASA's early decades. He gets the story right, too. This chapter, like all the others, is meticulously documented and on the mark.

The outline of the rest of the story is simple enough. John C. Whitcomb and Henry M. Morris reacted differently than most ASA members to the appearance of Bernard Ramm's *The Christian View of Science and Scripture* (1954). Ramm had, to the minds of many, granted theological permission to evangelical biologists to board the evolution bandwagon. But Whitcomb and Morris, outraged by Ramm's concession to uniformitarianism, read his work as the clarion call for a definitive restatement of Price's flood geology. Modern "creation science" — ironically, a term originally proffered by ASA's James Buswell III as a generalization for positions such as progressive creationism and theistic evolution — was born with the appearance of *The Genesis Flood* (1963), a formal rebuttal of the alleged "absurdities" of Ramm's position. And once Price's brand of creationism had undergone this professional-looking baptism by a credentialed theologian and scientist, deluge geology spread at a remarkable rate, gradually flooding the world. The Creation Research Society, the Institute for Creation Research, the Paluxy River fossils, the Arkansas trial, Robert Gentry's polonium halos, the second law of thermodynamics, etc. and etc. — are, as expected, all included in the tale.

But the fact that the book includes all the episodes that we rightly expect such a story to encompass is not what renders this volume such a gem. Rather, for every episode that the creation-evolution aficionado anticipates, the book details at least three more that he does not. From the Mormons, Jehovah's Witnesses and the Korea Association of Creation Research, to the Christian Reconstructionists, Great Britain's Biblical Creation Society, Clifford Burdick's bogus degrees, and the eccentric Arthur Custance, it's all there, even geocentrists, the Turkish Ministry of Education, and the "Gap-Flood" model of S. Hugh

Paine. That it is all woven together into a genuine page-turner is the real wonder and pleasure of this encyclopedic chronicle.

In the end, it is principally a chronicle, too. The book's great strength — taking a warehouse of details and cementing them together into a narrative that could have been much bumpier — might also be its chief weakness. For all its exhaustive research, nearly fifty interviews and scores upon scores of archival sources, more ink might have been devoted to answering that persistent question, "So what?" To be sure, the narrative is peppered with occasional critical commentary. For example, Numbers observes several subtle ironies: a new subject called "flood geology" which for some time could claim not one real geologist; a discipline called creation "science" in which the practitioners place a bewilderingly low premium upon experimenting or studying nature; anti-evolutionists who railed against the ideas of credentialed scientists while coveting those credentials with an unsavory fervor. But Numbers reserves his explicit attempt to make sense of it all for his brief concluding section, entitled "Why Flood Geology?" Here he offers a few reflections on the curious hijacking of "creationism" by "flood geologists." What he has to say is insightful and thought provoking. I only wish that he would have carried on here for more than four pages. After decades of research and reflection, there must be more to say. Maybe that will be another book some day.

What *does* he say here? Numbers proposes that the question "Why Flood Geology?" does not admit to simple answering. That, however, does not stop him from offering what seems to be a rather simple answer. Morris and Whitcomb, to many Christians, succeeded in making "sense of the Bible." Numbers explains that they "at one stroke eliminated the need for such 'biblical gymnastics' and deprived evolutionists of the time required for the natural origin of species."[16] While this simple explanation of flood geology's popularity may not be the whole answer, it certainly is not the wrong answer.

Flood geology did not only make sense of the Bible; it also made sense of human history. For the many American Protestants waiting in eager anticipation for the return of Christ in a catastrophic apocalypse, the symmetry provided by a catastrophic deluge near the beginning of time proved irresistible. Of course, this vision of earth history is hardly news. Historians of science will recall the frontispiece of Thomas Burnet's *The Sacred Theory of the Earth* (1684) in which drawings of Noah's flood and the final global conflagration provide a tidy pair of boundaries for human history.

Upon consideration of the near-comprehensive world view offered by creationism, Numbers also notes that it becomes increasingly difficult to tar "creationists" with the "anti-intellectual" epithet. Their tradition was in part "just as 'intellectual' as the one they rejected," he explains. "What most distinguished the leading creationists from their evolutionary counterparts was not intellect or integrity but cosmology and epistemology."[17] Creationists could read the same literature and review the same evidence as evolutionists, but reach wildly different conclusions. And this is not because creationists are stupid. Rather, as the British evolutionist H. S. Shelton put it, creationists "*see* things differently."[18] If this is right, then so is Numbers' conclusion that understanding creationism has far less to do with expertise in science or philosophy than it does with gaining "familiarity with the Byzantine world of popular religion."[19]

But if entry to the "world of popular religion" is the prescription for genuine understanding of the creationist subcultures, then I wish Numbers had given a larger dose of the medicine. Yes, creationists live along those contested borderlands between science and religion. So the focus of the chronicle must be where it is. Yet border skirmishes often reflect activity further inland. In short, for all the richness of Numbers' tale, had the book been sufficiently longer to imbed the narrative more deeply in the contexts of American evangelicalism, in the history of American science, and in that concomitant scientism that infects so much of contemporary secular culture, then, perhaps, the activities of the borderlands would have been even more intelligible.

Then, too, I believe it would become clearer that flood geology, a curious mutation of Seventh-Day Adventist prophecy, flourished mightily because, while for some it made sense of the Bible, it also met the silly unyielding scientism of a Carl Sagan — "The Cosmos is all that is or ever was or ever will be" — with an equally unyielding hyperliteralism; the former eschewing the Creator, the later every shred of conventional science. Thus when the scientific elites pose as pontiffs uttering their secular cosmogonies, nobody should be surprised when populist spokesmen for the unconvinced masses finally came forward with a tale just as hard to swallow. Still, neither extreme satisfies the patient minds of those many believers who take both conventional science and Christianity seriously. Ironically, this thoughtful group of the faithful, wary of any world view that has all the I's dotted and T's crossed, would also like to think of themselves as creationists. But they dare not use the term; for they know it has been the victim of a most curious hijacking. ✱

NOTES

[1]Numbers first contributed to the ASA with his article, "Science Falsely So-Called: Evolution and Adventists in the Nineteenth Century," *Journal of the American Scientific Affiliation* 27 (March 1975) 18-23. About a decade later the ASA reprinted the important *Church History* article that Numbers had coauthored with David Lindberg, "Beyond War and Peace: A Reappraisal of the Encounter between Christianity and Science," *Perspectives on Science and Christian Faith* 39 (September 1987) 140-149. Numbers' work on ASA history, especially the ASA vis-a-vis modern creationism, first appeared in his article "Creationism in 20th Century America," *Science* 218 (1982) 538-544 and later in a revised form in "The Dilemma of Evangelical Scientists," in *Evangelicalism and Modern America*, edited by George Marsden (Grand Rapids: William B. Eerdmans, 1984), 150-160.

[2]For Numbers' History of Science Society publications on science and religion see "The Creationist Controversy," *Isis* 76 (September 1985) 375-377; "George Frederick Wright: From Christian Darwinist to Fundamentalist," *Isis* 79 (December 1988) 624-645; and "Science and Religion," *Osiris*, 2nd series, 1 (1985) 59-80.

[3]Of course being in love with one's subject is not the same as participating in it. See Barbara W. Tuchman, *Practicing History: Selected Essays by Barbara W. Tuchman* (New York: Alfred A. Knopf, 1981), 14.

[4]The remark about the "proverbial slippery slope" is from Numbers, *The Creationists*, xvi.

Among the many books that Numbers has either authored or edited are *Creation by Natural Law: Laplace's Nebular Hypothesis in American Thought* (1977); *Almost Persuaded American Physicians and Compulsory Health Insurance, 1912-1920* (1978); *The Disappointed Millerism and Millenariansim in the Nineteenth Century* (1987), co-edited with Jonathan Butler; *Caring and Curing: Health and Medicine in the Western Faith Traditions* (1986), co-edited with Darell Amundsen; and *God and Nature: Historical Essays on the Encounter between Christianity and Science* (1986), co-edited with David C. Lindberg.

[5]The poignant story of the writing and reception of the original edition of *Prophetess of Health* is movingly told by Jonathan M. Butler in the introduction to the book's new edition. See Jonathan M. Butler, "Introduction: The Historian as Heretic," in *Prophetess of Health: Ellen G. White and the Origins of Seventh-day Adventist Health Reform* (Knoxville: The University of Tennessee Press, 1992), xxv-lxviii. Quotations from Butler, pp. xxxiv, xxxv, xxxvii, and xlviii.

[6]A fine compendium of literature — much of which illustrates this point — from one side of the debate is Tom McIver, *Anti-Evolution: An Annotated Bibliography* (Jefferson, NC: McFarland and Company, 1988). If one considers the assorted propaganda issuing from such divergent organizations as the Institute for Creation Research and the National Center for Science Education, it rapidly becomes clear that for many, proselytizing is of greater value than understanding. This is not to suggest that the entire creation-evolution industry is in the business of generating friction. The ASA's own annotated bibliography, *Contemporary Issues in Science & Christian Faith*, contains many entries that bear this out.

[7]Interestingly, I have seen an evolutionist publicly charge Numbers of being no more than a sophisticated apologist for creationism, and I know creationists have labeled him a champion of evolutionism. Together, these accusations should say something important about his zeal for treating his subject fairly.

[8]Numbers, *The Creationists*, xv.

[9]Ibid., xiv-xv.

[10]Langdon Gilkey, *Maker of Heaven and Earth: A Study of the Christian Doctrine of Creation* (Garden City, NY: Doubleday & Company, 1959), 31.

[11]The most thorough rehearsal of the volume (ideal for anyone wanting a "Cliffs Notes"-type overview by an ASA member and participant in the drama) is Davis Young's essay review. See *Fides et Historia* 24 (Fall 1993) 100-110. Three other reviews worth reading are Mark A. Noll, "Ignorant Armies," *First Things* (April 1993)45-48; George M. Marsden, "Literal Interpretations," *Nature* 360 (17 Dec. 1992) 637-638; and J. David Hoeveler, Jr., "Inside Creationism," *Science* 258 (16 Oct. 1992) 487-488. Less valuable reviews include Stephen R. L. Clark, "In the Beginning Was What?" *New York Times Book Review*, January 10, 1993, 24; and Richard G. Hodgson, "*The Creationists*," *Pro Rege* (March 1993)24-25.

[12]Numbers, *The Creationists*, 74.

[13]Ibid., 75, 81.

[14]Conservative Lutherans, to my knowledge, never entertained the gap theory; and the day-age theory was strictly *verboten*. Most were widely influenced by Francis Pieper, the Missouri Synod's chief dogmatician and president from 1899-1911. In his magnum opus, *Christian Dogmatics* (completed in 1924), he pronounced unequivocally, "Scripture forbids us to interpret the days as periods, for it divides these days into evening and morning. That forces us to accept the days as days of twenty-four hours." And, "It is by no means a clever objection to the inspiration of Holy Scripture when modern theologians remark that the Bible is no textbook of history or geography or natural science and that for that reason inspiration could not pertain to the historical, geographical, and scientific data." From *Christian Dogmatics*, vol. 1, trans. Theodore Engelder (reprint; Saint Louis: Concordia, 1950), 468, 221.

[15]Numbers, *The Creationists*, 102, 114.

[16]Ibid., 338.

[17]Ibid. 336.

[18]Quoted in Ibid.

[19]Ibid., 337.

Essay Review

The "Strange Loop" of Complementarity

The Knight's Move: The Relational Logic Of The Spirit In Theology And Science *by James E. Loder and W. Jim Neidhardt. Colorado Springs, CO; Helmers & Howard, 1992. 308 pages, glossary, appendix, indices. Hardcover; $24.95.*

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This is an unusual book co-authored by a theologian and a physicist. Dr. James E. Loder is Professor of the Philosophy of Christian Education at Princeton Theological Seminary, and the late Dr. W. Jim Neidhardt, a well-known member and supporter of ASA, was Associate Professor of Physics at the New Jersey Institute of Technology. Both a theologian from Germany and a physicist from England give their strong recommendations to the book, citing it, respectively, as "a thoroughly fascinating and challenging book, especially perhaps for theological teachers and students," and as "an indispensable contribution to the on-going dialogue between science and theology." In the Forward, Thomas Torrance describes the book in these words: "They develop a new, exciting form of complementarity embodying a relational logic of the spirit called 'the strange loop.' ...This is the most exciting and uplifting book of its kind that I have read in recent years"(xii).

The book is concerned basically with an expression of complementary thinking that facilitates positive interaction between science and Christian theology. The symbol of "the Knight's move" refers to the unique move of the chess piece that is the only one not moving in a straight line, as an indicator of a leap of insight or a leap of faith. The book also draws heavily on the symbolism of the Moebius strip, the two-dimensional "strange loop" twisted in the middle, which has a two-dimensional surface that can be totally traversed with continuous motion along the strip.

The purpose of the book is described as an effort to "engage the contemporary cultural fragmentation between theology and science in such a way as to counteract any assumption that each is a universe of discourse closed off from or radically incommensurate with the other.... The creative work of this book has attempted to disclose a bipolar-relational unity in which science and theology, while preserving their respective disciplinary identities, participate in dialogue according to the strange loop model" (p. 307). Or again, "The central concern behind this study is not a critique of culture. It is rather an interdisciplinary search for ways, models, and patterns by which we can approach the inherent order of creation and facilitate some reintegration of the fragmented fields of study in our culture" (p. 7).

In an Appendix, the authors summarize "some of the significant strange loop relationality structures in theology and science." In theology, examples given are: deity/humanity in the nature of Jesus Christ; Holy Spirit/human spirit in the concept of spirit; the presence of Christ/community of believers in the church; and prayer/reflective study in theological productivity. In science, examples given are: contingent intelligibility/physical structures of the universe in the ontology of natural science; mathematical pattern/empirical structures in the epistemology of natural science; wave-like/particle-like behavior in quantum science, and mind/body in human consciousness.

In actual execution the book depends heavily on an exposition and investigation of the significance of the thought of Soren Kierkegaard. Kierkegaard's name appears in the titles of seven of the thirteen chapters in the book, and the index indicates over 100 references to Kierkegaard in the book. The

authors indicate that the theological side of their treatment is represented by the Reformed perspective on the Judeo-Christian tradition, and name Kierkegaard, Barth and Torrance as three of the principal figures. The conventional student of theology might be a little curious about this nomenclature, since Kierkegaard is usually described as the father of Christian existentialism, and Barth as the father of neo-orthodoxy, neither of which could really be said strictly to lie "in the Reformed perspective." Many other well-known authors are cited and discussed in the main treatment of the book, with special attention to Bohr, Einstein, Piaget, Prigogine, and Torrance.

The flavor of the book can be illustrated by citing the authors' own description of the "strange loop." This quote indicates the correlation between the approach taken in this book and the perspective of complementarity involving hierarchical interrelationships leading to emergent properties frequently advocated by other Christians considering the interaction between science and theology.

> In general, the model presents the asymmetric bipolarity of relationality, suggesting its inherent unity. The apparent two sides or edges of the Moebius band represent the two poles in a dynamic interrelatedness which via a 180° twist brings the apparent duality in to a paradoxical unity. This aspect of the model stresses our claim that the relationship itself is the reality. In the models' bipolar-relational unity, a mutual reciprocity exists between the two levels; the upper level implies the lower level, and the lower level implies the upper level. However, because the two levels are regulated by a form of marginal control principle sustained by the asymmetry of the relationship, there is a hierarchical aspect to this mutual reciprocity. This hierarchical interplay results in the "lower" level having a value and significance in and of itself, while being given its full meaning only in relation to the "higher" level which exerts a controlling or "molding function." ... Thus the twisted Moebius band, with its two different arrows integral to its one side, is aptly designated a strange loop model of bipolar-relational differentiated unity. (pp. 55-58).

This quote also illustrates that the book is written at a high level of erudition, which presents a formidable task in its reading and assimilation. I was reminded of the simple verse, "My soul is restless until it rests in Thee," when I read this passage in the book, "Here it must be said in Kierkegaard's terms that the human spirit, left to itself, is at best an advanced and complex form of despair, until it (the human spirit) is itself transformed in relation to an ultimate context of meaning especially designed to give its essentially relational nature an ontological ground" (p. 160). These samples are not isolated cases but are typical of the degree of scholarly abstraction present throughout the entire book.

Because of the emphasis of the book on complementary thinking, it is surprising to find that on several occasions, the authors refer to complementary concepts as "contradictory," instead of recognizing that they may indeed appear to be paradoxical, but are never logically contradictory.

If the complexity of style of this book may at times boggle the mind of the simpler-thinking scientist, it certainly offers a rich reservoir to be explored and applied by both the scientist and the theologian. ✱

Books Received and Available for Review

(Please contact the book review editor if you would like to review one of these books.)
Richard Ruble, Book Review Editor
***Perspectives on Science and Christian Faith*, 212 Western Hills Drive**
Siloam Springs, AR 72761

L. Aden & J. Ellens, (eds.), *Christian Perspectives on Human Development*, Baker
P. & A. Angela, *The Extraordinary Story of Human Origins*, Prometheus
M. Bauman (ed.), *Man and Creation: Perspectives on Science and Theology*, Hillsdale College
M. Biagioli, *Galileo Courtier: The Practice of Science in the Culture of Absolutism*, Chicago
R. Clifford & P. Johnson, *Shooting for the Stars: Astrology, Clairvoyance, Reincarnation, Near-Death Experiences*, Albatross
J. Haught, *The Promise of Nature: Ecology and Cosmic Purpose*, Paulist
P. Hefner, *The Human Factor: Evolution, Culture, and Religion*, Fortress
J. Hick, *Disputed Questions in Theology and The Philosophy of Religion*, Yale
T. Janabi, *Clinging to a Myth: The Story Behind Evolution*, ATP
D. Locke, *Science as Writing*, Yale University Press
M. Lubenow, *Bones of Contention: A Creationist Assessment of Human Fossils*, Baker
A. McGrath, *Intellectuals Don't Need God and Other Modern Myths*, Zondervan
D. McKown, *The Myth-Maker's Magic: Behind the Illusion of Creation Science*, Prometheus
H. Morris, *Biblical Creationism*, Baker
J. Moss, *Novelties in the Heavens: Rhetoric and Science in the Copernican Controversy*, Chicago
R. Richards, *The Meaning of Evolution*, Chicago
K. Sharpe, *David Bohm's World: New Physics and New Religion*, Bucknell University Press

Book Reviews

PTOLEMY'S UNIVERSE: The Natural Philosophical and Ethical Foundations of Ptolemy's Astronomy by Liba Chaia Taub (Chicago and La Salle, IL: Open Court Press, 1993), xiv, 188 pages, endnotes, bibliography, index. Hardcover: ISBN 0-8126-9228-4, $35.95; Paperback: ISBN 0-8126-9229-2, $14.95

Much has been written about the great Alexandrian scientist, Claudius Ptolemy. Astronomer, geographer, mathematician, he was one of the most important of all Hellenic scientists. But most students of Ptolemy have concentrated on the results of his researches, not on their philosophical foundations, or his motives.

Dr. Taub remedies this lack in masterly fashion. She has two goals. One is to examine Ptolemy's place in the philosophy of Greek science, particularly in relationship to Aristotle. The second is to examine the religious and ethical motives to Ptolemy's research.

Appropriately, the book opens with the epigram attributed to Ptolemy in *The Greek Anthology*, in which he says that contemplating the stars made him feel one of the immortals—an important theme throughout the book.

An introduction outlines the work. Chapter one discusses how historians of science have usually placed Ptolemy among Aristotle's followers. It emphasizes that, while Ptolemy's theories about physics and mathematics had similarities with those of other Hellenic scientists, over-all his ideas were distinctive. Chapter two follows this theme in more detail, looking at the ideas in the philosophical preface to *Syntaxis Mathematike* (or *Almagest*), Ptolemy's most famous work. Here we learn that while Aristotle says that theology is the most important science, Ptolemy gives that honor to mathematics (pp. 26, 29). "Mathematics is the surest road to that which divine and eternal," (p. 29) and to study mathematics can make one virtuous and beautiful (p. 31). This last statement is evidence of Plato's influence, Taub believes.

Chapter three discusses very thoroughly the *Syntaxis*'s seven basic assumptions about the earth and the universe. These include: that the universe moves spherically; that the earth is a sphere; that the earth is in the center of the universe; that the earth has the size of a geometric point compared to the size of the universe; that the earth itself does not move; and that the sky has two primary motions. All are common assumptions in Greek astronomy, but Taub is particularly concerned to demonstrate how Ptolemy's justifications for these hypotheses differ from Aristotle's. Usually, where Aristotle appeals to his physical theory, Ptolemy prefers to rely on observation and mathematics (pp. 71, 74).

Chapter four, "Ptolemy's Cosmology," discusses Ptolemy's works other than *Syntaxis*, particularly *Planetary Hypotheses* and *Tetrabiblos*, and how they portray the universe. A particular focus is on the order of the planets, and why they move. As in earlier chapters, Taub emphasizes Ptolemy's differences with Aristotle. Thus, Ptolemy supports the so-called Chaldaean order (from outside in): Saturn, Jupiter, Mars, Sun, Venus, Mercury, Moon. Other thinkers, such as Plato, used other orders. The relative position of Sun, Mercury, and Venus was the issue, since all three have the same period.

Ptolemy also emphasized that a planet moves in the same way an animal moves, that is, by an effort of individual will. He rejected the mechanism of spheres transferring force from an external source, which Aristotle preferred (pp. 113-118, passim).

Ptolemy believed that the planets were made of elements similar to the earth's, and that the planets had noticeable effects upon terrestrial events. This he discusses in his *Harmonics* and especially in *Tetrabiblos*, which is as important to the study of astrology as *Syntaxis* is to astronomy. All this is in strong contrast to Aristotle, who thought the sky and the earth had completely different elements and different laws, and who never mentions astrology (pp. 123-124, 126, 129-133).

Chapter five is perhaps the most interesting, for it discusses Ptolemy's religious motives for studying astronomy. Not only did he believe that the planets were immortal gods, as most Greeks did. Ptolemy thought that the study of the heavenly gods was a spiritual and ethical discipline. As his epigram says, Ptolemy thought the astronomer could imitate the calm unchanging planets, and thus achieve peace of mind for himself. Astrology, in particular, could help one be reconciled to the inevitable without grief (pp. 135-138).

The work is illustrated with twelve woodcuts from Renaissance astronomical textbooks, and has itself a handsome Renaissance format, with stars flanking the page numbers, and headlines beneath them. Endnotes, a useful ten page bibliography and a four page index end the volume. The style is not difficult, but assumes readers who are already acquainted with the history of Greek science and philosophy. It is probably best suited to graduate students as well as their mentors.

Reviewed by Dr. Lester J. Ness, 309 E. Third St. #4, Bloomington, IN 47401-3595.

HISTORY, PHILOSOPHY, AND SCIENCE TEACHING: Selected Readings by Michael R. Matthews (ed.). Toronto & New York: The Ontario Institute for Studies in Education Press & Teachers College Press, 1991. 244 pages., bibliographical reference. Paper; $22.95.

The editor is a faculty member of School of Education, University of New South Wales, Kensington, Australia.

This book is published as the first volume in a series entitled *Readings in Educational Controversy.* It contains 17 articles by authors from three continents. The need to incorporate history of science and basic philosophy of science into today's science classrooms and in the preparation of tomorrow's science teachers is emphasized in this collection. The authors' varied perspectives (including historians, philosophers, psychologists, physicists, chemists, biologists, and science educators) advocate the same idea that the teaching of science should be from a broader view — understanding the history as well as the philosophical findings of science, rather than relying on a textbook-centered focus. They also discuss methods to improve students' perception of the discipline, increase the development of critical skills, and retain a greater number of students in the field.

Articles are grouped by theme. In Part One, the interplay of the history and philosophy of science and science teaching in the past history is outlined, and some of the fundamental questions about the role of the former in the science classroom are laid out. In the first article, Ernst Mach's genetic approach about science education—that the narrow curricula should be presented historically—is explained. Every young student could come into living contact with and pursue to their ultimate logical consequences merely a few mathematical or scientific discoveries. In the second article, the author takes a critical realist position regarding the philosophy of science and proposes that it be adopted in science curriculum design. This position understands that scientists aim at a true description of the world and a true explanation of observable events, but cannot know for certain that their findings are true.

In Part Two, the major contention of recent, post-Kuhnian philosophy of science is addressed: Is theoretical change in science a rational process? And the curriculum implications of the debate are developed. Papers also address the critical issue of ethics and science and the classroom ramifications. In the first article, the author affirms the rationality of science, and explains the scientific method not as a particular set of procedures or techniques but rather as a general commitment to evidence. The second article states that controversies over moral education and over the teaching of evolution are linked in the concept of rationality. The author argues that the creationist theory should be allowed in the classroom since the new philosophy of science considers that just as morals are, science is not totally objective. This argument was debated in the third article. It counters that the occurrence of scientific revolutions do not justify relativism, but a doctrine of successive approximations to the truth.

Part Three takes up the question of what the history of conceptual change and development in science tells us about the history of conceptual development in individuals. One working hypothesis is that there should be a single cognitive model for conceptual change in science and in learning science; therefore, laboratory work should be directed explicitly towards conceptual instruction and expose areas of conflict with preconceptions. In Part Four, the recent feminist critiques of the epistemology of science are examined, and suggestions for appropriate responses by science teachers are made.

In the final section of the book, Part Five, papers deal with some representative curricula and classroom implications of the history and philosophy of science for teaching physics, chemistry, and biology. One paper deals with the metaphysics conveyed in science teaching. Another paper discusses the question of the religious motivation and the theologically informed philosophy of the great scientists when science is taught in its context. A third paper also addresses the importance of thought experiments in the history of science and in the teaching of science.

The conviction underlying this book, and the international project from which it derives, is that science teachers who know something of the history and philosophy of their subject will be able to teach it in a manner that is more engaging, critical, and coherent. They will be able to convey something of richness and importance of the scientific endeavor.

I am totally in agreement with the tenet of this book. As a student, I did not have the correct motivation in studying science. The incorporation of the history and philosophy of science into science teaching would have definitely helped me to understand science and to grow as a scientific researcher. This book is highly recommended for science teachers and scientists. It is also useful to parents who care about their children's science education.

Reviewed by T. Timothy Chen, National Cancer Institute, Bethesda, MD 20892.

THE ART OF SCIENCE: A Practical Guide to Experiments, Observations, and Handling Data by Joseph Carr. San Diego, CA: Hightext Publications Inc. 1992. 365 pages, index. Paperback: $19.95

The preface aptly describes the book as being "designed as your standard, generic, plain-vanilla survival manual." The book has three basic sections; formulating hypotheses and performing the experiment; measuring and analyzing the data; and presenting the data. Three appendices deal with fallacious arguments, and provide BASIC programs for statistical analysis and a statistical sampling game. (Both programs are available on disk by writing to the author.)

As one of several "survival manuals," this book is aimed at the beginning scientist and is written in a casual and easy to read style. Many practical examples are provided throughout, drawing particularly from the author's work in biomedical instrumentation. Throughout the book the author insightfully identifies how personal opinion sways interpretation (for an example, see p. 102) and advocates

measures to ensure scientific integrity and to identify mistakes.

The book begins by defining science and the scientific method. Scientific thinking is presented as a reductionist problem solving method. The problems of reductionism are identified and an appeal made to maintain the "big picture," which the author refers to as the holistic method. The interplay between common sense and critical thinking is examined, with the author arguing that common sense arises from each person's world view, and prevents change by limiting new ideas to the familiar. Consequently, common sense is seen as impeding scientific thinking so that the "opposite of common sense is good sense..." (p. 19).

Having presented the scientific method, the authors emphasize the importance and legalities of record keeping. The advantages of recording experiments are posed in light of pattern recognition, avoiding repetition, propriety, and future relevance of the data.

The second section of the book introduces basic mathematical skills. Significant figures, scientific notation, and the importance of units are illustrated with several solved problems. This section naturally leads to a discussion of averages, differentiating between mean, median, and mode, analyzing how skewed data affect the mean, and methods that compensate for such cases.

The subsequent chapter returns to an earlier theme, the design of experiments. Three guidelines for formulating experiments are introduced: formulating the problem, determining how to observe the system, and collecting numerical data. The advantage of comparative experiments and the need to control variables is illustrated with four hypothetical tomato plots that are fertilized differently (p. 99). One plot is a control, one is treated with fertilizer x, one with fertilizer y, and one with both x and y. If the fertilizers have no interactions then:

> Increase in the tomatoes fromthe fertilizer equals the increase from the treatment with x plus the increase from treatment with y on the plot treated with x and y.

xy plot - control= (x-control) + (y-control)
xy plot= control + (x-control) + (y-control)

The xy plot yields 60 pounds of tomatoes, the x plot 50 pounds, the y plot, 40 pounds, and the control, 25 pounds. Therefore:

60 = 25 + (50-25) + (40-25)
60 = 65

The author "conclude(s) that there is no interaction between the fertilizers, and that the effect is simply additive." The correct interpretation would seem to be that more tomatoes are obtained from the use of x and y on separate plots than their combined use, implying that the fertilizers do, in fact, interact to yield fewer tomatoes when used together. Unfortunately, the author's interpretation detracts from an otherwise useful example.

The chapters on measurements and errors are interesting and well written. Theoretical and environmental errors are discussed with examples and ways to avoid or minimize their effects. Probability theory is approached using die and card combinations to illustrate the laws of probability. With such lucid explanations of probability theory, small errors such as the use of both instead of either (p. 139) and multiplication instead of addition (p. 141) are somewhat surprising.

The final section concerns data presentation and interpretation. Normal distributions, samples means and variance are defined, followed by methods of data correlation. The subsequent chapter concerns methods of graphical presentation and interpretation. As with many books on statistical analysis, the section on graphical abuses gleefully identifies different ways graphs can, and have been used to mislead the unwary.

The book concludes with some common-sense guidelines for science fair projects. The author's experience as a science fair judge provides the basis for these suggestions presented as a comparison of two common types of projects: one well presented and poorly executed and the other poorly presented but well executed.

An appendix addresses different types of fallacious arguments, and shows when arguments are advanced for personal rather than scientific reasons. With 26 different types of fallacies discussed, some topics might have been combined, such as the "Error of Composition" (p. 300) and the "Error of Wrongful Division" (p. 301) that discuss reductionism. Other topics are covered in an unusual order. For example, hypotheses are not discussed in "Theory, Hypothesis, and Law — What's the Difference" (the word hypothesis only appears twice in the chapter!) but null hypotheses are covered four chapters later. Headings and subheadings are sometimes difficult to differentiate and some headings ("Fallacies of Ambiguity," (p. 298) are repeated as subheadings ("Type XXII: Fallacy of Ambiguity," p. 299).

The author is a lucid writer and presents scientific concepts clearly. Each chapter stands alone and the topics are well indexed. In maintaining a light style and extensive examples the author is able to convey methods in an easily understood manner that should make the book a good asset for new practitioners of science.

Reviewed by Fraser F. Fleming, Assistant Professor of Chemistry, Duquesne University, Pittsburgh, PA 15282.

THE SCIENTIFIC TRAVELER: A Guide to the People, Places & Institutions of Europe by Charles Tanford and Jacqueline Reynolds. New York: John Wiley & Sons, Inc., 1992. 335 pages, preface and indices. Paperback; $16.95.

Scientists Tanford and Reynolds have ably met a long standing need. Guides to European art museums, WWII battle grounds, cathedrals, gardens and other interests abound, but until now, the sciences have been neglected.

This work offers "a framework that would put each particular place into reasonable historical and scientific perspective, to jog the memory of the expert and to provide some orientation for the novice."

The authors follow a distinctively hierarchical style. First, they consider the regions; the Mediterranean, Western Europe, "Mitteleuropa," Scandinavia and the Baltic. The scientific history of individual nations in the regions is discussed in a broad fashion which sets the stage for a description of points of interest in specific cities and towns. The rhetoric flows smoothly, avoids technical jargon and reflects the things that have impressed one who has both a geographic and a historical perspective. One interesting note for this reader was the account of William Derham, Rector of Upminister for nearly 50 years. Derham's *Physico-Theology* influenced the thought of 18th century evangelicals such as William Paley and John Wesley. Derham's claim to scientific fame involved an accurate measurement of the speed of sound which disagreed with both the *experimental* and *predicted* values of one Isaac Newton. Newton had used his predicted value in the first edition of the *Principia* but "manipulated" the prediction in a later edition to arrive at Derham's value (see Westfall's *Never at Rest: A Biography of Isaac Newton*).

Coverage is generally excellent. Both large cities and smaller towns are listed. Personal favorites not included were the Science and Natural History museums in Oxford and the Apothecary Museum housed in the castle above the old part of the university in Heidelberg. We can expect a more expanded coverage of Russia in a revision.

The Scientific Traveler would be an essential tool for scientists planning that "once in a lifetime" trip to Europe or for those who have time to "look around" in conjunction with a scientific meeting.

Reviewed by J. W. Haas, Jr., Gordon College, Wenham, MA 01984.

THE MEANING OF EVOLUTION: The Morphological Construction and Ideological Reconstruction of Darwin's Theory by Robert J. Richards. Chicago, Illinois: The University of Chicago Press, 1992. 205 pages. Hardcover; $19.95.

Do you want to read a rigorous historical analysis of the development and structure of Darwin's theory? Well, perhaps the lucid prose and humanizing illustrations Richards employs will enable you to persevere and profit from this volume.

Darwin remains a venerable figure within the history of science. Consequently, biologists often attempt to demonstrate their historical continuity with Darwin. This becomes suspect when Marxist punctuationalists begin to bicker with capitalist gradualists or sociobiologists; both paint portraits of Darwin which curiously resemble themselves. Furthermore, biologists and biology texts show how Darwin's rigorous scientific method and acumen eventually triumphed over competing ideas which were steeped in German idealism or other metaphysical constructs which have now rightfully been discarded. History of science becomes a hymn to science.

In contrast, Richards — a "historian of ideas" — uses the term "evolution" as an "index to probe the vitality of a larger set of ideas...from the seventeenth century through Darwin's lifetime." Evolution once referred to embryological development; and it was used in arguments about preformationism, epigenesis and recapitulation. The meaning shifted decades before Darwin from the "notion of the embryo as a miniature adult of its own species to that of the embryo as a sequence of miniature adults of lower species." Soon both species progression was conjoined to this idea of embryological progression; this led to much research and theorizing by Von Baer, Lamarck, and eventually Haeckel.

These ideas crossed the English channel to Darwin via Lyell, Grant, Green and others. Richards painstakingly documents how Darwin's theorizing, despite modern pronouncements to the contrary, was integrally linked to both evolutionary progress and recapitulation. Species evolution itself was modelled on individual evolution (evolution or unfolding of the embryo), and thus the embryo must recapitulate the adult forms of its ancestors. Darwin's own experiments and the logic of his theorizing necessitates these conclusions.

Richards then bravely takes on Darwin's modern reinterpreters/hagiographers from Russell to Mayr, Gould, and Bowler. He incisively analyzes their claims and interpretations of Darwin's texts, and shows that, surprise, Darwin was a nineteenth century biologist after all; progress oriented, Lamarckian, and recapitulationist!

Why do modern scientists/historian remake Darwin? Richards replies:

> I think it can only be ideology...Gould and Mayr have a scientific interest in reading Darwin as they have. He is the patron saint of evolutionary biology — and for very good reason. To have his blessing on scientific positions one wishes to maintain in the late twentieth century can only advance their cause. Both ... regard freely flowing variational possibilities as the juice of evolution; and suspect constraints (like recapitulation) that act to inhibit the flow can, they believe, only produce stagnation. But more fundamentally they reject any notion of guidance in evolution by teleological factors (and ideals of progress)... All of these unhappy changelings could be more easily buried if Darwin himself were to chant the obsequies.

This book exemplifies the challenge to perform good scholarship, to read texts carefully and to fruitfully question prevailing dogmas.

Reviewed by Marvin Mareinko Kuelar, 3731 W 6th Ave #106, Vancouver, BC V6R 1T8.

CHEMICAL DECEPTION: The Toxic Threat to Health and the Environment by Marc Lappe. San Francisco, CA: Sierra Club Books, 1991. 360 Pages, bibliography, index. Paperback; $15.00.

Marc Lappe is Professor of Health Policy and Ethics at the University of Illinois, College of Medicine. He has written three other books, *Genetic Politics*, *Germs That Will Not Die*, and *Broken Code: The Exploitation of DNA*.

Inserted in this book is a note from its publisher to the books editor that says "Do not review before publication date." I wish the book's editor had reviewed this book long before its publication, so that the author could have a chance to remove the many deficiencies in this book. I will mention only a few of these deficiencies in this review.

In this book, the author attempts to dispel ten common myths about toxic threat to our health and about environmental pollution. Although cases of deceptions using these myths are cited, in some other cases of toxic chemicals the author has not provided evidence to prove that the polluters have deliberately deceived us with these myths or otherwise. A case in point: on page 12, the author states that a viral agent associated with farming activities confounds the apparent association of leukemia with agricultural chemicals. Where is the evidence for chemical deception in this case?

Furthermore, I am not convinced that the ten myths presented in this book are genuine myths. These so-called myths include: environmental pollution is a local problem, human bodies have adequate detoxication mechanisms, effects not immediately apparent are non-toxic, toxicity has thresholds, the fetus is out of reach of toxic substances from the maternal body, nonreactive chemicals have no adverse effects, the human body's own chemicals are safe, naturally occurring substances cause most cancers, tap water is safe to drink, and the environment is resilient to pollution. I believe that these myths may be truths for some chemicals and/or under certain circumstances. Take myth number four — toxicity has thresholds. Carbon monoxide certainly has a toxicity threshold; otherwise, how could we have survived today?

The author cites cases of chemicals that are suspected (but not demonstrated) to cause diseases, on the basis of correlations or speculations. An example is found on page 194, where the author states that the rate of increase in brain tumors in certain age group has been so dramatic that only an environmental explanation makes sense, and then points his fingers at chemical toxicant as being on top of the list of suspects. The author does not bother to explain how he arrived at the correlation and suspicion. Other examples abound.

On page 115, the author points out that the Chinese population ingested considerable amounts of cancer-protective foods, and refers the readers to see Chapter 10. I find no reference in Chapter 10 to that point made on page 115. A book's editor should be able to detect this kind of deficiency.

The book discusses the threat of radiation, including electromagnetic wave, to our health, but omits noise and thermal pollution. Why does this book include one type of physical pollution and not the others? The author does not say. The author also fails to mention that our daily activities contribute directly or indirectly to generating man-made toxic chemicals, such as food preparation (deep fat frying and browning) and human waste excretion, whose products are toxic or potentially toxic.

In spite of these deficiencies, the book is a good general reference on the toxic effects of selected chemicals. It has a very extensive bibliography.

In conclusion, this book lacks a probabilistic risk assessment on the threat of toxic chemicals to our health and the environment. It has no balanced view on the benefits versus toxic risks of chemicals, and has an inadequate discussion of exposure doses versus physiological responses. It also has not adequately addressed what I firmly believe to be the ultimate threat to the environment, namely, the rapid increase in human population, general increase in human longevity, and constant expansion of human activities.

Reviewed by James Wing, 15212 Red Clover Drive, Rockville, Maryland 20853

FOUNDED ON THE FLOODS by S. Hugh Paine. Walnut, CA: Productions Plus, 1993. Approx. 150 pages. Paperback, $18.00.

S. Hugh Paine majored in math and physics at Wheaton College and did his graduate study at the University of Chicago. After working for several years as a process metallurgist at Bell Aircraft he returned to the University of Chicago where he became a senior metallurgist at Argonne National Laboratory. There he spent fifteen years studying radiation damage to metals related to nuclear reactors. In 1960 Professor Paine became head of the physics department at Houghton College where his brother, Stephen Paine, served as president. He taught physics and earth science and began a serious study of Hebrew, until his retirement in 1976. The study of Hebrew was to gain an understanding with a sure translation basis of the critical passages of Genesis. Professor Paine recalls in the book's introduction, "My introduction to the Gap theory, however, came through an intriguing volume from Dad's uncle's library, Pember's *Earth's Earliest Ages* (a volume I still treasure), which gave me my first taste of the Gap theory." He taught the Gap-flood theory in essentially the form printed in this book for about ten years before his retirement.

At the urging of family, friends, and former students, Professor Paine has reluctantly agreed to record the insights he has gained from his extensive studies of the

Bible, with special emphasis on Genesis, and from his teaching involvement with the earth sciences, particularly geology, for the understanding of the events of creation. In his words: "My situation is somewhat similar to that of Copernicus, who did not dare publish his work for fear of reprisals. Near to the time of his death his friends took a hand in the matter. In the same way, my friends, are urging me to publish my studies of Genesis." (p. 23)

A reading of *Founded on the Floods* reveals several guiding principles which were very important in shaping Professor Paine's views of origins. I understand several of these as follows: (1.) He is convinced that the Bible deals with realities, not myth or fantasy. However, at times figurative language is used. In short, the Bible is the record of God's historic dealings with mankind and the Bible says what it means. Professor Paine has made an intensive study of the Hebrew language to better understand that record. (2.) He believes that the verified findings of the physical sciences are to be accepted if one is really interested in finding the truth. (3.) He finds the ,'theory of naturalistic biological evolution cannot honestly be called anything but a faulted hypothesis." (4.) What we believe about Creation really does matter because it affects what we believe about the Bible and about God himself.

After a prologue the book has two main parts; *The Bible as the Ultimate Source* (50 pages) and *Science as a Reliable Source* (45 pages). These are followed by an epilogue, 3 brief appendices and a postscript. *The Bible: Ultimate Source*, obviously a study of Genesis, includes interesting sections such as Difficulties in Translating Scripture, Language Gaps and Discriminating Figurative and Literal. Professor Paine's thesis is that we must be very careful in interpreting clear statements of God's inspired word as figurative, and further, that we should not depend on English versions or commentaries but should do the hard work of reading the original language. This part of the book concludes with a discussion of Noah's flood as universal and placid. *Science: Reliable Source*, presents Professor Paine's applications of the scientific method to creation theories. He favors the Gap-flood theory because "it is in complete harmony both with what the Bible says and the verified findings of Science." This section includes flood tectonics, the age of the earth and the universe, the standard geologic column, and pre-Adamic hominids.

This book is important, not so much for its clear presentation of the Gap-flood theory but because it represents one man's life-long search to understand God through his revealed word by study in the original language and through his creation by application of the scientific method. I close with another thought from this book: "What we believe about the Bible influences what we believe about Creation, and what we believe about Creation influences what we believe about the Bible. It has to be that way."

Reviewed by Bernard J. Piersma, Professor of Chemistry, Houghton College, Houghton, New York 14744.

WEATHER AND THE BIBLE: 100 Questions and Answers by Donald B. DeYoung. Grand Rapids, MI: Baker Book House, 1992. 162 pages, references, glossary and indexes. Paperback.

Donald DeYoung is a Christian physicist, a member of the science faculty at Grace College in Indiana, editor of the *Creation Research Society Quarterly*, and adjunct professor at the Institute for Creation Research Graduate School of Science in San Diego.

Weather and the Bible covers an amazing range of topics. It is presented in a question and answer format, the questions being grouped into five chapters; ,'Weather basics", "Water, wind and clouds", "Stormy weather", "Past weather" and "Future weather." Some answers are illustrated with simple figures, charts, or formulas. DeYoung wrote a similar book titled *Astronomy and the Bible.*

This book starts with weather fundamentals such as atmospheric, composition, pressure, temperature, etc, and world wide weather dynamics such as the water cycle, movement of major weather systems and the jet stream. It also discusses more localized phenomena such as Chinook winds, squall lines, and storms on the Sea of Galilee. Interspersed with the basics are discussions of everything from weather lore to odd weather phenomena like ball lightning and noctilucent clouds to recent findings about weather on other planets to controversial topics such as ozone layer depletion, the Gaia hypothesis and circles that appear in British fields.

The chapter on "Past weather" best reveals the book's recent creation view point. It discusses things like preflood weather, evolution of the atmosphere, glaciation and the extinction of the dinosaurs. This chapter is not limited to presenting evidence for recent creation. It also deals with topics like the climate in Jesus' time and the dust bowl of the 1930s.

"Future weather" covers popular speculations about what will happen to the earth's climate such as nuclear winter, global warming or cooling and the effects of deforestation as well as what may be deduce about the future of the weather from the Bible and our understanding of climatic stability.

There are at least two motivations behind this book. One is to encourage those who view science as something evil to reevaluate their opinion. The other is to counter a recent weather book (*The Weather Companion* by Gary Lockhart) which is "critical of the Bible, creation and even of missionaries." Throughout his book DeYoung reflects on ideas like the intricacy and beauty of God's creation, the planning that must have gone into it and His continued participation in it. While he includes questions such as "Does God send deadly storms," and "Is it okay to pray for rain" don't look for powerful theological argument that you can lay on others. Instead, DeYoung approaches all with a respect for God's sovereignty and his majesty.

Weather and the Bible is not scientifically and theologically deep, but it covers such diverse weather, Bible and

related subjects that even the well informed are bound to pick up some new tidbit. It is written at a level suitable for the high school student or the person with only a passing interest in the sciences. Yet, the author adheres to sound scientific principles in every topic with which I am familiar. He treats speculative areas so circumspectly that I find it worth considering his material favoring recent creation, even though I don't count myself among the adherents to recent creation. If you are a collector of diverse facts or want some light weight but very informative reading, try this book. Easily read in an evening, it's the sort of thing you might take along to read while sitting in a waiting room or riding public transportation.

Reviewed by E. Eugene Hartquist, Research Support Specialist, Mechanical and Aerospace Engineering, Cornell University, Ithaca, NY 14853.

HEALTH AND FAITH: Medical, Psychological and Religious Dimensions by John T. Chirban (ed.). Lanham, MD: University Press of America, 1991. 142 pages. Hardcover; $34.50. Paperback; $17.50.

This book is a compilation of essays by members of the Orthodox church — physicians, psychologists and theologians — on matters concerning medical ethics and treatment of people who are ill.

Editor Chirban, professor of psychology at Hellenic College and Holy Cross School of Theology in Massachusetts, divides the book into five parts. The first part, perhaps the most instructive, lays the groundwork for the Orthodox approach to healing. There's a strong enphasis on the part of all three contributors on the interdependence of the body, mind and soul in determining a person's health and therefore the necessity for cooperation of physical, psychological and religious healing. This part contains also an exhortation by Bishop Nicholas for the professional care-giver to merge his faith with his practice. He furthermore encourages the Orthodox layperson to speak strongly on areas of public ethics such as abortion or watch the field become dominated by the secularists.

Part Two speaks of genetic engineering, describing it and then trying to decide what is permissible and at which point we begin to dehumanize people. Professor Breck would prohibit interventional eugenics but would focus on the integrity, humanity and freedom of the person. He suggests ethical oversight committees and increased training at the seminary and congregational level. Parts Three and Four describe what should be our approach to depression, AIDS and cancer, with emphasis on compassion and understanding.

The last part purports to deal with "Miracles and Technology." I would not describe it as an in-depth approach to the topic, but one of the contributors, Pastor Constastine Sarantidis, has a very interesting approach. He concludes that the New Physics of quantum mechanics (as contrasted to Newtonian physics) allows us to more readily be open to miracles as God's way of returning the universe to what he had planned for it. Balancing that positive contribution is one on Therapeutic Touch by Karen Piligian, a registered nurse trained in that technique. As originally described by Delores Krieger, that technique is strongly grounded in Eastern mysticism. Although Piligian speaks of the "universal energy flow" as being "God, love, the Christ light," it's very questionable whether such a technique should be used by a Christian practitioner.

This book would be of interest to readers who would like to learn more about the Orthodox approach to health and healing. It's encouraging that it is strongly biblically-based, and most of the authors relate their contributions to God's view of and plan for man. Its weakness, in my opinion, is the unevenness of the contributions — some of them are pretty ordinary. Editor Chirban could have deleted some of the essays, asked for others that might be a little more vital and perhaps added a few summaries that tied the chapters together.

Reviewed by Edward M. Blight, Jr., Professor of Surgery, Loma Linda University, Loma Linda, CA 92354.

A GOOD DEATH: Taking More Control at the End of Your Life by T. Patrick Hill and David Shirley. Reading, MA: Addison-Wesley Publishing Company, 1992. 160 pages, index. Paperback; $11.95.

The copyright for this work is held by Choice in Dying, the national council for the right to die. One author was formerly an associate director of education for the organization, and the other is the current director. The book reflects the group's reason for existence, the promotion of individual choice in how and when one dies. The authors are responding to a widely felt problem. In our pluralistic society, our caregivers' values and the pressures on them might be quite different from our own. In addition, many treatment decisions come to the fore at times when the patient's competency may be questioned, which compounds the potential for conflict. In these cases, whose wishes should prevail?

The authors argue that "Physicians tend to provide life-support care, for example, long after any reasonable justification for it has ceased." There is pressure on them to do everything possible. While physicians are usually not asked to justify maximum intervention, they *can* be held accountable by hospital administration, courts, or others for *not* using an available technology. Not treating to the maximum requires greater reflection and consensus building than utilizing every option, and reflection and consensus are time-consuming processes. The authors of this book do not even mention two additional motivations for more intevention: this type of care can provide an

opportunity to test new techniques too risky at first for patients with a better prognosis; and the fact that our system reinforces intervention with fee-for-service care. The incentives today are to treat the patient to the greatest possible extent. If that is not in the patient's best interest, how can the juggernaut be stopped, or even slowed down?

The time to think through and voice choices on these treatment decisions is when there is time to think, and no challenge to one's competency. Yet not only have most people not thought about or discussed the challenge of dying, "many of us will face our own death without ever having witnessed firsthand the death of someone else, even those closest to us." We tend to come without preparation to these decisions at one of life's most important transitions. That can lead to conflict between the unclear wishes of the patient, the current choices of the family, caregivers, institutions such as the hospital, and finally the courts. In response, many states now require an abbreviated discussion of living wills upon hospital admission. That is a potentially unnerving time to raise the subject, but at least this system provides an accessible bottleneck to enforce the requirement.

The authors of this book advise that a living will is helpful, but usually insufficient. Future circumstances usually cannot be predicted accurately enough to give precise treatment directions ahead of time. The value of such a document is in encouraging family and others that would be involved in such decisions to consider the issues involved while there is time and recognized competency. What the authors wisely recommend is that the patient choose a proxy, in some states called a "health care agent." This individual is appointed by the patient with power of attorney for heath care matters. He or she can competently speak for the patient, with all the patient's rights, when the patient is unable to speak for him or herself.

While presented in a book format, the essay addresses the above more as an extended pamphlet than as a scholarly analysis. There are 139 pages of large print text. While the authors allude to views and arguments other than their own, the discussion is not even-handed. The purpose of the book, as of the organization, is to advocate self determination and society's obligation to carry out whatever those wishes may be. The short descriptive cases are chosen and described in a way to emotionally tug us to support a patient's right to directly and deliberately end his or her life. The discussion of physician-assisted suicide does not even mention complications for legal protection against murder, nor slippery slope concerns that one marginally acceptable step may lead to many unacceptable ones. Beyond advocating foresight and room for individual choice, the book tends to assume and encourage a kind of existentialism, where the individual creates and is the final authority of life's meaning and end. We not only have a legal right to guide our deaths — whatever we choose for ourselves is, by definition, the right thing to do. This reflects an insidious confusion between institutionally protecting people's autonomy to live and choose within their particular community (for example, Christians in a secular hospital) and total individual autonomy as a lauded personal goal. One is a call for toleration and cooperation in social institution such as hospitals. The other is a relativistic claim about what matters. In the book, these two very different claims of autonomy seem conflated. The underlying philosophy is summarized in a preface written by Fenella Rouse, the executive director of Choice in Dying. "We are a central character in a story we write ourselves, and it is not so much what happens to us but how we feel about it that gives our life shape and meaning." Autonomy, interpreted as the individual as sole authority, is the final arbiter.

To their credit, Hill and Shirley do devote a chapter to the voices of several major world religions. They recognize the pervasive influence of traditional religions in most people's perceptions of death and how they should deal with it. Unfortunately, the characterizations often doe not ring true. For example, Protestantism is summarized as an attempt to answer the question, "how can we be true to ourselves, and, at the same time, faithful to others." This is a reductionist summary more reflective of extremes in the liberal tradition than of the historic Christian tradition found in Scripture and consensual teaching. "American fundamentalists" are simply written off for their "uncritical affirmation" of preserving life. The chapter summary of the authors is that Buddhism, Judaism, Roman Catholicism, and Protestantism all agree that there is a "difference between warranted and unwarranted efforts to prolong life." Yes, prolonging physical life is not an absolute in any of these traditions, but leaving their contribution at that ignores their many insights for the tough questions. When are we saving a life and when are we prolonging dying? How much certainty do we need in predictions of future suffering or health? How much is too much suffering? Is withdrawing medical nutrition and hydration allowing nature to take its course, or pushing it along to a predicted and planned end? For the authors, the practical questions seem to fall not just to personal responsibility, but to the personal authority of each individual. "To answer these we must turn inward," and whatever one finds as an individual is by definition the best course. Religion and religious leaders have a role, but it is only to give emotional support and help clarify and communicate the patient's own values.

In response, the authors feel that the public places (such as hospitals) where most of us now die should design their procedures to accept and support a range of different choices. Autonomy at this level is to allow each person to remain true to and strengthened by their particular tradition. It is important to note, however, that cooperating within political pluralism is not an affirmation of individualistic relativism. Respect for individuals should not be confused with an existentialist philosophy of each human being as the measure of all things. Also, political autonomy is not an absolute. Our society frequently restrains practices which are too harmful to the individual or others. Failing to do so too easily disguises and promotes apathy. The book offers a needed call to think ahead and to protect individual choice in institutions where caregivers may not share the patient's convictions. Voicing concerns and choices and designating a heath care proxy while undoubtedly competent can help protect each patient. However, this book also tends to advocate not only

institutional toleration, but further, the subjective individual as the final ultimate standard. As a Christian, I would affirm that we are not the final standard in and of ourselves, nor do we belong solely to ourselves. Our Lord is Lord as much in how we live through dying as he is in any other part of life.

Reviewed by James C. Peterson, C.C. Dickson Chair of Ethics, Director of the Program in Religion, Ethics, and Technology, Wingate College, Wingate, NC 28174.

COUNSELOR'S GUIDE TO THE BRAIN AND ITS DISORDERS by Edward T. Welch. Grand Rapids, Michigan:Zondervan, 1991. 336 pages, index, 4 appendices. Paperback; $14.95.

Counselor's Guide to the Brain and Its Disorders begins with a noble purpose, to present biological and medical data to pastoral counselors whose backgrounds in the physiology of the brain and emotional disturbances is weak or totally lacking. Much of the book is helpful, but its pervasive hostility toward medicine and psychiatry, evident to even the most naive reader, undermines the book's general usefulness.

As a licensed psychologist and member of the American Psychological Association, Welch has adequate credentials as a psychologist. He holds a Master of Divinity degree, and whether or not a reader agrees with his scriptural interpretations, he can be commended for remaining internally consistent in his theological tenets. In the preface, Welch asserts that psychiatry is essentially evil, setting an adversarial stage for medical and scriptural visions of mental illness. His thesis is that medicine and psychiatry compromise faith and scripture. Welch's overt purpose for writing the book, " ... a clear biblical perspective ... robust enough to include and explain recent developments in biological psychiatry," is submerged, lost in his diatribe against medicine.

What useful information does Welch offer to pastoral counselors, seminary students, and nonmedical personnel? "Part I: Biblical and Medical Background" summarizes a conservative evangelical biblical model of illness, yet emphasizes that "sin does not lead to physical disability" (p. 48) and "righteousness does not lead to health" (p. 49). Chapter 3, "Biological Foundations" provides a concise summary of brain and endocrine anatomy and physiology. Chapter 5 contains explanations of diagnostic tests surprisingly free of the anti-medical bias found elsewhere. Part II of *Counselor's Guide* is particularly helpful, with satisfactory discussions of selected neurological disorders. Welch alludes to healthy interdisciplinary cooperation between mental health professionals, a working model students especially should see before venturing into unsupervised practice.

Part III is entitled "Misdiagnosis: Counseling Problems with Medically Treatable Causes." Welch provides a valuable list that salvages the book and should be known to all pastoral counselors. He notes six signs that warrant immediate medical referral, including changes in consciousness, vital signs, headaches, and body movement, and recent head injury or visual disturbances.

Counselor's Guide is so exaggerated in its anti-psychiatry bias that I must assume that Welch has never worked on an interdisciplinary team where various professionals and specialists function in the patient's best interest. He repeatedly criticizes psychiatrists for using the medical model and not being pastoral counselors. He neglects the fact that they are physicians, and medical and spiritual assessments can enlighten each other and work synergistically for growth in body, mind, and spirit. His arguments are faulty, demonstrating a true lack of experience and/or understanding of the field. For instance, quotes by Thomas Szasz, M.D. are used as ammunition against psychiatry, but nowhere is it stated that Szasz is a renegade in the profession and virtually no reputable practicing psychiatrist would ever consider quoting him. Welch's division of "heart" and "brain," or "body," are misleading for patients with head injuries or strokes in which speech and behaviors that appear to be sinful are beyond conscious control even when the individual is fully oriented. Competent psychiatrists will readily agree that some undesirable, or sinful, behaviors are too often excused as illness instead of misconduct, but Welch goes too far and demonstrates his lack of basic medical knowledge by labeling rituals and obsessions of legitimate obsessive-compulsive disorder as "rituals to appease God or assuage his perceived wrath" (p. 222). This position is not unlike the biblical belief that seizure disorders were always demon possessions.

Welch devotes much space to psychotropic medications. Some of the material is academically accurate, but again his personal bias against medicine is potentially damaging to readers. Psychiatrists know that medications are not without side effects, and the best medication is none at all. Welch ignores the fact that medications are prescribed and necessary because, despite side effects, illness is often worse. He condemns psychiatrists for overprescribing drugs, but fails to mention studies documenting over 95% of psychoactive medications prescribed in the United States are by internists and family practitioners, not psychiatrists. The book abounds in assumptions not founded in fact, but stated in rigid, dogmatic language that perpetuates stereotypical, untrue images of psychiatrists.

In summary, I find portions of *Counselor's Guide* to be acceptable reading, but most is extremely biased and in direct contradiction of Welch's stated purpose of interdisciplinary dialogue. I hope that in the future he has the opportunity to work with an individual who is both a Christian and a psychiatrist and comfortable in both roles simultaneously.

Reviewed by Mary Lynn Dell, M.D., M.T.S. Assistant Professor of Psychiatry, Emory University School of Medicine, 1405 Clifton Road, 6th Floor, Atlanta, Georgia 30322.

WHEN THE NEW AGE GETS OLD: Looking for Greater Spirituality by Vishal Mangalwadi. Downers Grove, IL: InterVarsity Press, 1992. 287 pages; paperback.

The author was born and raised in India, and is actively involved with the Himalayan L'Abri Resources Centre and the Good Books Club in Mussoorie, U.P., India. In this book he offers a comprehensive look in nine chapters at the various elements of the New Age: astrology, spiritism, UFO's, tantric sex, ecological aberrations, vegetarianism, reincarnation, and spiritual healing, concluding with an Appendix on the New Physics and Hinduism. In each case he describes in some detail the New Age view and its claims, then analyzes it from a Christian perspective to point out its excesses or pitfalls. He "accepts the New Age's rejection of the old 'secular, materialistic, rationalistic' age as both untrue and harmful," and sees the "despair of Western humanism as the source of the New Age." Yet he "is not convinced that what is called 'the New Age spirituality' is the answer." Therefore he "keeps comparing the New Age answers with the biblical world view (not necessarily the same as contemporary Christianity)," as a viable alternative.

Mangalwadi argues that "an essential feature of the New Age is its conscious rejection of reason as the means of discovery of truth." This shift involves three moves: (1) away from logical reason to feelings and intuition, (2) away from normal human consciousness to another mystical state of consciousness, and (3) away from human beings themselves to spirits and disembodied entities who live in a "spiritual dimension." "For the New Ager the biggest advantage of spiritism is that revelation from spirits finally frees the West from the restricting influence of logical reason."

New Age spirituality can be seen as "a process of privatising Eastern religious traditions," and "the current emphasis in some New Age circles on time as *nowness* reflects another attempt by the West to conquer Eastern pessimism, while bowing before its metaphysics and spirituality."

Sometimes the author states the case for certain phenomena so convincingly that the reader might be misled as to his intention. For example, in the chapter on "The Reincarnation of the Soul," he writes, "This suggests that the mind is not just a function of the body, but has an existence of its own ....The simple fact is that millions of people have attested to direct experience of the spirit world — faith-healing, mediums (or channels), spirit-possession, exorcism, etc.... Even if one accepts the existence of the soul as a fact, that does not automatically prove that souls reincarnate." Then after a lengthy summary of the empirical evidence in favor of reincarnation and the apparent benefits of reincarnation, he comes some ten pages later to the case against reincarnation and why the Christian view is not reincarnation but resurrection.

Similarly, in the chapter entitled "My Course in Miracles," the author describes his own treatment by homeopathy and then states, "Hahnemann arrived at the above 'law of nature' through the scientific method of experiment, observation and deduction on the basis of observed data....Homeopaths have not sought a scientific explanation of why shaking 'potentises' their otherwise ineffective medicines. They just know from their experience that it does." After discussions in the following pages of alternative therapies, psychic surgery, viewing sickness as illusion, the author comes finally to divine healing, human responsibility, and God's role in our healing.

The author makes several significant points in the Appendix.

> "What is often missed by the readers of authors such as Capra is that when he is propounding a mystical world view, he is not speaking as a scientist at all, but as someone who is denying science and yet invoking his prestige as a scientist to make his readers accept an extra-scientific proposition."

Or again,

> "Since there are compelling reasons why scientists who reject scientism turn to mysticism in search of a better philosophy of life, we need to examine whether their choice is in fact justified. Or would a return to the original world view which made science possible be a more sensible alternative?"

> "It is naive to accept the viewpoint which says either that the conclusions of modern science point toward mysticism or that mystical, non-dualistic philosophy provides an intellectual framework for modern science."

Finally, the book can be summed up in a single sentence: "Scientism has failed to provide a satisfying philosophy of science, and mysticism is a blind alley which destroys the possibility of science."

Reviewed by Richard H. Bube, Professor Emeritus of Materials Science and Electrical Engineering, Stanford University, Stanford, CA 94305.

THE WEB OF THE UNIVERSE: Jung, The "New Physics," and Human Spirituality by John Hitchcock. New York, NY: Paulist Press, 1991. 243 pages, index. Paperback; $14.95.

Hitchcock states:

> I once taught at a school where the students were "born again" Christians and good science students as well. They could cite evidence for scientific theories and could use their knowledge of atomic physics to explain, e.g., the physical properties of two forms of the element carbon, diamond and graphite. They even *knew* that their science conflicted with their fundamentalist Christianity, but they could hold these areas of their lives apart. The *conflict* was not felt at all ... (p. 77).

These sentences show the danger which Christian students face when going to college. Also, it indicates that Christian scientists must show that Christianity does not need to create an inner conflict.

Faith shapes how we look at everything. Christians know that God is the Creator and wants to renew his creation to what he originally intended it to be. Man's fall into sin made redemption necessary. But it is *not* redemption in Hitchcock's sense, (p. 128) who states that the Brahmanic Rta and the Chinese Tao yield the same meaning of redemption. Hitchcock is not a Christian and this book is *not* a Christian book. Hitchcock places all religions on the same level.

Chapter 3 (about Job) uses Jung's book *Answer to Job.* God is both good and bad, and the cause of Job's misery. Therefore, God is "unconscious," (p. 91). God does not feel the conflict between good and bad as we do. Still, God wills that *love* overcome *wrath*; we have to challenge *humans* to justice. Nothing is said about Satan, a central person in the book of Job. In Hitchcock's (Jung's) view all misery is caused by God. The synopsis of the book of Job to which Hitchcock refers on p. 74 is missing. Clearly Jung's book is more important than the book of Job for the conclusion that opposites, including moral ones, originate in God. The chapter concludes that "behavior according to one's own deepest (contradictory) nature is moral behaviors, so long as it comes from a place as deep as we can reach, and embodies our essential convictions" (p. 93).

I think that it is worthwhile to study this book to get a feeling for the background of the New Age movement. Read the book to discover the dangers which our present generation experiences and be prepared for questions your pupils may have.

Reviewed by Jan de Koning, Instructor of Mathematics, Box 168, St. Michael's College (University of Toronto), 81 St. Mary Street, Toronto, Ont., M5S 1J4, Canada.

THE NEW MEDICINE: Life and Death After Hippocrates by Nigel M. de S. Cameron. Wheaton, IL: Crossway Books, 1991. 182 pages, bibliography, index. Paperback.

Doctor Cameron is a British theologian whose interest is medical ethics. He has lectured internationally for several years in this area, including to the (American) Christian Medical and Dental Society. The premise of his book is that western medicine is moving away from its reverence for life and towards a position where relief of suffering is paramount. When this becomes the norm, abortion, infanticide and euthanasia are easy to justify. He describes this movement as abandoning the Hippocratic foundation for the practice of medicine, which is embodied in the Hippocratic Oath, sworn by most graduating medical classes in our country today.

The first two chapters deal with the Oath itself. Cameron describes it as having been revolutionary in its time, a time when physician was both healer and killer. He was the person in society who helped with suicide, euthanasia, and abortion, as well as the one who healed. Hippocrates called physicians to a three fold covenant: to his patients, his teachers, and his gods, and he specifically prohibited help with suicide and abortion. He described a two-fold obligation — philanthropy and sanctity of life and a single role for the physician-healer. When Christianity came along, it was easy to substitute the commitment to the one true God for the pagan gods of the Oath, thus making it acceptable for the Christian world. Cameron goes on to describe the eventual triumph of Hippocratism, aided by Christianity. In Chapter 3, he covers the terrible abuses during Nazism, when German psychiatrists killed 94,000 people who were mentally and physically ill and considered unrehabilitatable. He describes the Nuremberg Code and the Geneva Declaration, offered as attempted correctives after World War II, but rejects them as "pallid," secular efforts that water down the Hippocratic Oath. They lose the transcendental character of the Oath — no longer are physicians answerable to God, or gods. Therefore there are no absolutes, and in fact in 1960, the phrase in the Geneva Declaration — "utmost respect for human life from the time of conception" was amended to read — "utmost respect ... from its beginning."

The fourth chapter — "The Margins of the Human Race" — describes efforts to kill not only the unborn or the elderly who have incurable diseases, but handicapped infants and others who are powerless. Chapter 5 covers the subtle dichotomy between healing and relief of suffering, noting how an excess of the latter will interfere with a physician's commitment to heal. The final chapter discusses the future of medicine — where are we headed? and what should we do about it? His appendix: "Towards a Theology of Medicine" should not be skipped. Among other considerations, he says that healing should be looked upon as an image of the final conquering of death and that therefore it should be considered the physician's sacred responsibility.

I would consider this must reading for anyone interested in medical ethics. It covers numerous current headline topics, such as physician-assisted suicide, the use of fetal tissues in Parkinson's Disease research, and test-tube conception, as well as the more obvious issues of abortion and infanticide of newborns with disabilities. Rather than deal directly with those issues, this book lays the groundwork for us to consider them. I have problems with some of Cameron's points, however. Why his emphasis on the Hippocratic Oath with its swearing by all the pagan gods? In my medical school, the Oath was rarely mentioned. When I realized we were to stand and swear it at graduation, I read it, could not get past that first sentence about the gods, stood with my classmates but did not raise my hand to swear the Oath. Why not compose a whole new oath and commit ourselves to the sanctity of life because God gives it? The second area that bothers me is his concern over relief of suffering. In practice, it's hard to differentiate it from healing, and it is certainly the major concern of physician-patient interaction today. I'm sure we can deal with the philanthropic desire to relieve suffering without

crossing the sanctity of life line. Nevertheless, this is an excellent, clearly-written book which I heartily recommend.

Reviewed by Edward M. Blight Jr., Professor of Surgery (Urology), Loma Linda University, Loma Linda, CA ~2354

DEADLY DOCTRINE: Health, Illness, and Christian God-Talk by Wendell W. Watters. Buffalo, NY: Prometheus Books, 1992. 198 pages. Cloth; $24.95.

Watters is Professor Emeritus in psychiatry at McMaster University in Canada. For 25 years he was involved in clinical practice, which brought him into contact with individuals, couples, and families. Based upon his experiences, training, and insights, Watters has come to the conclusion that "Christian indoctrination is a form of mental and emotional abuse that can adversely affect bodily health in the same way a drug can" (p. 10), and that Christian doctrine is "incompatible with healthy human development" (p. 11). Watters was reared in the Anglican faith, and states that this book was difficult for him to write because he did not desire to alienate some of his Christian friends.

Nevertheless, Watters finds it difficult to understand how anyone who is familiar with the history of Christianity can remain a practicing Christian. That history, as Watters sees it, is full of horrible atrocities including the debauchery of the popes, the madness of the Crusades, the terror of the Inquisition, the censorship of scientists who challenged the Bible, and the burning at the stake of thousands during the witch-hunting mania. Watters rejects the Christian explanation of these events: that they were caused by Satan rather than God. If Watters thinks that religions, especially Christianity, are the enemy of human morality, what does he propose as an alternative? Not surprisingly, "...religion is not the only existential gem in town. The other one is humanism" (p. 182). However, writes Watters, to get people to switch from religion to humanism, education — not legislation — should be used. Humanity's best hope of survival, continues Watters, is for *Homo religiosus* (religious man) to evolve into *Homo sapiens* (wise man).

What can be said about Watters' complaint against Christianity? Not much that has not been said before. Watters' error, from a scientific viewpoint, is to confuse correlation with causation. Another way of saying this is that the rooster who thinks he causes the sunrise by crowing early in morning engages in a non sequitur. Indeed, the name of Christianity has been associated and continues to be associated with malevolent acts. The question which must be considered is: are these acts based on the teachings of Christianity or are they the acts of sinful humans who cast a bad reflection on Christianity by their behavior? The many illustrations in the New Testament of saints who act unsaintly supports the latter conclusion.

Furthermore, to argue that the doctrines of Christianity are deleterious to mental health is a rather strange position when a large body of research shows that irreligious people, when compared to religious people, show significantly more symptoms of mental disturbance and report significantly less satisfaction with life. Higher rates of psychological disturbance are found among people who shift from organized religion to no religion. Subjects report their lives as significantly more worthwhile to the degree that they view religious faith as extremely important. Watters quotes with approbation the infidel Robert G. Ingersoll's comment that if people were "a little more enlightened, religion would perish." How then do we explain the allegiance to Christianity of some of the enlightened and enlightening individuals in history, including the Apostle Paul, Martin Luther, Samuel Johnson and C.S. Lewis? It appears to me that Watters wants the world of religion to be more tidy than it is. Since religion stands for good, only good should flow from its stand. But in the real world, there is always a mixture of the good and the bad whether in government, industry, education, individual behavior, or religion. Because of this mixture, one will never be able to point to religion as an unmitigated source of the good. Abuses will always be committed in the name of Christ by those who bear the name of Christ. As for mental health, people possess it to the extent that they have a grip on reality. Jesus' followers have an inside track to grasping this reality because it is contained in the truth that sets people free.

Reviewed by Richard Ruble, John Brown University, Siloam Springs, AR 72761.

IN SEARCH OF A NATIONAL MORALITY: A Manifesto For Evangelicals And Catholics by William Bentley Ball. Grand Rapids & San Francisco: Baker Book House & Ignatius Press, 1992. 298 pages, general & scripture indexes, paperback; $13.99.

Forty years ago Roman Catholics and evangelicals had little in common. We evangelicals were very suspicious of our Catholic neighbors, believing that they worshipped the Virgin Mary and that the Pope leads an organization that was at cross-purposes with the Gospel. There were, to be sure, similar mistaken perceptions on the Catholic side as well.

The intervening years have seen the secularistic agenda coming to the fore (i.e., anti-family values, abortion on demand, gay rights and the like). This has caused both groups to take a fresh appraisal of our common spiritual roots. The purpose of this soul searching is to examine the possibility of cooperation between orthodox Roman Catholic and orthodox evangelicals in combating the increasing secularization of contemporary culture. This volume is a result of such examination.

William Bentley Ball is a logical choice for editor. A distinguished constitutional lawyer, he has argued religious rights cases in 22 states and nine times before the Supreme Court of the United States. He has written in

Christianity Today and the Catholic lay magazine *CRISIS* about how his experiences with legal issues have given him, a practicing Roman Catholic, a fresh understanding of the spiritual underpinnings of his evangelical clients.

Ball has gathered an impressive group of leaders and scholars drawn from both faith jurisdictions. The topics, nine in all, are each addressed by a Roman Catholic and an evangelical.

Chapter 1, on secularization, features the "god-father" of the contemporary evangelical movement — theologian Carl F. H. Henry. The Catholic respondent is James Hitchcock, history professor at St. Louis University and a seasoned participant in Catholic/evangelical dialogues. Both indicate the extent that secularism has permeated our culture. Hitchcock in particular examines the role that pluralism has had in both modern Catholicism and Protestantism. (James Turner has a similar theme in his *Without God, Without Creed* (Baltimore: John Hopkins University Press, 1985).

Morality is addressed in Chapter 2. The Catholic respondent is Paul Vitz, professor of psychology at New York University. Among his books is *Sigmund Freud's Christian Unconscious* in which he raises the interesting possibility that Freud was clandestinely baptized by his Catholic nanny. Harold O. J. Brown, professor of ethics at Trinity Evangelical Divinity School, presents the evangelical perspective. Vitz speaks to the influence that values clarification has had in public education. Brown, having studied and ministered in Europe as well as this country, takes an international look at morality today.

Chapter 3 concerns Christian witness-bearing in society. Richard Land, director of a social concerns agency in the Southern Baptist Church, and Henry Hyde, Congressman from the Sixth District of Illinois, collaborate in this chapter. Land speaks to the point that Christians, citizens of both earthly and heavenly Kingdoms, have rights and duties in both areas. He clearly states the biblical basis for this thesis and also discusses the separation of church and state issue—what it does and does not mean. Hyde, who has been an articulate supporter of prolife causes in Congress, details how relativism has impacted politics and public life.

William May and Norman L. Geisler write the fourth Chapter, on human life. May has taught moral theology at the Catholic University of America and Geisler has been an educator, writer and lecturer internationally for forty years. Both approach their subject from the purview of natural law and the fine hand of the "Doctor Angelicus" Thomas Aquinas can be seen in their presentations.

Randall Hekman, a lawyer associated with Focus on the Family, and Carl Anderson, vice president for policy of the Knights of Columbus, write the chapter on the family. They both address the effect that easy divorce, pornography and substance abuse has had on the American family.

In Chapter 6, on education, Robert Destro, law professor at Catholic University of America, and James Skillon, director of Public Justice, discuss the thorny issue of public vs. private education/parental choice. On Higher Education, Chapter 7, we have George Fuller, Westminster Seminary, and the urbane Catholic man of letters, Russell Kirk.

This volume's editor, William Bentley Ball, and Robert P. Dugan, Jr., former director of the National Association of Evangelicals, collaborate on Chapter 8 — Government. Finally, Chapter 9, on rights, is authored by John Lapp, Secretary of the Mennonite Central Committee and John Hittinger, professor of Philosophy at the College of St. Francis.

This book has extensive endnotes and represents the thinking of some of the leading scholars in the Roman Catholic and evangelical traditions. From the degree of assent evidenced by the writings of these leaders, it seems that Catholics and evangelicals are not such "strange bedfellows" after all.

Norman L. Geisler (Chapter 4) and I are presently at work on a volume, *Evangelicals & Roman Catholics: Agreements & Differences.* This volume edited by Ball will be used by us to great effect. Highly recommended.

Reviewed by Ralph E. MacKenzie, Biblical Cornucopia Ministries, 5051 Park Rim Drive, San Diego, CA 92117

IMAGES OF AFTERLIFE: Beliefs from Antiquity to Modern Times by Geddes MacGregor. New York, NY: Paragon House, 1992. 231 pages, index. Hardcover; $21.95.

The author is Emeritus Distinguished Professor of Philosophy at the University of Southern California. He has written thirty books, including *Dictionary of Religion and Philosophy, Immortality and Human Destiny* (editor), *Reincarnation as a Christian Hope,* and *Reincarnation in Christianity.*

Some books with the word "afterlife" in their titles are commentaries of the Book of Revelation. This book is not one of them. Nor does the author of this book claim to know what afterlife will be like, since that is not knowable. But we *can* imagine what it is like, which leads to the main title of this book.

In this book, the author summarizes the many religious, philosophical, and literary writings on the subject of life beyond death in different periods of human history and in various regions of the world. The book starts with a chapter on scientific objections to belief in afterlife, which should interest members of the American Scientific Affiliation. It then takes us to a smorgasbord of beliefs and disbeliefs of afterlife from antiquity to modern times in the Western and Eastern religions, philosophies, literature, and customs. The last few chapters are devoted to the Christian doctrine of resurrection and everlasting life. In

the final chapter, the author presents a general review of the images of afterlife and his personal view on the subject.

This book is truly a scholarly work on the topic of afterlife or immortality. It is well organized and has a fairly extensive bibliography and seventeen interesting illustrations. The text is not too hard to comprehend, though there are difficult spots. Beware of those sentences that contain more than sixty-five words in each. Some of the sentence structures could be improved. For example, on page 71, there is this awkward phrase, "In the course of the discussion of some of the views of afterlife characteristic of the outlook of people..." We could have certainly shortened it and eliminated some of the "of"s to make it easier to read.

Reviewed by James Wing, 15212 Red Clover Drive, Rockville, MD 20853.

A CENTURY OF BIBLICAL ARCHAEOLOGY by P. R. S. Moorey. Louisville, KY: Westminster/John Knox Press, 1991. xvii + 189 pages, indexes. Paperback; $14.99

The legitimacy of Biblical archaeology as a field of study has been under severe attack, and at times one wonders which side Moorey is on. At the end he does provide at least some hints of a future for the discipline, along with viewpoints of some contemporary archaeologists that could be used for a defense of sorts. After he has lamented the influence of the Judeo-Christian faith on archaeology throughout most of the book, however, one is left wishing that he had devoted a few paragraphs to discussing the value a Biblical background might have for the archaeology of Palestine — if, indeed, he sees any value. While Moorey nowhere explicitly treats his idea of the direction that Biblical archaeology should take, he does provide succinct and thoughtful evaluations of individual contributions and the contributions and disadvantages of various excavation and interpretation techniques. Furthermore, Moorey admits his bias because he is an archaeologist rather than a theologian, observing only that maybe that's not so bad since "Biblical" is only an adjective qualifying archaeology.

Moorey presents the strengths and weaknesses of individuals, schools, and methodologies within an evaluative history of the development of Biblical archaeology since 1800 as an interdisciplinary field relating primarily to the Old Testament. Very little is included for the New Testament, because only recently has archaeology been applied in any substantive way to the New Testament, according to Moorey.

The strictly period by period chronological format is good for the history of archaeology, but it is bad for understanding the sites involved. When the interpretations of a site during one period are radically reinterpreted in the next period, one may have to wait for the next chapter to find out about it. However, the indexes of personal names and place names will greatly facilitate obtaining an overview of one specific site or person.

The most irritating aspect of the book is the very regretful tones in which the Biblical orientation of virtually all but the most recent archaeologists is cited. The recent ones are considered superior for not having any theological orientation. Breasted, among the pioneers, is praised as a "remarkable exception ... in advance of his time" (p.51) because of his lack of Biblical orientation. To be fair to Moorey, the sins of the "proving the Bible" enthusiasts are many and flagrant, all too often in the same category as the Paluxy "human" footprints among the dinosaur tracks fiasco. In spite of the problems with the "Biblical bias," however, one must wonder if he has ever considered the problems occasioned by the present secular bias that we see seeping in everywhere. He gives us an indication of such an awareness. Late in the book, Moorey does provide us with the views of recent scholars supporting a difference in purpose between the Bible and archaeology and a difference in types of evidence that each presents. Nevertheless, it is surely not unfair to suggest that this evaluative history is a bit incomplete without at least a brief concluding chapter discussing the relationship between the Bible and archaeology and how the two might be melded into a legitimate discipline called Biblical archaeology.

Moorey has been in the thick of archaeological activity in the Holy Land and is well positioned to write a survey such as this. He is President of the British School of Archaeology in Jerusalem and Keeper of Antiquities at the Ashmolean Museum in Oxford, and author of several books on the subject, including a collaboration with Kathleen Kenyon on *The Bible and Recent Archaeology*.

A Century of Biblical Archaeology is well designed, with a rudimentary chronological table from 4,000 B.C. to the Roman Empire, three site maps, an index of personal names and an index of places. The "brief glossary" is, indeed, brief; but it will be valuable to those new to archaeology. The endnotes and the select bibliography will give novices a start into the literature.

It is difficult to present a chronological history of archaeology that is not as dry as the dust of Palestine and as boring as reading the telephone book. However, Moorey succeeded admirably. The prose is accessible to educated people and the explanations, comments and evaluations make it interesting and understandable.

All in all, this is an excellent book to peruse before beginning a detailed study of archaeology related to any part of the Bible. I would also recommend it to any student of the Bible who lacks a basic understanding of archaeology and its problems. It could have prevented some of the pain I have felt while listening to many a sermon. While Moorey's unquestioning acceptance of some of the prevailing interpretations, such as those of the Jericho digs, will cause problems for conservatives, all can profit from his book.

Eugene O. Bowser, Reference Librarian, The James A. Michener Library, The University of Northern Colorado, Greeley, CO 80631.

WHAT IS THE BIBLE? by Carl Lofmark. Buffalo, NY: Prometheus Books, 1992. 118 pages. Hardback; $18.95.

The late Carl Lofmark, author of this book, also wrote *Does God Exist?* He was professor of German at the University of Wales and wrote many books and articles in the field of medieval literature. The Bible is the best selling book of all time. However, despite its popularity, most people have a superficial knowledge of its contents. In this book, the author presents in laymen's terms the basic structure, history and imbedded theological controversies of the Bible. Lofmark presents the basics of biblical scholarship and criticism, how the canon came to be, and a history of scriptural translations. In addition, Lofmark delivers a critique of the Bible in relationship to its self-contradictions, its mixture of fact and fiction, its questionable morality, and its inadequacy as a guide for living.

This is a short, simple book, and its 118 pages are divided into ten chapters plus an introduction, notes and brief bibliography. The tone of the book is set in the introduction where Lofmark writes that the Bible is "full of things which are very hard to believe." But Lofmark concedes that in the long run each person must decide, after carefully examining the Bible, whether to accept its teachings. His purpose in the book is to assist the reader in developing an informed opinion about the Bible's value — one based on rationalism rather than tradition.

Lofmark's rationalism leads him to many positions which are at odds with conservative biblical understanding: the first Bible book was written about 600 B.C. (p. 11); no New Testament book was recognized as holy before A.D. 200 (p. 15); the Pentateuch was not written by Moses and contains contradictions (p. 18); the Old Testament contains fantasy (p. 19); David probably wrote none of the Psalms (p. 20); Ecclesiastes does not agree with Jewish or Christian teaching (p. 22); the prophets prophecy after the event has occurred (p. 23); and Paul did not write many of the New Testament epistles ascribed to him (p. 32).

As is obvious, Lofmark has a low view of scripture. He writes: "the whole text of the Old Testament is so full of such absurdities that one feels it is bad sportsmanship to point them out .... But when we turn to the New Testament the absurdities and contradictions do not cease" (p. 45).

Are these assertions by Lofmark supported by the evidence? Consider his claim that the New Testament never uses the term "scripture" to refer to the writings of the New Testament. Many conservative scholars think Peter is referring to Paul's writings as "scripture" (2 Peter 3:16) and Paul may be calling Luke 10:7 "scripture" (1 Timothy 5:18). Although I am not an expert in the field of Bible difficulties, it appears to me that most of the objections Lofmark raises were raised previously by Thomas Paine in his *Age of Reason*. There is a genre of biblical scholarship which deals with difficult or seemingly contradictory passages in the Bible. Lofmark seems to be unaware of it, or if he knows about it, gives it no space in this book. Lofmark thinks it bad sportsmanship to point out errors in the Bible. Actually, it becomes tiresome and frequently casts a bad reflection on the critic. The alleged errors in the Bible are actually not numerous compared to its length, and they have all been dealt with quite extensively by apologists.

The real point at issue here is one's view of inspiration. If a person goes to the Bible looking for errors, some problem passages will surface. On the other hand, if one goes to the Bible with an open mind and examines all of the evidence, the problem passages will fade into insignificance in the light of the overall good news which the Bible contains. This book would be a good one to read by neophyte Christians who want to test their faith. It might be a good one for a seminary class to examine in relationship to the doctrine of inspiration. And it might be a good one to look at if you want your faith to be challenged by a rationalist who writes lucidly if not always convincingly. (By the way, how is it that misspelled words continue to appear in books when computer spelling checks could easily eliminate them, i.e., "treatnent" on p. 62.)

Reviewed by Richard Ruble, John Brown University, Siloam Springs, AR 72761.

UNCOMMON DECENCY: Christian Civility in an Uncivil World by Richard J. Mouw. Downer's Grove, Illinois, InterVarsity Press, 1992. 173 pages, paperback.

I believe it was Harry Emerson Fosdick who told of a little boy who prayed, "Dear Lord, please make the bad people good and the good people nice." It is one of the scandals of Christian history that some of those most zealous in their quest for piety have been harsh, arrogant, and overbearing in their approach to those not sharing their view of things. In the secular political arena Christians have scorned the abusive language and uncivil tactics of various interest groups. Homosexual rights advocates, politically correct activists, and environmental crusaders have used tactics and rhetoric that do not contribute to a kinder and gentler America. But Richard J. Mouw charges that many Christians themselves have become part of the problem instead of part of the solution. The basic dilemma for Christians is how to show common decency to our fellow man and still speak the truth with a "passionate intensity." Mouw accepts the challenge to come up with what he calls a "convicted civility."

Richard Mouw, as a serious philosopher and ethicist, is well qualified to deal with the perplexities of this question. Mouw is the president of Fuller Theological Seminary and has also authored *Holy Worldliness and Distorted Truth*. At the outset it seems necessary to raise the question whether civility should occupy a prominent place in evangelical thinking. Obviously John the Baptist had not read any books on how to improve our relationships with those in the other camp: he called his opponents a brood of vipers! Mouw believes civility is a serious concern. Al-

though he insists upon maintaining firm convictions, in a chapter on "Defending Christian Civility" he argues that Christians have failed to understand the gentleness in God's nature.

In the Christian's attempt to live at peace with all men, he is confronted by many difficult issues. Mouw wrestles with many of these situations. What should the Christian's attitude toward a pluralistic society be? How can we be civil in dealing with the sexual attitudes and values of modern society that so obviously clash with our own belief system? How shall we approach the issue of legislating on issues like obscenity or homosexuality? What kind of dialog can Christians have with other religions? How can evangelicals preach about hell without appearing to be uncivil? In dealing with these issues, Mouw calls on Christians to shun an unbecoming triumphalism, to maintain a humble spirit, a correct motivation, a willingness to wait upon God's providential plan to work its purposes rather than demanding instantaneous perfection.

This book offers needed counsel for modern evangelicalism. It is time for reformers, crusaders, and pulpiteers to step back and ponder their tactics, rhetoric and most of all their heart attitude. There are sins such as abortion or sexual perversion that seem to cry out for prophetic condemnation — but have we confronted these evils with the kind of compassionate spirit that should characterize those who follow Jesus Christ?

Reviewed by Richard L. Niswonger, Professor of History, John Brown University, Siloam Springs, AR 72761.

BEHIND THE SCENES OF THE NEW TESTAMENT by Paul Barnett. Downers Grove, IL: InterVarsity Press, 1990. 247 pages. Paperback; $11.95.

Barnett covers his topic geographically by tracing the spread of Christianity from Bethlehem to Patmos. In between these two places, he pegs his thoughts on Nazareth, Jerusalem, Antioch and Rome. Although following a geographical progression, Barnett also includes in his account the wider social, political and historical background of the Roman Empire. Barnett wrote this book because he believes that the story line of the New Testament is hard to follow, that the New Testament lacks a political and social context, and that the accuracy of the historical aspects of the New Testament need emphasis. Barnett writes intelligently, clearly, and winningly.

Barnett's book qualifies as a book on apologetics when discussing such topics as Jesus' genealogy, virgin birth, and resurrection. This is reminiscent of the question Barnett dealt with in his previous book, *Is the New Testament History?* Barnett believes that the New Testament contains very reliable history. He delivers this message to secular as well as religious audiences in his lectures at a secular Australian university. Presently, Barnett serves as a bishop in Australia. This book was previously published in Australia by Hodder and Stoughton. It is recommended for those who could benefit from a succinct overview of the background and growth of Christianity.

Reviewed by Richard Ruble, John Brown University, Siloam Spring, AR 72761.

OUR IDEA OF GOD: *An Introduction to Philosophical Theology* by Thomas V. Morris. Notre Dame, Indiana: University of Notre Dame Press, 1991. 216 pages, notes, references. Hardcover; $18.95.

Morris is associate professor of philosophy at the University of Notre Dame. His previous books include *Anselmian Explorations: Essays in Philosophical Theology* (Notre Dame Press, 1986), and *Philosophy and the Christian Faith* (Notre Dame Press, 1988). This is an elementary introduction to philosophical theology. Morris attempts to provide an example of how some simple, straightforward philosophical methods of thinking can shed light on theological matters which might otherwise remain obscure. This book does not cover the whole field of theology; it only deals with the theology proper—the theology of God.

In Chapter 1 , Morris outlines his approach as a focus on the philosophically rich tradition of Christian theism which is grounded in the biblical revelation. His primary task is to investigate whether a conception of God can be articulated which is both philosophically plausible and biblically faithful. The possibility of theology and our grounds for proceeding are based on the belief that human beings have been created in the image of God and the doctrine that we have been created by a perfectly good and loving God for the purpose of having communion with him.

In Chapter 2, Morris explains the rationality of perfect being theology and creation theology as the methods for conceiving of God. The perfect being theology focuses on the intrinsic properties of God, whereas creation theology emphasizes the actual and potential relations holding between God and all else possible. God's goodness is explained in Chapter 3. Morris understands that God is not only wholly good, but He is also necessarily good. God is so firmly entrenched in goodness, that it is strictly impossible for there to be in him any sort of flaw or defect. Morris refutes the objection that if God's goodness is a necessity, then He does not have morally significant freedom, or moral duties, and hence not praiseworthiness. God's omnipotence is addressed in Chapter 4. It is derived from the conceptual and intuitive resources of perfect being theology. Even though God cannot sin, it does not negate his omnipotence. In Chapter 5, God's omniscience is discussed. Morris concludes that, at the present time, there is no consensus among Christian or theistic philosophers, or among theologians, concerning which is the best response to the argument from foreknowledge to the nonexistence of free will.

In Chapter 6, the question is raised about what sort of being God is. The thesis of spatial simplicity (God is without any spatial parts) and of temporal simplicity (God is without any temporal parts) is accepted by Morris. God's eternity is discussed in Chapter 7. Morris explains the difference between the temporally everlasting of God and the atemporally eternal. The former means that there is in the life of God a past, present and future, as in the life of his creatures. But unlike any of his creatures, God is everlasting, and necessarily so. The latter means God does not in any way exist in time. There is no temporal location or duration in the life of God. Morris concludes that either view can be held and defended by a Christian seeking to articulate a reasonable idea of God.

In Chapter 8, the relation between the creation and the Creator is explained. The philosophical and metaphysical doctrine of creation is different from a scientific theory. The creation is purposive and ex nihilo, and God was free to refrain from creating and free to create something other than what he did choose to create. The creation also depends on God both directly and absolutely. The omnipresence of God can be understood as his perfect knowledge and power extending over all and not as something akin to physical location.

In the final chapter, "God Incarnate and Triune," a unique Christian theology is explored.

According to Morris, in understanding the doctrine of the Incarnation, the challenge is to secure the unity of the person of Christ while at the same time acknowledging the real distinctness of his two natures. In understanding the doctrine of the Trinity, the challenge is to balance the distinctness of the persons with the real unity of the divine nature, a unity sufficient to justify the Christian insistence that monotheism has not been abandoned. In each case we can construct alternative, intelligible models or theories which offer interesting interpretations of initially paradoxical ideas.

This is a useful book which fulfills its purpose as an elementary introduction to philosophical theology. It can be used as supplementary reading in a college course on Christian philosophy. Morris is biblical, objective, and tolerant. He challenges his reader, stimulating deeper thinking about one's Christian faith.

Reviewed by T. Timothy Chen, National Cancer Institute, Bethesda, MD 20892.

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As an organization, the ASA does not take a position when there is honest disagreement between Christians on an issue. We are committed to providing an open forum where controversies can be discussed without fear of unjust condemnation. Legitimate differences of opinion among Christians who have studied both the Bible and science are freely expressed within the Affiliation in a context of Christian love and concern for truth.

Our platform of faith has four important planks, listed on the back of this membership application.

These four statements of faith spell out the distinctive character of the ASA, and we uphold them in every activity and publication of the Affiliation.

WHY MUST THERE BE AN ASA?

Science has brought about enormous changes in our world. Christians have often reacted as though science threatened the very foundations of Christian faith. ASA's unique membership is committed to a proper integration of scientific and Christian views of the world.

ASA members have confidence that such integration is not only possible but necessary to an adequate understanding of God and His creation. Our total allegiance is to our Creator. We acknowledge our debt to Him for the whole natural order and for the development of science as a way of knowing that order in detail. We also acknowledge our debt to Him for the Scriptures, which give us "the wisdom that leads to salvation through faith in Jesus Christ."

Church Affiliation _____

What was your initial contact with the ASA? _____

If you are an active missionary on the field or on furlough or a parachurch staff member, please give the name and address of your mission board or organization.

Name _____

Street _____

City _____ State _____ Zip _____

I am interested in the aims of the American Scientific Affiliation. Upon the basis of the data herewith submitted and my signature affixed to the ASA Statement below, please process my application for membership.

STATEMENT OF FAITH

I hereby subscribe to the Doctrinal Statement as required by the Constitution:

1. We accept the divine inspiration, trustworthiness and authority of the Bible in matters of faith and conduct.
2. We confess the Triune God affirmed in the Nicene and Apostle's creeds which we accept as brief, faithful statements of Christian doctrine based upon Scripture.
3. We believe that in creating and preserving the universe God has endowed it with contingent order and intelligibility, the basis of scientific investigation.
4. We recognize our responsibility, as stewards of God's creation, to use science and technology for the good of humanity and the whole world.

Signature _____ Date _____
(required for Member, Associate Member, Student member status)

Amount enclosed _____ Category _____

Please mail to: American Scientific Affiliation, P.O. Box 668, Ipswich, MA 01938

OTHER RESOURCES AVAILABLE FROM ASA

Teaching Science in a Climate of Controversy is a 64-page book that guides science teachers in presenting origins with accuracy and openess. (Now expanded in its 1993 (4th) printing!) It is available from the Ipswich office for: $7.00/single copy; $6.00/2-9 copies (sent to same address); $5.00/10 or more copies (sent to same address).Shipping included on prepaid orders.

Gift subscriptions to *Perspectives on Science & Christian Faith* are also available. Give the gift of challenging reading for $20/year.

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All rates and conditions subject to change.

We believe that honest and open study of God's dual revelation, in nature and in the Bible, must eventually lead to understanding of its inherent harmony.

The ASA is also committed to the equally important task of providing advice and direction to the Church and society in how best to use the results of science and technology while preserving the integrity of God's creation.

AS A MEMBER YOU RECEIVE:

- ASA's bimonthly Newsletter.
- ASA's science journal, *Perspectives on Science & Christian Faith*, the outstanding forum for discussion of key issues at the interface of science and Christian thought.
- Discount on *Contemporary Issues in Science & Christian Faith: An Annotated Bibllgraphy,* the ASA Resource Book — a catalog of science books and tapes on current issues of concern.
- ASA's Membership Directory.
- Opportunities for personal growth and fellowship, through meetings, conferences, field trips, and commissions.
- *Search: Scientists Who Serve God*, an occasional publication relating current trends in science and the people involved in them.

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THE CANADIAN SCIENTIFIC & CHRISTIAN AFFILIATION was incorporated in 1973 as a direct affiliate of the ASA, with a distinctly Canadian orientation. For more information contact:

Canadian Scientific Affiliation
P.O. Box 386
Fergus, Ontario N1M 3E2 CANADA

The American Scientific Affiliation

Founded in 1941 out of a concern for the relationship between science and Christian faith, the American Scientific Affiliation is an association of men and women who have made a personal commitment of themselves and their lives to Jesus Christ as Lord and Savior, and who have made a personal commitment of themselves and their lives to a scientific description of the world. The purpose of the Affiliation is to explore any and every area relating Christian faith and science. *Perspectives* is one of the means by which the results of such exploration are made known for the benefit and criticism of the Christian community and of the scientific community.

Canadian Scientific & Christian Affiliation

A closely affiliated organization, the Canadian Scientific and Christian Affiliation, was formed in 1973 with a distinctively Canadian orientation. The CSCA and the ASA share publications (*Perspectives on Science & Christian Faith* and the *ASA/CSCA Newsletter*). The CSCA subscribes to the same statement of faith as the ASA, and has the same general structure; however, it has its own governing body with a separate annual meeting in Canada.

LOCAL SECTIONS

of the ASA and the CSCA have been organized to hold meetings and provide an interchange of ideas at the regional level. Membership application forms, publications, and other information may be obtained by writing to: American Scientific Affiliation, P.O. Box 668, Ipswich, MA 01938, USA or Canadian Scientific & Christian Affiliation, P.O. Box 386, Fergus, ONT N1M 3E2, CANADA.

Central California	Chicago-Wheaton	Delaware Valley	Eastern Tennessee	Guelph, ONT
Indiana-Ohio	New England	NY-New Jersey	North Central	Oregon-Washington
Ottawa, ONT	Rocky Mountain	St. Louis	San Diego	San Francisco Bay
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Vol. 39-41	(1987-1989),	Perspectives	42,	65-72	(1990);
Vol. 42-44	(1990-1992),	Perspectives	44,	282-288	(1992).

A keyword-based on-line **subject index** is available on 5 1/4" computer disks for most IBM compatible computers with a hard disk or two floppy disk drives. It includes all software and instructions, and can be ordered from the ASA Ipswich office for $20.

Articles appearing in *Perspectives on Science and Christian Faith* are abstracted and indexed in the CHRISTIAN PERIODICAL INDEX; RELIGION INDEX ONE: PERIODICALS; RELIGIOUS & THEOLOGICAL ABSTRACTS, and GUIDE TO SOCIAL SCIENCE AND RELIGION IN PERIODICAL LITERATURE. Book Reviews are indexed in INDEX TO BOOK REVIEWS IN RELIGION. Present and past issues of *Perspectives* are available in microfilm form at a nominal cost. For information write: University Microfilm Inc., 300 North Zeeb Rd., Ann Arbor, MI 48106.

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