PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

In this issue . . .

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

VOLUME 49, NUMBER 2 JUNE 1997

Perspectives on Science and Christian Faith

MEMBER EVANGELICAL PRESS ASSOCIATION

MANUSCRIPT GUIDELINES

The pages of *Perspectives in Science and Christian Faith (PSFC)* are open to any contribution dealing with the interaction between science and Christian faith in a manner consistent with scientific and theological integrity. Papers published in *PSCF* do not reflect any official position of the American Scientific Affiliation.

1. All manuscripts (except Book Reviews) should be addressed to the Editor, P.O. Box 668, Ipswich, MA 01938.
2. Authors of *Papers* and *Communications* must submit **3 copies** of their paper for review purposes (an original and two copies).
3. Regular Papers should be accompanied by an *Abstract* of not more than 100 words.
4. All manuscripts should be typed double-space on good quality 8 1/2 x 11 paper (computer copies should be printed letter-quality).
5. References and footnotes should be collected at the end. Each note must have a unique number.
6. Figures or diagrams should be clear, black and white, line ink drawings or glossy photographs *suitable for direct reproduction.* Captions should be provided separately.

REGULAR PAPERS are major treatments of a particular subject relating science and the Christian position. Such papers should be at least 10 manuscript pages in length, **but not more than 6000 words**. Publication for such papers should normally take 18 to 24 months from the time of acceptance.

COMMUNICATIONS are brief treatments of a wide range of subjects of interest to *PSCF* readers. Communications **must not be longer than 2700 words.** Accepted Communications should normally be published in 9 to 12 months.

DIALOGUE offers the opportunity for brief and timely debate of relevant issues.

BOOK REVIEWS are an important part of *PSCF*. They serve to alert the readership to books of interest and provide a valuable source for reference. Readers are encouraged to review books in their scientific fields which have implications for the Christian faith. To avoid duplication of reviews, prospective reviewers must notify the Book Review Editor of their intentions. Guidelines for book reviewers are available from the Book Review Editor and should be obtained before submitting a book review. **All reviews may be sent directly to the Book Review Editor or by e-mail to RRUBLE@acc.jbu.edu** The viewpoints expressed in the books reviewed, and in the reviews themselves, are those of the authors and reviewers respectively, and do not reflect an official position of the ASA.

LETTERS to the Editor concerning contents of *PSCF* may be published unless marked not for publication. Any letter submitted for publication is subject to editorial review. Letters selected for publication will be published within 6 months.

ADVERTISING is accepted in *PSCF*, subject to editorial approval. Please address inquiries for rates or further information to the Managing Editor. The ASA cannot take responsibility for any orders placed with advertisers in *PSCF*.

PERSPECTIVES ON SCIENCE AND CHRISTIAN FAITH
(ISSN 0892-2675) is published quarterly for $30 per year by the American Scientific Affiliation, 55 Market Street, Ipswich, MA 01938-0668. Phone (508)356-5656. Fax (508)356-4375.
e-mail: asa@newl.com
http://www.calvin.edu/chemistry/ASA
Periodicals postage paid at Ipswich, MA and at additional mailing offices. POSTMASTER: Send address changes to: *Perspectives on Science and Christian Faith*, The American Scientific Affiliation, P.O. Box 668, Ipswich, MA 01938-0668.

God Did It, But How?

I first became acquainted with the work of Indiana University chemist Robert Fischer in the 1960s when *Quantitative Analysis* became my choice as a text because I thought its lucid writing style would appeal to neophyte scientists—it did! Ten years later, science for the masses became an educational mandate. Once again Fischer came to the rescue with his *Science, Man and Society* which interpreted the scientific enterprise to a reluctant "other culture."

Fischer's move to Biola University saw him produce the popular first edition of *God Did It, But How?* His gift for clear writing distinguished this work as one which appealed to a broad audience in the Christian community—and beyond. Recently, Fischer was asked to do a thorough revision of the original as the benchmark offering of the ASA Press. The result is again an illuminating work dealing with issues in areas where scientific and theological interpretations interact.

God Did It, But How? 2d ed. is the first of a series of inexpensive works from the ASA Press aimed at students, the person in the pew, and church leadership. The success of this project depends on our readers willingness to use this text in educational and church settings and by making it available to church and school libraries and to students headed to college. You are our most effective marketers! Further information is found on page 110.

Jack Haas
haas@gordonc.edu

In This Issue

The University of Texas conference, "Naturalism, Theism and the Scientific Enterprise" (NTSE), offered rich fare for an appreciative audience. Advocates of the Theistic Science-Intelligent Design movement had full opportunity to develop their position before a scholarly audience made up of a few partisans, many others who were interested but uncommitted, and some who were fundamentally opposed to the program. Catholics, Protestants of many stripes, and a few acknowledged unbelievers managed to interact with a high degree of civility in spite of the sharp differences that were often expressed.

This issue begins with a NTSE conference report by biologist Raymond Grizzle. Our first paper offers a review of the origins and key features of a set of relatively recently observed phenomena which are now called chaotic systems. Author Jack Davis tackles some of the theological issues stemming from effects past a "predictability horizon" beyond which exact prediction is not possible. He sees in chaos theory "a new avenue for appreciating the limitations of human ability to predict the future and the complexity and richness of God's creative power." Next, Paul H. Seely argues that concordist models of the first four days of Genesis 1 needlessly lift the biblical passage from its Near Eastern setting to the context of modern science. He offers instead a historical-grammatical approach which includes an "eternally valid theological message" set in a context where "the package in which it came was a temporary concession to the people of the time." With John E. McKenna we return to the topic of natural theology. He contends (as did Jim Neidhardt and Thomas Torrance) that theologian Karl Barth was convinced that there was an authenic relationship between theological and natural science and the real history of the world in spite of Barth's concern that the "natural theology" supported by the German Church had become the "national theology" of the Nazi movement.

In our first *Communication*, Igor Kiss examines the ethics of medicine on the battlefield. James O. Morse's "The Great Experimenter" then provides a response to the question why an all-powerful, all-knowing Creator populated the Earth in the "halting, round-about ways of theistic evolution or progressive creation." William F. Tanner closes the section with a clarification of the relationship of the English words translated as "earth" and "land" from the original ancient Hebrew, Greek, and Latin originals. He is concerned that over-editing has resulted in translations which show what the translator felt the record should have expressed rather than the actual record.

Dennis L. Feucht's review of *American Militias: Rebellion, Racism & Religion* and two contrasting views on Behe's *Darwin's Black Box* head the book review section. Some spirited letters close this issue.

Conference Report

Naturalism, Theism and the Scientific Enterprise
Austin, Texas: February 20-23, 1997

Raymond Grizzle*

Taylor University
Upland, IN 46989

The ongoing debates over naturalism, theism and science, particularly as manifested in the intelligent design (ID) and theistic science (TS) movements, were revisited in Austin, TX in February. Robert Koons, a philosopher at the University of Texas at Austin, organized a well-balanced program that included as plenary speakers biologist Fred Grinnell, attorney Phillip Johnson, and philosophers Alvin Plantinga and Michael Ruse. Contributed papers were delivered by several prominent proponents of ID and TS, including Steve Meyer, Paul Nelson, Bill Dembski, and Jonathan Wells. There were thirty-nine presentations in all, the remainder given by philosophers, scientists, and a few theologians.

The attendance list totaled 116 names, but there were probably 150 present at some of the plenary sessions. I don't know the details of how the meeting was organized but the result, in my view, was a fair airing of the issues. Clearly, there is no way to do justice in a brief report on a meeting like this because of the wide diversity of presentations and exchanges among participants. Moreover, there were usually three sessions running concurrently. This report is, at best, an attempt to convey a sense of some of the trends and major developments. The emphasis is on the ID and TS movements because the movements themselves and the issues they have raised were really what the meeting was about.

I need to state at the outset that for several years I have been a dissenter with respect to both movements, although I am sympathetic to some of their arguments. My major motive for attending was to see how things were progressing for the ID and TS people, particularly in the presence of what I suspected would be a critical—and more importantly, philosophically sophisticated—crowd. I wasn't disappointed. I was a little encouraged by what seemed like a few promising developments.

There were no clearly consensus views on any topic, and none should probably have been expected. The closest thing to consensus I heard dealt with Phillip Johnson's persistent (going on about five years now) broad-brush statements regarding "naturalism." It was repeatedly argued that he is simply wrong in equating the methodological naturalism (MN) of science with a metaphysical naturalism that denies the existence of God. The philosopher Michael Ruse made the most pointed and extensive statements I heard, with Johnson in the audience. He posed this question as being at the core of one of Johnson's foundational arguments: Can one hold to the MN of science and be a Christian theist? Ruse's answer was: "It depends on what you mean by a Christian theist." He then proceeded to briefly, but I think fairly, characterize the kinds of Christians who can and cannot embrace MN. Most of his presentation at this point was a discussion of Philip Hefner, Langdon Gilkey, and others who have written extensively on their Christian faith and respect for the MN of science. His point was that Johnson simply has not engaged a rich literature, and this is wrong. It is simplistic and even insulting to act as if the serious work of these theologians (not to mention the work of many in the ASA) is

**ASA Fellow*

essentially futile and self deceiving. Johnson did not respond.

As I listened to Michael Ruse, a confessed non-Christian (though not an atheist), tell of his personal interactions with the Lutheran theologian Phil Hefner, particularly his respect for Hefner's views on Christ as his Savior, I sat there almost embarrassed to be an evangelical. Why? Mainly because of the warfare kind of mentality that is so popular among us. It just seems so inappropriate for dealing with scientists generally, most of whom have devoted their lives to searching for a truthful understanding of how the world works. When will we begin to dialogue in careful, thoughtful, and considerate terms with our "enemies" instead of rushing to ill-informed conclusions about "truth" and refusing to budge? Critics of science (like Johnson), who paint everything in broad strokes, badly need to appreciate some of the subtleties involved in these issues, which includes the wide diversity of theistic perspectives among scientists.

Ruse also chided his fellow philosopher Alvin Plantinga (who had left the meeting and could not respond) in what seemed to me minor ways, but only after describing him as the foremost religious philosopher in North America. He then turned to the materialists, Richard Dawkins, Dan Dennett, William Provine, and E. O. Wilson. Overall, his complaint was what many others (including Phillip Johnson, and I am sure most of us in the ASA) have long maintained: they simply take their science too far, inappropriately using it to somehow try to "prove" God does not exist. No one escaped Ruse's scrutiny, and I was surprised to find myself largely in agreement with most of his major criticisms.

At one point in Ruse's presentation, when things were getting pretty wild, I was strangely tempted to ask a question just so I could join the ranks of the criticized and embarrassed! All in all, I think his session was alone worth the price of the meeting. You simply had to be there.

I also noted in at least two sessions that there may be some fine-tuning going on among TS proponents that might be in a promising direction. The major discussion was by Alvin Plantinga, perhaps the primary architect philosophically (at least in this generation) of the TS movement. He briefly discussed the potential fruitfulness of assessing TS by levels or academic disciplines. For example, he noted that probably no one would try to argue for something like a "Christian engineering." He suggested that in general the closer you get to the study of humans, or "origins" of various sorts, the more relevant TS becomes. Such a notion certainly doesn't solve all the problems. However, it does represent a fine-tuning of what I have always seen as a far too general (much in the fashion Johnson treats "naturalism," as discussed above) approach to TS in the past.

In a related vein, Steve Meyer emphasized that his presentation on explaining the development of DNA using information theory was aimed at "original origins" or the area usually called "chemical evolution." I suspect many scientists consider such research to be at the boundaries of science. So, I think if any area of science could benefit from ID-type work, this is it. I am still not persuaded, but at least it is in the proper direction for now.

Another indicator of change by ID and TS people, or at least a new revelation for me, started in informal conversation with Bill Dembski, a major contributor to ID in the area of information theory. In response to a question about the possibility of decoupling ID from TS, he indicated that they weren't necessarily associated now. But he recognized that in most people's minds ID implies theism. Moreover, he suggested that TS was probably just a temporary development along the way toward a "new" science of some kind. What kind of new science might this be? Well, I don't know exactly what Dembski has in mind but I did learn a little about what one of his colleagues from Berkeley, the developmental biologist Jonathan Wells, is thinking.

As noted above, Ruse's talk was worth the trip for me, for his insights as well as entertainment. Wells' presentation (which was attended by several of us biologists) was of similar value, but for a different reason. He spoke several times of a paradigm shift being underway, and this shift was going to involve abandonment of "neo-Darwinism." But just how much abandonment was going to occur? Wells admitted that he had no quarrels with the notion of common descent, meaning organic continuity among species over time. But he really couldn't say much about what the new science would be like. Moreover, in general the "problems" for neo-Darwinism Wells spoke about were either adamantly argued by the biologists present as misconceptions on his part, or simply evidence of incomplete knowledge. Neither of which seem very serious for neo-Darwinism. After all, we don't discard a whole theory because of some gaps in our understanding. But even if Wells is right and a shift away from neo-Darwinism is underway (which has been argued by others, mainly from the perspective of "chaos" or "complexity" theory), the shift will not mean abandonment of the notion of common de-

scent. I suspect that many evangelicals who heartily support Johnson and Wells (and others predicting the demise of whatever they think neo-Darwinism entails) don't really understand that neither rejects the notion of common descent, which has always seemed to me to be the core concept of neo-Darwinism that bothers most evangelicals.

The only explicit argument I heard for a fully materialist form of naturalism as the foundation of science was made by Steve Schafersman, a geologist at Miami University. During his presentation and in several subsequent sessions, Schafersman seemed to represent the lone metaphysical naturalist perspective. Though I found myself in disagreement much of the time, I was at the same time impressed by his arguments which were measured and calm. Maybe other materialists were just keeping quiet, but I suspect his was the extreme minority view. Interestingly enough, his is the same basic argument that many claim permeates science. A little data in the form of a comprehensive survey might go a long way toward settling some of the peripheral issues, for example, who believes what among scientists.

A final topic that garnered at least some amount of consensus was the opinion stated by some of the scientists (myself included) who professed an ongoing willingness to fully consider ID—or any other new approaches—if they can be demonstrated to be better. Quite frankly, this has always been one of my major reasons for not supporting ID and TS. As Fred Grinnell (and others) emphasized, science is fundamentally about mechanisms. ID explanations seem to be dead ends scientifically, having no more long-term potential for understanding than saying "God did it." This is not to say that recognizing that "God did it" is wrong, rather that it is not fruitful for further research. Hence, for me, as a scientist I am not attracted to such notions as a part of my science. The ID people may be on to something, but even they admit that no convincing demonstration of a superior new way to do science has been achieved. I certainly do not aim to hinder or in any way denigrate their work, I just remain skeptical.

My skepticism, however, stands in stark contrast to how Phillip Johnson assessed the situation on the closing day of the meeting. He predicted that in 1998 the debate would move on "... to the merits of the issue on the evidence" and further indicated that the legitimacy of ID and TS in science (which have been associated with the ongoing "culture wars") essentially have been settled in the affirmative. I have two responses to such a conclusion.

First, from the perspective of a practicing scientist I see both movements as being little more than embryonic in their development, as indicated by my comments above that there has been no clear demonstration of ID or TS as a superior way to do science. Moreover, based on the number of scientists involved in the discussions compared to the number of scientists in North America, I think this suggests that both movements are really little more than a tiny blip on the screen. This is not meant to play down the importance of the debate, but rather to try to set it in perspective for the scientific community as a whole. In a question to Paul Nelson, I stated that I thought 90 to 95% of practicing scientists would not be affected at all by what was being proposed by the ID and TS people. He replied that he thought my figure was low! So, surely science in general—which everyone admits has been solidly based on MN for many years—has not been revised. Exactly what part of it will soon include ID and TS approaches?

My second response might seem strange because of the first, but I think I am happy to hear such a pronouncement of "victory" of some sort with respect to this part of the debate. I say this because of all the discussion that has been going on, I have been most concerned about the association of our academic debates with the notion of an ongoing "culture war." Warfare approaches do not lead to better understanding, only to strife, discord, and eventual schism. I am convinced that the vast majority of us who are involved in the debates are seriously searching for better understanding. The meeting we just completed is strong evidence for such a conclusion. Sure, there are exceptions, but they are just that—exceptions. As in most controversies, it is easy to identify the extreme "either/or" kinds of positions. The middle ground, however, is complicated. In the case of naturalism, theism and the scientific enterprise, the middle ground is also very broad. Work in this area requires slow going, including careful consideration of the full range of perspectives among the scientists, theologians, philosophers, and others involved. As an evangelical, I continue to be embarrassed by warfare rhetoric and the damage I fear it is doing within our academic communities. I sincerely hope these fears are unfounded.

My sincere thanks to John Burgeson for his assistence in preparing this report. Rob Koons has included many of the presented papers on his website (http://www.dla.utexas.edu/depts/philosophy/faculty/koons/ntse.hmtl).

Theological Reflections on Chaos Theory

John Jefferson Davis*‡

Gordon-Conwell Theological Seminary
130 Essex Street
S. Hamilton, MA 01982

This paper reviews the historical origins of chaos theory and some of its key features, and then reflects theologically on the implications of this theory for a Christian view of the world. It is argued that chaos theory does not represent a threat to Christian faith, but in fact provides new ways of understanding the richness and complexity of God's creative work and providential ordering of the physical universe.

"We collectively wish to apologize for having misled the general educated public by spreading ideas about the determinism of systems satisfying Newton's laws of motion that, after 1960, were proved to be incorrect." Professor James Lighthill, then president of the International Union of Theoretical and Applied Mechanics, made this remarkable public apology exactly three hundred years after Newton's great *Principia Mathematica* was presented to the Royal Society of London. "Modern theories of dynamical systems," Lighthill went on to say, "have clearly demonstrated the unexpected fact that systems governed by the equations of Newtonian dynamics do not necessarily exhibit the 'predictability' property."[1]

In his presidential address, Dr. Lighthill was reflecting on a new field of scientific research that has come to be known as *chaos theory*—a body of theoretical concepts and experimental results that has changed the way scientists think about determinism, predictability, and a broad variety of phenomena in the natural world ranging from the weather to the beating of the human heart to the growth and decline of animal populations.

It is the purpose of this paper to review the historical origins of chaos theory and some of its key features, and then to reflect theologically on its implications for a Christian view of the world. Does chaos theory provide new perspectives on the vexing question of determinism and free will, as some commentators have suggested? If chaos research has undermined the predictable, "clockwork" universe of Newtonian science, what implications does this have for our understanding of the limitations of human knowledge and man's control of nature? Does chaos theory open up new ways to understand the relationship of "chance" events to the providence of God, and the ways in which God creates new forms of life in the natural world? These are some of the questions that call for theological reflection. The general conviction that forms the basis of this paper is that not only does chaos theory *not* represent a threat to Christian faith, but it, in fact, provides new ways of understanding the richness and complexity of God's creative work and providential ordering of the physical universe.

*ASA Member

‡*This paper was one of the winners of the 1996 Templeton Exemplary Papers in Humility Theology.*

Chaos Theory: Historical Origins and Key Features

In 1963 Edward Lorenz, a meteorologist at the Massachusetts Institute of Technology, published an article, "Deterministic Nonperiodic Flow," which was destined to become a classic in the newly emerging field of chaos research.[2] Using mathematical models and computer simulations of flow patterns in the atmosphere, Lorenz concluded that for weather forecasting, "... prediction of the sufficiently distant future is impossible by any method." In view of the inevitable incompleteness of weather observations, "... precise very-long-range weather forecasting would seem to be non-existent."[3] As Lorenz's results became known, most scientists came to agree that earlier optimism about human ability to control the weather or even forecast it in the longer term was scientifically unfounded. Systems like global weather were simply too complex to admit of long-range predictability.

Lorenz's studies of weather forecasting gave rise to a concept in chaos research that is popularly known as the "Butterfly effect." The rather remarkable idea expressed in this term is that a very small change in the initial conditions of some physical system—e.g., the fluttering of a butterfly's wing in Peking, as it cascades unpredictably through a complicated system—can have very large effects later in time, e.g., producing a thunderstorm in New York. The "Butterfly effect" is a striking metaphorical expression of a general characteristic of chaotic systems that is more abstractly characterized as "sensitive dependence on initial conditions." If one were able to balance a pencil on its point, it is obvious that the slightest touch in any direction would produce a much larger effect—the fall of the pencil to the surface. This is a very simple and crude illustration of a feature—*sensitive dependence on initial conditions*—that applies to a great variety of complex systems in the physical world: the flow of gases and liquids through the atmosphere or through pipes, the behavior of certain chemical solutions; electronic circuits, human heartbeats; the spread of diseases through a population, the dripping of water droplets from a faucet, the formation of patterns and fractures in metallic and crystalline surfaces, the formation of snowflakes, the behavior of the stock market, and so on. In each of these cases, and many more like them, very small changes in the system at the beginning can be multiplied so as to produce erratic and unpredictable behavior at some later point in time. Even the swinging of a pendulum—long thought to be the paradigm of Newtonian predictability—is now known to exhibit "chaotic" and irregular motion under certain conditions.[4]

Chaotic behavior is associated with systems that are termed "dissipative" by physicists, that is, systems where friction is a significant factor. Water flowing through a pipe or a hockey puck moving across the ice are examples of such "dissipative" systems. In such cases a *nonlinear equation* is needed to describe the behavior of the system. In contrast to linear equations—represented by a straight line on a graph—nonlinear equations are very difficult to solve, and in many cases have no exact solutions. Such equations are "messy," and as a result mathematicians and physicists have tended to give them less attention until relatively recently. The recent research in chaos theory that began emerging in the 1960s established the remarkable result that systems described by such nonlinear equations, while in principle being deterministic and obeying the laws of classical Newtonian physics, are characterized by long-term unpredictability. One researcher in this field, David Ruelle, has suggested that the essence of chaotic systems is the paradoxical combination of "determinism—yet long-term unpredictability."[5] The surprising thing is, as James Crutchfield has noted, that "simple deterministic systems with only a few elements"—such as a swinging pendulum—"can generate random behavior." This randomness is fundamental, observes Crutchfield; "gathering more information does not make it go away."[6]

In 1975, the biologist Robert May published an important article in the journal *Nature* in which the concepts of chaos theory were applied to the growth of animal populations.[7] May demonstrated that a relatively simple equation of the form X[next] = kX(1-x), used to model the growth and decline of an animal population in a given environment, could display very erratic and unpredictable behavior over time. May's application of chaos theory to biological and ecological systems challenged biologists to look at population growth in a different way. Traditionally, biologists had tended to assume that erratic fluctuations in, say, the number of deer in a certain habitat simply reflected fluctuations in the environment such as drought or disease. May's analysis demonstrated that such fluctuations could be "built in" to the very mathematical laws that described population growth. In his seminal article May also drew attention to the fact that traditional scientific textbooks focused on the simple systems that had predictable behaviors. Consequently, students were poorly equipped to confront the *nonlinear* and "chaotic" systems that were so common

John Jefferson Davis is Professor of Systematic Theology and Christian Ethics at Gordon-Conwell Theological Seminary in Hamilton, Massachusetts. He is the author or editor of eight books, including Foundations of Evangelical Theology *and* Evangelical Ethics. *His course "Frontiers of Science and Faith" was a 1994-95 Templeton Foundation Science & Religion Course competition award winner.*

in the real world outside the laboratory. "Not only in research, but also in the everyday world of politics and economics," May observed, "we would all be better off if more people realized that simple nonlinear systems do not necessarily possess simple dynamical properties."[8] May was, in effect, calling for a "paradigm shift" in biology that would recognize and take seriously a body of unpredictable behavior that had been there all along. The fact that May was trained in theoretical physics and applied mathematics before becoming involved in biology "through the back door"[9] was symptomatic of the frequently cross-disciplinary interests of many workers in this new field—quite in contrast to the dominant trend toward narrow specialization that had come to dominate science since the nineteenth century.

During the 1960s and 1970s new developments in chemistry, thermodynamics ... and pure mathematics contributed significantly to the newly emerging field of chaos research.

During the 1960s and 1970s new developments in chemistry, thermodynamics [the study of heat] and pure mathematics contributed significantly to the newly emerging field of chaos research. In 1977 the Belgian scientist Ilya Prigogine was awarded the Nobel prize for his work in *non-equilibrium thermodynamics*. Classical thermodynamics, developed in the nineteenth century, studied the flow of heat in systems that were tending toward thermal equilibrium: if the door between one room with air at 80 degrees and an adjoining room with air at 60 degrees is opened, over time the air temperature will tend toward an equilibrium temperature of 70 degrees. Prigogine discovered that chemical solutions and heated fluids could also display both oscillations and erratic, unpredictable behaviors, quite unlike the phenomena studied in traditional chemistry and thermodynamics. Prigogine also argued that in many cases these nonlinear, chaotic systems could give rise to order and new complexity at higher levels in the system, and so also might provide a way of understanding the emergence of life itself from its chemical and physical substrates.[10]

New developments in pure mathematics also spurred the development of chaos research. In the 1970s Bernard Mandelbrot, a somewhat eccentric mathematician working in IBM's pure research division in New York, pioneered a whole new field of mathematics which came to be known as *fractal geometry*.[11] Mandelbrot coined the term "fractal" to describe the irregular, jagged patterns that could describe an astonishing variety of forms in nature: snowflakes, clouds, a flash of lightning, the coastline of Britain, fractures in metal, or the crust of the earth. Traditional Euclidean geometry had predisposed the human eye to see nature in terms of straight lines and smooth curves; Mandelbrot had provided a new geometrical "lens" that could help man to see nature in all its rough complexity. Mandelbrot had provided scientists and engineers with a powerful new mathematical tool to study the rough and jagged surfaces of metals, the tiny holes and channels in oil-bearing rocks, the intricate network of capillaries in the human body, to only mention a few of the many applications the new geometry in the physical and life sciences.

Some have raised the question of why "chaos" was not discovered sooner, given the fact that many of the phenomena—e.g., the possibly erratic motions of a simple pendulum—were, in principle, known long before the new field emerged in the 1970s. Very early in the twentieth century, for example, the great French mathematician Poincare had pointed to the "chaotic" possibilities lurking in the equations of Newtonian science.[12] Part of the answer may lie in the fact that not until the 1960s did scientists have at their disposal as research tools the powerful computers that could perform the laborious "number crunching" involved in solving the nonlinear equations used to model chaotic behaviors. For much of the twentieth century, the energy and attention of physicists were absorbed in exploring the new vistas opened by quantum theory and special relativity. And until Mandelbrot and other mathematicians developed new mathematical tools for conceptualizing and rigorously describing these irregular and erratic phenomena, scientists tended not to "see" realities that had been there all along.

The Reality of Chaos: Theological Reflections

At the time of this writing there has been only limited response from the theological community to the new discoveries in chaos research. This, however, is not surprising, given the rather technical nature of much of this work and the recency of these developments. The first international scientific conference on chaos theory was held in 1977 in Como, Italy, and many of the most significant of the original scientific papers are hidden away in obscure journals not easily accessible to the general public.

As early as the 1950s, however, some Christian theologians were giving attention to the issues of chance and unpredictability in relationship to God's providential government of the world. As we shall see below, these reflections do have relevance to the issues later raised by chaos research. These early reflections were in large measure attempts to come to grips theologically and philosophically with the issues raised by the strange and unpredictable phenomena of quantum physics, which began to penetrate the public consciousness in the 1920s. In his 1958 book *Chance and Providence*, the priest-physicist William Pollard stated that the Christian could answer "Yes" to Einstein's famous question, "Does God throw dice?" According to Pollard, "... only in a world in which the laws of nature govern events in accordance with the casting of dice [i.e., probability] can the biblical view of a world whose history is responsive to God's will prevail."[13] For Pollard biblical and scientific descriptions of the same events were complementary, and "chance" was encompassed within the divine providence.

As early as the 1950s, ... some Christian theologians were giving attention to the issues of chance and unpredictability in relationship to God's providential government of the world.

Similarly, Donald M. MacKay, writing in 1978, defined "chance" as "what defies determination on the basis of precedent." Chance refers to events that may be *unforeseeable*, but they are not therefore *meaningless*. From a Christian perspective, apparently chance events are subsumed under the wider providence of God.[14] Both Pollard and MacKay were dealing with "quantum" uncertainties rather than "chaotic" uncertainties, but their observations do have analogical relevance to the newly discovered unpredictable phenomena that burst upon the scientific world subsequent to their writings.

In his 1979 article, "God and the Contingent Order," the Scottish theologian Thomas F. Torrance reflects on the new awareness of *temporality* and *irreversibility* in science, alluding to Big Bang cosmologies and the non-equilibrium thermodynamics of Ilya Prigogine. Torrance writes at a time when an initial awareness of chaos research is beginning to extend beyond the boundaries of the scientific community, and attempts to incorporate these new perspectives into Christian understandings of God's relationship to the world.[15]

The 1984 book by the statistician D. J. Bartholemew, God of Chance, is one of the most significant recent attempts to relate the reality of chance in the natural world to a Christian understanding of providence.

The 1984 book by the statistician D. J. Bartholemew, *God of Chance*, is one of the most significant recent attempts to relate the reality of chance in the natural world to a Christian understanding of providence. Thinking primarily of quantum uncertainties, but with some awareness of the newer chaos theory, Bartholemew believes that "... since chance is such an integral part of creation, it must be part of God's plan." Chance should be seen as "... grist for the providential mill rather than as an obstacle to providential action." Chance can, in fact, play a very positive role in God's creative work, since the variety and uncertainty which it introduces provide a stimulating and challenging environment for the full scope of human development.[16] Like Pollard and MacKay before him, Bartholemew sees chance and unpredictability as consistent with, rather than antithetical to, the providential purposes of God.

Writing in the 1980s and early 1990s, Philip Hefner and Stuart Chandler discussed the notion of chaos in ancient religious mythologies, but with little or no interaction with recent scientific research in chaos theory.[17] In his 1989 article, the British meteorologist J. T. Houghton suggests that chaos theory represents a significant challenge to reductionistic views of the world, and believes that nature uses chaos constructively to provide biological systems with access to new forms of novelty.[18]

In August of 1993 a cross-disciplinary group of twenty scholars and scientists met at the Center for Theology and the Natural Sciences in Berkeley, California to explore the implications of chaos theory for philosophical and theological understandings of God's action in the world. The conference papers, representing both scientific and theological perspectives, were subsequently published under the title *Chaos and Complexity: Scientific Perspectives on Divine Action*.[19] This volume represents the most substantial philosophical and theological response to date

to chaos theory. Most of the contributors, however, concluded that chaos theory did not provide any easy answers to the question of exactly how God's action in the world was to be understood in relationship to scientific laws.

Chaos Theory: Further Theological Reflections

Some writers have suggested that chaos theory provides a way of resolving the vexing problem of *determinism and free will.* If the behavior of matter is determined by physical laws, and human beings (including their brains) are at least in part material beings, how can the exercise of free will be consistent with these physical laws? James Crutchfield has suggested that inasmuch as underlying chaotic processes selectively magnify small fluctuations, "... chaos provides a mechanism that allows for free will within a world governed by deterministic laws."[20] In a similar vein, Doyne Farmer, a scientist then working at the Los Alamos National Laboratory, observed that chaos theory might provide "an operational way to define free will," a way to reconcile free will and determinism. "The system is deterministic, but you can't say [exactly] what it is going to do next."[21]

However attractive those suggestions might initially appear to be, further reflection reveals them to be seriously problematic. The basic problem is that these suggestions are essentially *reductionistic,* in that they attempt to explain a human and personal reality (freedom) in terms of entities that are impersonal and sub-personal. As such, this approach makes a fundamental category mistake: physical realities can be explained by appealing to physical substances and laws, but personal realities refer to a higher dimension of reality—the personal—that subsists within the natural order, but at the same time transcends it. Such a standpoint is indicated by the biblical conception of man as being both "dust"—and so part of the natural order—and "image of God"—and so transcending the natural order. The biblical doctrine of the *imago Dei* places a fundamental barrier (from a Christian viewpoint) against all attempts to explain the human person completely or exclusively in terms of scientific laws. The suggestions noted above, while well intended, have the irremediable defect of reducing a human and spiritual reality to a phenomena explainable by the behavior of material objects and forces.

There is yet another sense in which the suggestions of Crutchfield and Farmer represent serious category mistakes. In attempting to find a "space" for human freedom in a deterministic world, there is an implicit identification of "freedom" with "randomness" or "unpredictability." The problem with this implicit identification is that it overlooks the crucial fact that genuine human freedom is connected with the *purposes* of human agents acting for the realization of certain ends. I choose a certain career or to marry or not to marry in light of my values and purposes. Genuinely free choices of human agents take place within this purposive or *teleological* context. The point being made here can perhaps be clarified by noting that it makes no sense to say that a spinning roulette will is exercising "free will" simply because its behavior appears to be random and unpredictable. The appearance of randomness or unpredictability may be associated with a free choice, but such randomness is not of the essence of freedom. The purposive dimension of human choices, directed toward the realization of certain ends among a number of alternatives, cannot be reduced to the categories of physics—whether or not the physics in question is Newtonian, quantum-mechanical, or "chaotic."

Physical realities can be explained by appealing to physical substances and laws, but personal realities refer to a higher dimension of reality ... that subsists within the natural order, but at the same time transcends it.

A substantial consensus has emerged among scientists, philosophers, and theologians that the new discoveries in chaos research have shattered forever the Newtonian image of a predictable "clockwork universe" that has dominated the popular imagination for the last three hundred years. It is now known that for these chaotic systems, while in principle governed by laws that are still deterministic in form, small uncertainties are amplified so radically that in practice, as Robert J. Russell has noted, "their behavior rapidly becomes unpredictable."[22] Arthur Peacocke, a trained biochemist and Anglican priest, has emphasized that such unpredictability is "ineradicable" and is not removable by even an "absolutely accurate knowledge of the initial conditions, if this were attainable."[23]

In chaotic systems there is an inescapable "predictability horizon" (e.g., for the weather, about two weeks) beyond which exact prediction is impossible.

"We are able to come to this conclusion without ever having to mention quantum mechanics or Heisenberg's uncertainty principle," notes James Lighthill. "A fundamental uncertainty about the future is there, indeed, even on the supposedly solid basis of the good old laws of motion of Newton."[24]

In chaotic systems there is an inescapable "predictability horizon" ... beyond which exact prediction is impossible.

These startling new scientific perspectives are just beginning to penetrate the general public's consciousness, but informed scientists realize that the Enlightenment dream of a thoroughly predictable and controllable world is now dead and in the process of being buried. This dream was given classic expression in a famous series of lectures given in 1795 at the Ecoles Normales in Paris by the great French mathematician Pierre-Simon Laplace, an apostle of the Newtonian world system. Imagine, said Laplace, that we could look at the world, with all its objects, planets, and individual atoms, from the perspective of an infinite intelligence, having a comprehensive knowledge of all the initial positions and velocities. "We ought then to consider the present state of the universe as the effect of its previous state and as the cause of that which is to follow," wrote Laplace, expressing the determinism of physical law. "For such an [unlimited] intelligence nothing would be uncertain, and the future, like the past, would be open to its eyes."[25] In this Laplacean "clockwork" universe an "infinite intelligence"—or quasi-omniscient scientist—could presumably predict the headlines appearing on tomorrow's *New York Times*!

This Laplacean dream has been shattered forever; scientists now realize that indeed it was never true. Ironically, it is now apparent that even that paradigm of regularity and predictability—the simple pendulum—can exhibit chaotic behavior under certain conditions. And astonishingly, it has been recently recognized as well that the *solar system*, long considered to be the model of regularity, exhibits chaotic behavior as well. The motion of the planet Pluto is chaotic, and the orbits of Venus and the Earth exhibit substantial irregularities. The known instabilities in the orbit of Mercury are such that this planet can probably cross the orbit of Venus within five billion years. According to the French astronomer Jacques Laskar, "Without the Moon, the tilt of the Earth would be highly unstable, which would probably have strongly disturbed the development of organized life on its surface." The rotation of the planet Mars on its axis is chaotic, and can "wobble" between 0 and 60 degrees![26]

In reality the larger universe is not a simple, linear Newtonian mechanical system; in many respects it behaves as a chaotic system. "No finite intelligence, however powerful," physicist Paul Davies has concluded, "could anticipate what new forms or systems may come to exist in the future."[27]

This "death of the dream of unlimited predictability" points to fundamental *limitations on human knowledge* that scientists have encountered during the last century. Einstein's Special Theory of Relativity stated that the speed of light placed an absolute limit on the speed of travel of any physical object or message. Heisenberg's Uncertainty Principle indicated fundamental limitations on human ability to measure quantities in the sub-atomic world. The Second Law of Thermodynamics pointed to inherent limitations on the efficiency of heat devices and the impossibility of ever constructing a "perpetual motion" machine. Now chaos theory has demonstrated the inherent limitations on human ability to predict and control the future. From a Christian perspective, such an encounter with the limits inherent in the nature of the physical realm should remind man of the fundamental distinction between an *infinite Creator* and a *finite and limited creation, including man.* The new discoveries of chaos theory give man further reason to adopt a stance of "epistemic humility" in the face of a complex and unpredictable world.

... informed scientists realize that the Enlightenment dream of a thoroughly predictable and controllable world is now dead and in the process of being buried.

Chaos theory also has important philosophical implications for the *reductionism* implicit in much of the modern scientific agenda. Now that it is increasingly being realized that even simple systems can give rise to complex and unpredictable behavior, more scientists are beginning to acknowledge that the entire range of physical and personal reality cannot be adequately explained in terms of the motions and interactions of atoms, molecules, and elementary particles. These scientists have begun to see the limitations of studying parts in isolation

from the whole. "For them," notes James Gleick, "chaos was the end of the reductionist program in science."[28]

James Crutchfield has concluded that the hope that physics could offer a complete description of physical reality through an increasingly detailed understanding of fundamental particles and forces is unfounded. The fact is that the interaction of components on one scale "... can lead to complex global behavior on a larger scale that in general cannot be deduced from knowledge of the individual components."[29] Paul Davies says flatly that "... reductionism is nothing more than a vague promise founded on the ... discredited concept of determinism."[30]

[Some] scientists have begun to see the limitations of studying parts in isolation from the whole.

This growing recognition of the inadequacy of reductionism as a master paradigm for science implies that the realities of living organisms, including man, cannot be exhaustively understood in terms of the categories of physics and chemistry. Living beings subsist within the material order, of course, and are subject to and, to a considerable extent, analyzable in terms of material categories. But these physical and chemical processes give rise to new levels of organization, complexity, sentience, and value that transcend the purely physical, and which should be accorded "ontic recognition" together with the elementary particles of physics.

It should again be stated that what is *not* being claimed here is that one can draw a straight logical inference from chaos theory to, say, human freedom. To attempt to do so would be to fall back into the same reductionistic approach that is being criticized, i.e., the notion that at the end of the day human freedom is really "nothing but" the product of the motion of material particles. What is being suggested here is rather that the new perspectives arising from chaos research help to make "cultural and epistemic space" for the human sciences, including religion. Any scientific work that highlights the untenable nature of the Enlightenment and Laplacean vision is, at least indirectly, a significant contribution to a more adequate worldview that acknowledges the complex, multi-leveled, and less predictable nature of the world that God has created. If science now acknowledges the impossibility of predicting the future behavior of even a simple *pendulum* in all cases, then how much more should it be seen to be impossible to reduce *human behavior and values* to nothing more than the motion of material particles. To the extent that chaos research provides a check against the "epistemic hubris" of a Laplacean agenda for science, then a new sensibility is made possible and a new cultural space can arise for more fruitful interactions between the natural sciences and religious communities.

Chaos theory also provides new perspectives for understanding God's works of *creation* and *providence*. In particular, these new discoveries make it possible to see some of the issues in the historic creation-evolution controversies in a different light. As a case in point, it is well known that in his 1874 attack on Darwinism, the Princeton theologian Charles Hodge saw the fundamental threat to Christian faith to be the denial of purpose and design in nature. "The denial of final causes is the formative idea of Darwin's theory," Hodge believed, "and therefore no teleologist can be a Darwinian." In Hodge's view, the denial of design in nature was tantamount to a denial of God. Darwin was personally not an atheist, but his theory was "virtually atheistical." God may have called the universe into existence, and created the first germ of life; but afterward "abandoned the universe itself to be controlled by chance and necessity, without any purpose on his part as to the result." It was this denial of divine providence, as Hodge understood Darwin's theory of evolution, which led Hodge to finally conclude, as the answer to the question posed in the title of his book: "What is Darwinism? It is atheism."[31]

***Chaos theory also provides new perspectives for understanding God's works of* creation *and* providence.**

In Hodge's view, Darwinism was completely incompatible with Christian theism because "pure chance" was inconsistent with divine providence. The new perspectives provided by chaos research have opened up other ways of understanding the relationship between "chance" events and lawlike behaviors. As Bartholemew and others have pointed out, it is now recognized that apparently random behaviors can lead to orderly results; order can be a consequence of "chaos." For example, the behavior of any given individual and their age of death are highly uncertain, but the actuarial tables of life in-

surance companies can give very accurate forecasts of mortality for the population at large. Bartholemew has drawn attention to the very significant fact that "... the mere existence of chance processes in nature is not a sufficient ground for inferring the absence of purpose."[32] Just as human agents can use chance mechanisms for their own purposes—in a lottery, in a game of Monopoly, or to distribute a limited number of kidney dialysis machines—so it is certainly possible to conceive of God using apparently random processes to achieve his own creative purposes.

... chance is not an autonomous metaphysical principle opposed to divine purpose, but is part of a larger lawful structure and one of the mechanisms used by God in the process of creation.

Writing from this perspective, Arthur Peacocke has argued that the new discoveries of chaos and complexity have suggested a new paradigm for understanding nature in terms of the *creative interplay of chance and law.* Chance operates within a lawlike framework which limits the possible outcomes. Chance allows for new forms of life and organization to emerge, while deterministic laws provide the stability for these new forms to endure. "It is the combination of the two [law and chance] which makes possible an ordered universe capable of developing within itself new modes of existence."[33] In this perspective, chance is not an autonomous metaphysical principle opposed to divine purpose, but is part of a larger lawful structure and one of the mechanisms used by God in the process of creation. Viewed in this light, the role of chance in evolutionary theory is not necessarily a threat to Christian theism as Hodge supposed.[34]

This way of viewing the relationship of chance events to the providence of God has significant precedent in the history of Christian theology. In *Summa Contra Gentiles,* Thomas Aquinas states that while all events are subject to divine providence, not all "... will be necessary, but a good many are contingent." God is the cause of all things, and just as an animal cares for its young, so God takes care of all that he has made. His divine providence applies to contingent singulars such as the fall of a sparrow (Matt. 10:29) as well as to those things that happen by necessity.[35]

In chapter five, paragraph two of the Westminster Confession of Faith (1647) — perhaps the single, most influential confessional document in English-speaking Christianity—the issue of providence is addressed. The Westminster divines, speaking from a Puritan and Calvinistic theological perspective, stated that "Although in relation to the foreknowledge and decree of God, the first cause, all things come to pass immutably and infallibly, yet by the same providence he ordereth them to fall out, according to the nature of second causes, either necessarily, freely, or contingently." The confession here uses the Thomistic distinction between *primary* and *secondary* causes. God is the primary and ultimate cause of all that happens, whether the fall of a sparrow, the fall of an empire, the rising of the sun, or the crucifixion of the Messiah. God's primary causation is usually mediated, however, through the agency of secondary causes—either through human choices or through the operation of natural laws. These secondary causes can act "necessarily," as in the falling of a stone to the ground; "contingently," as in the casting of a lot; or "freely," as in King David's decision to commit adultery with Bathsheba. Though the seventeenth century worldview of the Westminster divines understood the term "contingently" in terms of what we would now call "classical uncertainty" (i.e., a "coin toss") rather than "quantum" or "chaotic" uncertainty, which were unknown at the time, it is nevertheless the case that their basic standpoint can be extended to encompass the new phenomena of chaos theory. "Secondary causes" can be expanded to include the phenomena described by quantum mechanics and chaos theory as well as those described by Newtonian (or Aristotelian) physics. All events of history and nature are embedded within a lawful, coherent structure ultimately ordered by the providence of God.

The God of the Bible is the sovereign Creator, Sustainer, and Redeemer who uses the humanly unpredictable and controllable forces of the natural world for his own purposes.

It is also important to note that the biblical understanding of the relationship of God to chaotic phenomena is quite different from that found in many cosmologies of the ancient world. In a creation myth from the ancient Near East such as the *Enuma Elish,* the so-called "Babylonian Genesis," Marduk

battles for supremacy among the gods by defeating Tiamat, the personification of the forces of chaos.[36] In Plato's *Timaeus*, the Demiurge gives form to a pre-existing chaotic matter rather than calling all things into being by a sovereign act of *ex nihilo* creation.[37] In biblical thought, the chaotic forces of nature and history are not divine beings or metaphysical principles that have independence over against God. The God of the Bible is the sovereign Creator, Sustainer, and Redeemer who uses the humanly unpredictable and controllable forces of the natural world for his own purposes.

In a textbook on chaos theory written for scientists and engineers, Francis C. Moon notes that the new paradigm which is beginning to supplant the Newtonian "clockwork" image embodies a "... concept of chaotic events resulting from orderly laws, not a formless chaos, but one in which there are underlying patterns, fractal structures, governed by a new mathematical view of our 'orderly' world."[38] Moon's observation that chaotic phenomena are embedded in deeper underlying structures accords remarkably well with a biblical theology of creation and providence. There is a "logos structure" (John 1:1,3; cf. Col. 1:15-20) in God's created order which encompasses the turbulent and unpredictable events studied by the chaos theorists. These phenomena are "chaotic" but do not represent a "lawless" or "unbounded" chaos; they are embedded within deeper structures of order.

... chaos theory can be seen as a new avenue for appreciating both the limitations of human ability to predict the future and the complexity and richness of God's creative power.

In one of the closing chapters of the book of Job, God speaks to Job out of the whirlwind and asks: "Where were you when I laid the earth's foundations?" (Job 38:4). In a long series of questions about the creation, God leads Job to realize that a deeper awareness of the features of the natural order can be a cause for wonder and humility in the face of God's creative work. Recently Ilya Prigogine has written, "Everywhere we look, we find a nature that is rich in diversity and innovations."[39] The new discoveries of chaos theory represent one of the more recent and exciting chapters in the history of mankind's encounters with God's creation. Far from being a threat to a biblical understanding of providence, chaos theory can be seen as a new avenue for appreciating both the limitations of human ability to predict the future and the complexity and richness of God's creative power. ✱

Notes

[1]James Lighthill, "The Recently Recognized Failure of Predictability in Newtonian Dynamics," *Proceedings of the Royal Society of London* A 407 (1986): 35-50 at 38, 35.

[2]Edward N. Lorenz, "Deterministic Nonperiodic Flow," *Journal of the Atmospheric Sciences* 20 (1963): 130-141. Lorenz's work is discussed in James Gleick, *Chaos: Making a New Science* (London: Abacus, 1993; 1987), 11-31. Gleick's work is one of the most readable popular presentations of chaos theory currently available.

[3]Lorenz, op. cit., 141.

[4]Lighthill, op. cit., 42-47.

[5]David Ruelle, *Chance and Chaos* (London: Penguin Books, 1993), 45.

[6]James Crutchfield, et. al., "Chaos," *Scientific American* 255:6 (December 1986): 38-49 at 38. This article is a good introduction to chaos theory for the general reader. Other introductions that use little mathematics include William Ditto and Louis Pecora, "Mastering Chaos," *Scientific American* 269:2 (August 1993): 62-83; Ian Stewart, *Does God Play Dice? The Mathematics of Chaos* (Oxford: Basil Blackwell, 1989), especially chapters 5-11; J. T. Houghton, "New Ideas of Chaos in Physics," *Science & Christian Belief* 1 (1989): 41-51; Paul Davies, *The Cosmic Blueprint* (London: Unwin Hyman, 1989), chapter 4, 35-56, "Chaos." Technical treatments for scientists and engineers include A. J. Lichtenberg and M. A. Lieberman, *Regular and Stochastic Motion* (New York: Springer-Verlag, 1983), especially chapter seven, "Dissipative Systems"; M. V. Berry, et. al., "Dynamical Chaos," *Proceedings of the Royal Society* A 413 (1987): 1-199; Jong Hyun Kim and John Stringer, eds., *Applied Chaos* (New York: John Wiley & Sons, 1992).

[7]Robert M. May, "Simple Mathematical Models with Very Complicated Dynamics," *Nature* 261 (1976): 459-467.

[8]Ibid., 467.

[9]Gleick, op. cit., 69.

[10]Ilya Prigogine, *Order out of Chaos: Man's New Dialogue with Nature* (New York: Bantam, 1984). Prigogine believes that the new discoveries in non-equilibrium thermodynamics, which emphasize the importance of time and irreversible events in nature, can provide a new paradigm that can reunite the physical, biological, and human sciences, often seen as fundamentally bifurcated since the time of Newton.

[11]The seminal work here is Bernard Mandelbrot, *The Fractal Geometry of Nature* (New York: Freeman, 1977).

[12]In 1903 Poincare had written, "... it may happen that small differences in the initial conditions produce great ones in the final phenomena. A small error in the former will produce an enormous error in the latter. Prediction becomes impossible, and we have the fortuitous phenomenon." Cited in Crutchfield, op. cit., 40.

[13]William G. Pollard, *Chance and Providence: God's Action in a World Governed by Scientific Law* (London: Faber and Faber, 1958), 97.

[14]Donald M. MacKay, *Science, Chance, and Providence* (Oxford: Oxford University Press, 1978), 39. Compare the similar viewpoint of Peter Geach, *Providence and Evil* (Cambridge: Cambridge University Press, 1977), 116: "Chance" events may not be determined by humanly knowable causes, but they do not "... escape from the knowledge and control of Divine Providence," citing Prov. 16:33. Geach also observes on p. 120 that "If men are to act freely there must be both some determinism [law, regularity, predictability] and some indeterminism [unpredictability] in the world." An "Alice in Wonderland" world in which pink-flamingo croquet rackets were not dependably rigid would be chaotic; a "clockwork" world of iron-clad determinism would be boring, oppressive, and destructive of genuine human freedom and moral responsibility.

[15]T. F. Torrance, "God and the Contingent World," *Zygon* 14:4 (1979): 329-348.

[16]D. J. Bartholemew, *God of Chance* (London: SCM Press, 1984), 118, 138, 143.

[17]Philip Hefner, "God and Chaos: the Demiurge versus the *Urgrund*," *Zygon* 19:4 (1984): 469-485, contrasting the negative role of chaos in Plato's *Timaeus* and the Babylonian *Enuma Elish* with the creative role of chaos in the philosophy of N. Berdyaev; Stuart Chandler, "When the World Falls Apart: Methodology for Employing Chaos and Emptiness as Theological Constructs," *Harvard Theological Review* 85 (1992):467-491, discussing chaos in religious mythology and "emptiness" in the Buddhist tradition. J. W. Stines, in "Time, Chaos Theory and the Thought of Michael Polanyi," *Perspectives on Science and Christian Faith* 44 (1992): 220-227, attempts to relate chaos theory to the notion of "tacit knowledge" in the philosophy of Michael Polanyi, but apparently does not clearly see chaotic uncertainty as a new *tertium quid* distinct from *quantum* uncertainty and the "classical" uncertainty [e.g., a coin toss] of Newtonian physics.

[18]J. T. Houghton, "New Ideas of Chaos in Physics," *Science and Christian Belief* 1 (1989): 41-51.

[19]Robert John Russell, Nancey Murphy, and Arthur R. Peacocke, eds., *Chaos and Complexity: Scientific Perspectives on Divine Action* (Vatican City: Vatican Observatory Publications, 1995).

[20]Crutchfield, op. cit., 49.

[21]Quoted in Gleick, op. cit., 251.

[22]Russell, op. cit., 14.

[23]Arthur Peacocke, *Theology for a Scientific Age* (London: SCM Press, 1993), 51.

[24]Lighthill, op. cit., 47.

[25]Pierre-Simon Laplace, *Philosophical Essay on Probabilities*. Translated from the 5th French edition of 1825 by Andrew I. Dole (New York: Springer-Verlag, 1995), 2.

[26]The astronomical data cited in this paragraph is from Jacques Laskar, "Large-Scale Chaos in the Solar System and Planetological Consequences," paper summary in *Sciences de la Terre et des Planetes* (Paris) Tome 322, Series IIa, No. 3, item 163.

[27]Davies, *The Cosmic Blueprint* (London: Unwin Hyman, 1989), 56.

[28]Gleick, op. cit., 304.

[29]Crutchfield, op. cit., 48; see also Houghton, op. cit., 50.

[30]Davies, op. cit., 140. Davies does not claim that "reductionistic" techniques in science are never justified, only that reductionism is not adequate as a global scientific paradigm or metaphysical framework.

[31]Charles Hodge, *What Is Darwinism?* (New York: Scribner, Armstrong and Co., 1874), 173-177.

[32]Bartholemew, op. cit., 78, 82.

[33]Peacocke, *Theology for a Scientific Age*, 65. Similarly, Prigogine has argued as one of the main conclusions of his research that "... nonequilibrium is the source of order," op. cit., 287.

[34]Hodge was, of course, correct in seeing an *autonomous* "blind chance," understood as an independent metaphysical principle, to be incompatible with Christian theism. Hodge no doubt would have reached similar conclusions with respect to modern anti-teleological presentations of evolutionary theory such as Jacques Monod, *Chance and Necessity* (London: Collins, 1972); Richard Dawkins, *The Blind Watchmaker* (Harlow, UK: Longman, 1986), and Stephen J. Gould, *Wonderful Life* (New York: Norton, 1989). The point being made here is that placing chance and chaos within the larger law structures created by God gives an entirely different perspective for understanding the issues of the creation-evolution debate. The "random variations" of evolutionary biology are then seen as the providential means ordained of God in the process of creation. For the variety of Christian responses to Darwinian evolution in the nineteenth century, see James R. Moore, *The Post-Darwinian Controversies* (Cambridge: Cambridge University Press, 1979).

[35]Thomas Aquinas, *Summa Contra Gentiles*. Book Three: *Providence*, Part I, chapters 72, 74; tr. Vernon J. Bourke (Notre Dame, IN: University of Notre Dame Press, 1975), 242-244; 250-253.

[36]For translation and commentary on the *Enuma Elish*, see Alexander Heidel, *The Babylonian Genesis: The Story of Creation* (Chicago: University of Chicago Press, 1951), and Stephanie Dalley, *Myths from Mesopotamia: Creation, The Flood, Gilgamesh, and Others* (New York: Oxford University Press, 1989). For illuminating discussion of the Genesis creation narrative in the context of ancient Near Eastern religions, see Claus Westermann, *Genesis 1-11: A Commentary*, tr. John J. Scullion (London: SPCK, 1984), "Creation in the History of Religions and in the Bible," 19-47.

[37]*Timaeus 30a*, in *Plato*, v. IX, tr. R. G. Bury (Cambridge, MA: Harvard University Press, 1929), 55.

[38]Francis C. Moon, *Chaotic and Fractal Dynamics: an Introduction for Applied Scientists and Engineers* (New York: John Wiley & Sons, 1992), 42, 43.

[39]Prigogine, op. cit., 208.

The First Four Days of Genesis in Concordist Theory and in Biblical Context

Paul H. Seely

1544 SE 34th Ave.
Portland, OR 97214

Moderate concordism's interpretation of the days of Genesis is derived from modern science. The correlation of Gen. 1:1 with the "Big Bang" has a certain legitimacy; but, concordism's interpretation of the days themselves takes Genesis 1 out of its historical and biblical context. Concordism achieves a concord between modern science and the Bible only because it has rewritten the Bible to agree with modern science.

From a biblical standpoint there is no need to take the Bible out of context in such a radical way as concordism does. Biblical inspiration, according to the teaching of Jesus, sometimes encompasses concession to human weakness even in the area of morals (Mark 10:5), how much more then in the area of science, the discovery of which God has delegated to man (Genesis 1:28). Scripture and science complement each other.

According to current concordistic theory (Moderate Concordism) each day in Genesis 1 sequentially initiates a geological epoch, with some epochs overlapping.[1] The purpose of the theory is to maintain the belief that Genesis 1 portrays a reliable history of creation in basic agreement or concord with modern science.[2] This theory has been accepted by a number of conservative theologians; but, it is primarily promoted by devout geologists and astrophysicists.

The abiding value of the works of these Christian geologists and astrophysicists is that they preserve intellectual integrity with regard to the data of geology, anthropology, and astrophysics; and this is in accord with the command of God that we worship him will *all* of our mind. Further, they often witness to God's wisdom by showing the intricacies and fine balance of the various parts of the universe, especially in the creation of the earth's size, distance from the sun, atmosphere, etc.

The problem with their work, however, is that it lifts Genesis 1 out of its ancient Near Eastern context, sets it down in the context of modern science, and then reinterprets Genesis 1 so that it agrees with modern science. I do not fault such interpreters personally for reading modern science into Genesis 1 because they were forced by an unbiblical definition of biblical inerrancy to become inventive exegetes. It is my task, however, first to expose the arbitrary nature of their interpretations of Genesis 1 and then point to a more biblical approach.

My procedure will be to take the first four days of Genesis 1 and show how Moderate Concordists interpret each day. Then I will contrast this with the meaning of the words of Gen. 1:1-19 when they are left within their historical and biblical context. To fairly represent the views of contemporary Moderate Concordists, I am following what I believe are the three best and most recent representatives of this theory, namely, Davis Young,[3] Robert Newman/Herman Eckelmann, Jr.,[4] and Hugh Ross[5]. I will also add, the views of Peter Stoner/Edwin Gedney[6] and John Wiester[7] in the footnotes. It should be noted, however, that despite having written one of the best books on concordism, Davis Young no longer holds to it.

Genesis 1:1

Our representatives of Moderate Concordism (I will simply call it concordism from now on) tend to regard Gen. 1:1 as a reference to the Big Bang of 15 to 20 billion years ago.[8] This correlation is appropriate since as E. J. Young explained: "... the first verse serves as a broad, comprehensive statement of the fact of creation."[9] As Gunkel noted, "There is nothing in the cosmogonies of other peoples [including *Enuma elish*] which can compare with the first sentence of the Bible."[10] It is, therefore, appropriate to apply Gen. 1:1 to the Big Bang though it leads us primarily, not to the unorganized world of Gen. 1:2, but through the whole process of Gen. 1:2-2:1 to the organized world of Gen. 2:1, where for the first time since Gen. 1:1 the "heavens and earth" are again mentioned.

Genesis 1:2

Gen. 1:2 describes the state of the earth before God's organizing activities began. The earth at this point was "formless and void," covered with an ocean, and shrouded in darkness. The question for the concordists is: "When did the earth look like this?"

Ross laid out a three-act sequence whereby the earth (and rest of the solar system) came into being: (1) An interstellar cloud or nebula (2) collapsed into a flattened disc and (3) separated into concentric rings which condensed into proto-planets. He then identified Gen. 1:2 with act 3b: "As the earth condensed out of the primordial disc, it appeared just as the Genesis writer says, 'formless and void.'"[11] Ross does not put a date on this, but according to most scientists the time of this condensation would be about five billion years ago.[12]

Newman & Eckelmann also relate Gen. 1:2 to the nebula out of which the earth came. They say:

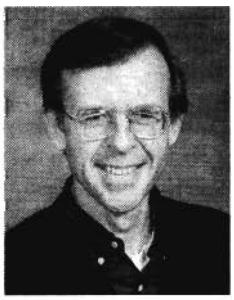
> the earth at this point in the narrative is not yet a solid body, but is shapeless and empty, perhaps even invisible. This [Gen. 1:2] is an excellent, though non-technical description of the gas cloud that would eventually form the earth.[13]

Young spoke of the earth in Gen. 1:2 as a "primitive earth." He also emphasized that the earth in Gen. 1:2 was only a "partially organized body" that was not yet "a completed product."[14] This coheres quite well with the others' judgment that the earth here is slowly, but surely, condensing out of a nebula 6 to 4.5 billion years ago.

The general consensus is that Gen. 1:2 is a good description of the state of the earth c. 6 to 4.5 billion years ago, when it was "formless and void" and dark, as it was condensing out of a dark nebula. Hence, Ross's statement: "the earth appeared just as the Genesis writer says."[15]

What about the ocean covering the earth? Ross ignores it. He presumably could not make any sense out of it since there was no ocean of water covering the earth as it condensed out of the nebula. Newman & Eckelmann acknowledge an ocean of water as stated in Gen. 1:2, but not in a liquid state. They identified the "Deep" with a "gas cloud." The water, they say, could be "a mass of ice crystals or droplets," a large cloud of water vapor, or even some other fluid.[16] Young accepted the *prima facie* meaning of "the deep" and the "face of the waters" in v. 2, and referred to them as "a primeval ocean." He said, the "early earth was desolate and lifeless, and there was a primitive ocean."[17] But Young was describing the earth long after it condensed out of its "formless and void" state.[18] The ocean in Gen. 1:2, on the other hand, is present while the earth is still in its "formless and void" state.

The problem the concordists have here is that science tells us the dry land of the earth formed first, condensing out of a nebula in a molten form that was far too hot for any water to rest upon it. After it cooled, however, an ocean did form on earth. But, in Genesis the ocean exists first, and then afterward the dry land appears. The statements of



Paul H. Seely received a B.D. from Westminster Theological Seminary in Philadelphia. He spent two decades carefully studying each verse of the Bible, and reading most of the extant literature of the ancient Near East, the intertestamental Jews, and the Greeks and Romans (up to 200 A.D.), with a view to seeing the Bible in its historical context. He often writes in the area of science and the Bible.

Gen. 1:2 and science are exactly opposite to each other. Our concordists dealt with this by ignoring "the deep" (Ross, Stoner, Wiester), changing the meaning of "the deep" so that it agrees with science (Stoner's editor, Newman & Eckelmann), or accepting "the deep" but obscuring the scientific chronology (Young).

... science tells us the dry land of the earth formed first ... But, in Genesis the ocean exists first ...

We need to answer the idea of Newman & Eckelmann (and of Stoner's editor) that "the deep" in Gen. 1:2 is a reference to a cloud of some kind. They cite a variety of Old Testament (OT) passages which supposedly indicate that "the deep" (Hebrew, *tehom*) can refer to a cloud or just "depth" without any reference to liquid water. They begin by citing Ezek. 31:4, Gen. 49:25 and Deut. 33:13 which all use "deep" to refer to the underground water that nourishes plants and trees. In their ancient Near Eastern and biblical context, these verses all refer to an underground sea.[19] Even if you remove them from their historical and biblical context and modernize them, they still refer to water, not just deepness, and to water in a liquid state, not to a cloud.

Newman & Eckelmann also cite Ps. 71:20 which speaks of resurrection from the grave as being brought up from the "depths (*tehomoth*, plural of *tehom*) of the earth" and say there seems to be no connection with water here. But, within its ancient Near Eastern and biblical context, the Psalmist is referring to the deepest part of the earth as resting on an ocean (cf. Pss. 24:2; 136:6). Thus it is that Jonah 2:2-6 speaks of being in "the depths of the grave ... in the deep ... down to the roots of the mountains" while he is in the ocean. This ocean below the "roots of the mountains" is the *tehom* which supplies water to the springs (*tehomoth*) on earth. Kidner, although basing his commentary on the Psalms in the RSV, refers his readers to the NEB for Ps. 71:20 and translates "watery depths."[20] So there is some connection between "depths" and water in Ps. 71:20. Further, even if the *plural* of *tehom* in Ps. 71:20 is translated simply "depths," it would in no way justify translating the *singular tehom* as "cloud."

In the end, Newman & Eckelmann seem to know they have not made a solid case and accordingly do not claim to have proven anything about the meaning of "the deep" and Gen. 1:2. They say they are only showing that it could be "a non-technical description of the gas cloud that would eventually form earth."[21]

If "the deep" in Gen. 1:2 is interpreted within its historical and biblical context, does it refer to a vaporous cloud or to a body of liquid water? The word "deep" (*tehom*) is certainly not used anywhere else in the OT to refer to a cloud or water in a vaporous state. Nor does any Hebrew lexicon give any such meaning to *tehom*. Koehler & Baumgartner define *tehom* as (1) the primeval ocean (2) the primeval oceans, and (3) the subterranean water.[22] The Ugaritic cognate *thm* means "sea," never cloud. The Akkadian cognate *ti'amtu* means "sea," never cloud. The Eblaite cognate means "sea," never cloud. It is accordingly highly improbable that "deep" (*tehom*) in Gen. 1:2 means anything other than a deep sea, a literal ocean.

Secondly, Gen. 1:2 speaks of the "face or surface of the *tehom*." This phrase is used two other times in Scripture. Job 38:30 speaks of the surface of the deep being frozen. This reference is obviously to a body of liquid water freezing. It is incredible that it is a reference to the surface of a cloud freezing. The other reference is Prov. 8:27 which speaks of God at creation "marking out a circle on the face of the deep." The "circle" refers to the curvature seen when one looks at the horizon of the ocean. This reference is clearly to the sea and just as clearly not to a cloud. So, when the words "face of the deep" are used elsewhere in the OT, they refer to a liquid body of water, a sea, certainly not a cloud; there is no contextual reason to understand these words in any other way in Gen. 1:2. We might add that the words "face of the waters" which are also used in Gen. 1:2 mean the surface of a liquid body of water elsewhere in the OT, never a cloud (Gen. 7:18; Ex. 32:20; Isa. 18:2; 19:8; Hosea 10:7).

Thirdly, it seems improbable that Moses would refer to a cloud as a *tehom* (which everywhere else always means a literal sea) when biblical Hebrew has more than half a dozen words meaning "cloud." Lev. 16:13 and Ezek. 8:11 even refer to a "cloud of incense"; so the words for "cloud" did not have to be restricted to rain clouds. If Moses had wanted to give a "non-technical description of a gas cloud," he could have used the words, "clouds and thick darkness" (Deut. 4:11 and Joel 2:2). These words would have been a much better description of science's dark nebula than the words "face of the deep" and "face of the waters" which lead one to immediately think of a sea. To say that Moses used the Hebrew word for "sea" in a straightforward account like Genesis 1 to describe a cloud is to embark on

a course where one could never be sure what the Bible meant, and where one could make the Bible mean anything one wants it to mean.

Finally, I do not believe that anyone before the advent of modern astronomy and geology ever interpreted the *tehom*-waters of Gen. 1:2 as anything other than a body of water in a liquid state, that is, a sea. From Augustine to Aquinas, the *tehom* of Gen. 1:2 was understood to be a "sea."[23] No modern, professional Hebrew scholar would admit the meaning "cloud" into Gen. 1:2.[24] It was not until the advent of modern geology-astronomy that the *tehom* of Gen. 1:2 was interpreted as a cloud; so, obviously this interpretation did not arise from the text but was derived from modern science and imposed upon the text. The concordists are rewriting the Bible.

Day One: Genesis 1:3-5

Newman & Eckelmann explain Gen. 1:3-4 as follows:

> ... After further contraction and heating, however, the whole cloud lights up and the observer [positing a hypothetical observer present on earth] immersed in light, can see no darkness anywhere ... the planet earth becomes a solid body at this point [at v. 5] in the Genesis account and not before.[25]

Ross explains Gen. 1:3-5 as the time when the opaque reducing atmosphere changed to translucent.[26] Day and night became recognizable only when light could diffuse through the cloud cover. Science tells us that this occurred after the earth solidified. Young said that Gen. 1:3-5 is about light falling on the earth's surface for the first time. He said the verses do not necessarily mean that there was no light elsewhere.[27]

Except for Wiester, there is a general agreement among our concordists that Gen. 1:3-5 is describing light falling upon a solidified earth. Explicitly or implicitly they agree that the formation of the earth, that is, its solidification had occurred by the time verse 5 ends.

It is this latter point which gives it away that the concordists are again rewriting the Bible. If the earth had solidified by verse 5 as they say, dry land must have already appeared. In the scientific account, the solidification of the earth entails an initial crustal temperature of c. 1100° F. Since any water touching the earth would immediately evaporate, the crust would have to be dry.[28] In the biblical account, however, dry land does not appear until Day 3 in verse 9. Also, the ocean in the biblical account does not come into existence *after* the solidification of the earth, but *before* it. The concordists, therefore, although representing science very well, have spun an interpretation of Day 1 that is just the opposite of what the Bible is saying.

Day Two: Genesis 1:6-8

Ross specifically identifies the expanse of Gen. 1:6 as "the atmospheric layer immediately above the ocean ... the troposphere."[29] This is the time that God established the water cycle. So for Ross the expanse is the atmosphere with clouds above and the ocean below. Newman & Eckelmann also identify the expanse with the atmosphere and the water above with the clouds.[30] Young identified the firmament as "the appearance of sky produced by a gaseous expanse."[31] The water above is ordinary rain clouds.

Our concordists are in complete agreement that the firmament is atmosphere or the space where the earth's atmosphere exists, and the "water above" refers to ordinary clouds.[32] Unfortunately, although our concordists are now all in agreement as to the meaning of Gen. 1:6-8, they are still rewriting the Bible. Interpreted within its historical and biblical context, the firmament of Gen. 1:6-9 is not atmosphere, nor are the "waters above" ordinary clouds. I have explained elsewhere that interpreted within its historical and biblical context, the firmament is a rock-solid dome or disc over the earth and the "waters above" are an ocean above that firmament.[33] Space prohibits a complete review of all the reasons why this is so; but below is a summary of the salient facts.

As to the solidity of the firmament, the historical context is that all peoples in all parts of the world including the ancient Near East, from the beginning of history until 200 A.D. (and almost all peoples after that until modern times) believed that the sky, the firmament, was rock-solid; they distinguished this rock-solid firmament from the atmosphere. The burden of proof lies on anyone saying that the Hebrews did not do the same.

Since all educated people in Moses' time affirmed the existence of a rock-solid sky differentiated from the atmosphere, historically it is extremely improbable that Moses did not do the same. Furthermore, when he wrote that the birds fly "in front of the face of the firmament" (Gen. 1:20), he obviously is referring to that blue thing above the earth, which anyone reading that passage then would have defined as a rock-solid dome (or disc) over the earth,

not as atmosphere. The word means what it meant to the people of that time, not what it means to the people of our time. Only by ripping the word "firmament" out of its context can you possibly define it as atmosphere (or mere space).

Gen. 1:17 tells us that the stars were set in the firmament; but, even modern science tells us the stars are not set in the atmosphere. Nor did the people of that time think of the stars as being set in the atmosphere. Rather, the stars look like they are embedded in a solid dome over the earth; hence people of that time believed that the stars were set in a solid dome over the earth. The contextual meaning of "firmament" in Gen. 1:17 is that it is a solid dome over the earth. Only by pulling it out of its biblical and historical context could it be defined as atmosphere.

... interpreted within its historical and biblical context, the firmament is a rock-solid dome or disc over the earth and the "waters above" are an ocean above that firmament.

Further, there is no verse anywhere in the Bible which even infers that the firmament was not solid. On the other hand, Ezek. 1:22-26 speaks of a firmament (the same Hebrew word as in Gen. 1:6-8) the color of ice, which is a divider between cherubim below and a throne above. This firmament is obviously solid and is so recognized by all commentators. It could not possibly be just atmosphere, much less just space. This solid firmament in Ezekiel 1 is identified in Scripture with the firmament in Genesis 1 (Rev. 4:6; 15:2).

It is no accident, therefore, that Jewish and Christian interpreters of Gen. 1:6-8 from the very beginning until the Renaissance regularly understood the firmament to be rock-solid and distinguished it from the atmosphere. Jews even tried by scientific means to measure the firmament's thickness.[34] Christians speculated whether the firmament was made of earth, air, fire, or water (the basic elements of Greek science). Defining the firmament as atmosphere is a modernizing reinterpretation of the Bible—indeed, a rewriting of the Bible.

Regarding "the waters above the firmament," one must simply look closely at Gen. 1:6-8. The waters being spoken of in v. 6 are the *tehom*-ocean waters of v. 2. The firmament is set "between" these ocean waters to "separate" them into waters "above" and "below" the firmament. Therefore the waters "above the firmament" are ocean waters and there is no indication in the text or anywhere else that they became clouds. Further, because these waters are above the same firmament in which the stars were placed, they are also above the stars; they could not possibly be ordinary clouds. As E. J. Young wrote:

> I am unable to accept the opinion that the waters above the expanse refer to clouds for this position does not do justice to the language of the text which states that these waters were above the expanse.[35]

Hence, until the Renaissance, Jewish and Christian exegetes regularly interpreted the phrase, "waters above the firmament," as a sea above the sky, above the sun. They also distinguished these waters from ordinary clouds. For example, Jewish writers explained that rain clouds rise up to the firmament in order to get filled with water from the waters that are dammed up above the firmament.[36] Chrysostom mentions the waters above the firmament as being above the sun.[37] To define "the waters above the firmament" as ordinary clouds is to remove both the "firmament" and the "waters" from their historical and biblical context and rewrite the Bible.[38]

Day Three, Part I: Genesis 1:9,10

Ross identifies Gen. 1:9 with the basin formed for the ocean when the moon pulled away from the earth, "leaving a supercontinent on the opposing side of the earth."[39] Science would date this event to c. 4.5 billion years ago. Newman & Eckelmann seem to agree with Wiester that Gen. 1:9 is speaking of the time when shallow seas were being gathered into ocean basins and granite rocks were welling up to form the continents, perhaps 3.5 to 2.5 billion years ago.[40] Young said the thickness of the continental crust caused it to be elevated much higher than the oceanic crust. The continental crust is at least 3.5 billion years old, but:

> It is not known scientifically how the primitive ocean, atmosphere, and continental crust are interrelated in terms of sequence of time, but it is believed that all of these features of the earth are extremely old.[41]

Our concordists cannot seem to agree about what period Gen. 1:9 is describing. Is it 4.5 billion years ago (Ross), 3.5 to 2.5 billion years ago (Wiester and probably Young and Newman & Eckelmann), or 2.5 to 1.5 billion years (Gedney)? Part of the prob-

lem, as Young said, is that science is not completely clear at this point. The major problem, however, is that the sea exists prior to the dry earth in the Bible; science says just the opposite.

Interpreted within its historical and biblical context, the "earth" of Gen. 1:10 is a flat disc.

Ross's explanation that Gen. 1:9 refers to the time when the moon pulled away from the earth relates to a time when the earth had no ocean at all and hence cannot possibly be identified with Gen. 1:9. Wiester and Gedney's dating of Gen. 1:9, 3.5 to 1.5 billion years ago (the same time implicitly accepted by Young and Newman & Eckelmann), is usually thought of in science as the period of ocean formation with the land having already been in existence. But, in Gen. 1:9 we have exactly the opposite: the formation of land with the ocean having already been in existence (Gen. 1:2) and simultaneously being in existence (Gen. 1:9). The ocean is not created in Gen. 1:9 as occurred during the period of ocean formation. The ocean already existed in Gen. 1:2. It is simply circumscribed in Gen. 1:9 (cf. Prov. 8:27; Job 26:10). We are dealing with two antithetical cosmologies.

Not only does the biblical account begin with a sea and the scientific account begin with an earth too hot to have a sea, the concordists are thinking of a global earth and are asking, "When did the sea become embedded in the earth?" The biblical writer was thinking of the earth as a flat disc and asking, "When did the earth become embedded in the sea?"

Everyone in the time of Moses understood the earth to be a flat disc; and, everyone in the ancient Near East understood that disc to be embedded in a surrounding sea. No one defined the earth as a globe until 400 B.C. (and even then most people went on believing it was flat). It is incredible that the writer and first readers of Gen. 1:9, 10 defined "earth" as a globe. The writer and first readers of Genesis 1 understood and defined the earth as a flat disc embedded in the sea (cf. Pss. 24:2; 136:6); and, it is their definition of "earth," not ours, which is the historical-grammatical meaning in Gen. 1:9, 10. There is not one verse in the OT that defines the "earth" as a globe.

The famous phrase "circle of the earth" in Isa. 40:22 may refer to the firmament; but, even if it refers to the earth, it cannot prove more than that the flat earth is circular. Egyptians also used the phrase, "circle of the earth," and they certainly believed the earth was flat. Had Isaiah (or any other OT writer) wanted to refer to the earth as a globe, he probably would have used the word he used in Isa. 20:18 which means "ball."

Further, although there are no verses in the Bible which define the earth as a globe, there are verses which imply it was flat. For example, the tree in Dan. 4:10, 11 which because of its height is "visible to the end of all the earth" implies that the earth was thought of as flat. Within its historical context, as I show elsewhere, the phrase "all the earth" in Dan. 4:11 refers literally to all the earth of creation, yet only on a flat earth could a tall tree be seen "to the end of all the earth."[42]

Interpreted within its historical and biblical context, the "earth" of Gen. 1:10 is a flat disc. The burden of proof lies on anyone defining it as a globe. It is no wonder then that concordists cannot harmonize Gen. 1:9, 10 with modern science.

Day Three, Part II: Genesis 1:11, 12

Ross identifies the period of these verses as the time when "relatively primitive" plants appeared on earth. "Seed" can be interpreted, he says, as any embryo from which a new plant can grow. "Fruit" in a broad sense is produced by all plants. "Trees" would include "shrubs, bushes, and plants with woody stalks." Science dates primitive terrestrial plant forms with "woody stalks" as first appearing in the Upper Silurian period, c. 400 million years ago.[43]

Newman & Eckelmann understand Gen. 1:11-13 as a 24-hour day introducing the creation of plants. They say:

> It is not necessary to suppose that the fruit trees of this passage were created before any kind of animal life, which would contradict the fossil record understood as a sequence.[44]

Young said that Moses

> simply intended for the reader to understand that the third day was generally a day of plant production and that most plant materials were formed at this time ... There is nothing which says that grasses could not have come first followed by herbs at some time later, and followed by fruit trees at a yet later time.[45]

In addition, Young, like Ross, suggested that the term "fruit trees" could well refer to the primitive ancestors of modern day fruit trees—even to Cenozoic flowering deciduous trees.

Interpreted within its context, Gen. 1:11, 12 means that the fruit trees came into existence before the creation of the sun on Day 4 ...

Our concordists do not agree about when this period of vegetation began, but they do all agree that "fruit trees," such as were known to the author, did not appear before Day 5. They know that in the geological record there are no real fruit trees until after the creation of animal life.[46] They suggest that the "fruit trees" of Gen. 1:11, 12 were not modern fruit trees, but just primitive ancestors of these trees; or else they say they were indeed modern fruit trees; but these did not appear on earth before Day 5. Neither of these explanations really agrees with the biblical text.

Contextually, the "fruit trees" of Gen. 1:11, 12 were undoubtedly defined by the writer as fig (Gen. 3:7), date (Ex. 15:27), pomegranate (Ex. 28:33), etc., that is, modern fruit trees. Fruit trees were highly esteemed in the ancient Near East; there is nothing in the text which indicates the author was not thinking of modern fruit trees. Further, to speak of "trees" at all is to refer at least to plants having "woody stalks" (the Hebrew word "tree" also means "wood"). The scientific record shows that plants with woody stalks did not appear on earth until after jawless vertebrate fish and numerous other sea creatures. Yet, in the biblical text such sea creatures did not begin to appear until after the appearance of plants (Gen. 1:20). The two accounts are diametrically opposed.

The other suggestion that the "fruit trees" of Gen. 1:11, 12 were genuine fruit trees, but did not appear on earth until after animal life was created, is similarly contrary to the context. There is no suggestion in the context that any of the items mentioned in conjunction with a particular creative day did not come into existence until a later creative day. In fact, the context speaks decisively against this.

The phrases, "and it was so," "brought forth," and "saw that it was good," imply here—as they do throughout the chapter—that the named objects came into existence before the close of each respective day and before the objects created on the next day. Interpreted within its context, Gen. 1:11, 12 means that the fruit trees came into existence before the creation of the sun on Day 4, so certainly before the creation of fish and animals on Day 5. This is the way the verse was interpreted from the rabbis to the reformers.[47]

As Calvin said:

> It did not happen fortuitously that herb and trees were created before the sun and the moon ... in order that we might learn to refer all things to him, he did not then make use of the sun or moon.[48]

As late as 1835, respected commentators, speaking of Gen. 1:11, 12, said, "here we find the earth bearing a great abundance of fruit, probably ripe fruit, before the sun and moon were made."[49] Only with the coming of modern geology was the Church led to believe that Gen. 1:11, 12 was saying that fruit trees did not come into existence until after the creation of fish and animals on Day 5. It seems evident that the concordists are reading modern science into the biblical text.

Day Four: Genesis 1:14-19

Ross identifies Gen. 1:14-19 as the time when, after the atmosphere became an oxidizing atmosphere, the consumption of CO_2 by plants along with a decrease in volcanic activity transformed the atmosphere from translucent to transparent. The result was that "suddenly the sun, the moon, and the stars became distinctly visible..."[50]

Newman & Eckelman believe that it is reasonable to suppose that

> Gen. 1:14-19 describes the first appearance of the sun, moon, and stars to our hypothetical earth bound observer on the occasion of the break up of the earth's cloud cover.[51]

Young did not identify Day 4 with any particular period, but like the other concordists, believed it was "not necessary to think that the sun, moon, and stars received their existence for the first time at this point."[52]

Our concordists are all in agreement about both the date of this period and the idea that the sun and moon were created billions of years before Gen. 1:14-19, and were first clearly visible on earth during this period. They all agree that Gen. 1:14-19 is not saying that the sun, moon, and stars were first created on Day 4. But, again we must ask, "Is this the historical-grammatical meaning of Gen. 1:14-19?"

The words, "Let there be"—which even concordists understand as referring to current, not past, creation in v. 6—are not well suited to refer to objects that have already been in existence for years. It is even more difficult to believe that here in a context of creation that the words "God *made* two great lights ... *made* the stars" really mean that they were actually made billions of years earlier, and God was just changing the atmosphere so that they could be clearly seen on earth. Before the advent of modern geology and astronomy, who would have guessed that the text meant this? In fact, no one did. Also, the implication of v. 17, God "set" them in the firmament, is that they were not there earlier. Had Moses intended to speak merely of the heavenly bodies appearing, he would have used the word "appear" as in v. 9.

The problem with the concordists' definition of "make" is that in Scripture the word is a synonym of "create."

As to the Hebrew in Gen. 1:14-19, as early as 1887, S. R. Driver rejected the concordist interpretation, saying the word "made" is

> perfectly unambiguous and distinct ... The writer expresses, as explicitly as it is possible for language to do, his sense that the luminaries had no existence prior to the Fourth Day.[53]

Seventy years later, M. Kline was protesting just as strongly. He said that in order to avoid the idea that plants thrived before the sun was created

> the most unwarranted notions of the work of the "fourth day" have been substituted for the straightforward statements of the text. Gen. 1:14-19 declares that the heavenly bodies were on the "fourth day" created and set in their familiar positions. Moses is certainly not suggesting merely that hitherto hidden heavenly bodies now became visible on earth.[54]

The problem with the concordists' definition of "make" is that in Scripture the word is a synonym of "create." Objects referred to in Genesis 1 as having been "created" are described elsewhere in the OT as having been "made" (Ex. 20:11; Neh. 9:6: Prov. 8:26). Further, in Gen. 1:21 and 25, 26 and 27, and 2:4 as well as elsewhere in the OT (Isa. 41:20; 43:7; 45:7), the Hebrew word "made" is used synonymously and interchangeably with the word "create." Interpreted within its biblical context, the sentence, "God made two great lights" does not mean anything significantly different from "God created two great lights."

There is an old interpretive tradition, however, which understands Gen. 1:1 to be saying that God originally created the raw materials of the universe or even a proto-earth, heaven, sun, moon, etc.; and then on the creative days perfected the formation of the various parts of the universe. This understanding was not uncommon among Jewish writers (e.g., *b. Hagigah* 12a, Rashi) and has flowed from Calvin down through generations of reformed commentators to the present day (e.g., Leupold). Young and others have appealed to this tradition as evidence that Gen. 1:14-16 could be speaking of a sun, moon, and stars that were already made.[55]

It must be noted, therefore, that the original tradition found in Calvin and those who followed him did not posit that the sun, moon, and stars already existed in a fully developed form prior to Day 4, as does the concordist theory. As noted above, even though espousing the tradition that Gen. 1:1 meant that God created the original matter of the universe, Calvin explicitly stated that "herbs and trees were created before the sun."[56]

This old tradition, therefore, does not support the concordist theory. It only posits the existence of raw materials or, at the most, unfinished prototypes of the heavenly bodies. So, if all that happened on Day 4 was that they were seen clearly for the first time, it would have been raw material or unfinished prototypes that would have been seen. Further, this old tradition, unlike the concordists, took Gen. 1:17 seriously. It accordingly held that not even unfinished prototypes were in the firmament prior to Day 4. Concordists ignore the force of v. 17.

If you interpret Gen. 1:14-19 within its biblical context, it is speaking of the original creation of the sun, moon, and stars, which is the historic understanding of the Church.[57] I should think it would be very difficult for even a concordist to really believe that all of the saints and scholars from the beginning of Church history until the rise of modern science (and most modern scholars as well) have all misinterpreted Gen. 1:14-19. Is it not rather that concordism has imposed modern science upon the Bible?

I could go on to document that in Days 5 and 6 the creation of birds in the Bible is contemporary with the creation of fish (v. 20) and precedes the creation of reptiles (v. 24) whereas in the scientific record birds follow both fish and reptiles. But, I be-

lieve my point is already sufficiently established: Concordism does not demonstrate agreement between the Scriptures and modern science. Rather, it rewrites the Scriptures so that they agree with modern science.

I have not dealt specifically in this paper with "creation science," which primarily rewrites science so that it agrees with Scripture. But, it is evident that they too have rewritten Genesis 1—at least with regard to the firmament, the sea above the firmament, and the flat earth.[58] I agree heartily, therefore, with Davis Young, who though originally espousing concordism, reviewed the history of both concordism and literalism ("creation science") and after noting the divergent, overly imaginative and unconvincing interpretations of Genesis and science within both traditions, came to the conclusion that "Literalism and concordism are failed enterprises that evangelicals should abandon."[59]

Surely, it is not God's will for evangelicals to uphold interpretations of the Bible which violate its historical-grammatical meaning. If we are really free to rewrite the Bible, then the Bible means absolutely nothing. I believe that there is a much more biblical way to relate science to Scripture than either by rewriting science or by rewriting the Bible.

A More Biblical Approach

The biblical approach that I believe better relates science to the Bible is to accept the historical-grammatical meaning of Genesis 1. Admit that it reflects the cosmology of the second millennium B.C., and that modern science presents a more valid picture of the universe. Then, recognize the fact that the theological message of Genesis 1 stands out in such superior contrast to the mythological accounts of creation (both ancient and modern) that even so radical a critic as Gunkel could see the difference. Finally, draw what seems to me the obvious conclusion: Science and the Bible are complementary.

Admittedly, this does not uphold the common but unbiblical assumption that the divine inspiration of Scripture cannot entail concessions to ancient "science." But, there is no biblical reason why the theological message in Genesis 1 cannot be eternally valid, while the package in which it came was a temporal concession to the people of that time.[60] Indeed, it was Jesus who taught that divinely inspired Scripture can and does include concessions to hardened hearts, concessions in the area of faith and morals (Mark 10:5). How much more then is concession possible in the area of mere science?

We might add that, according to Scripture, the development of scientific knowledge was delegated by God to humankind (Gen. 1:26-28). The divine purpose of biblical inspiration, therefore, is not to reveal science but to inform us of God's standards of faith and morals (2 Tim. 3:16).

It is time for evangelicals to lay aside extra-biblical definitions of biblical inspiration, and agree with Jesus that inspired Scripture can contain concessions. Genesis 1 is a concession. Or, as a modern missionary, aware of the imperative need for divine revelation to be clothed in the terms of the culture to which it comes, has explained: Genesis 1 is a case of divine contextualization.[61]

There is no need to rewrite either science or the Bible. Both offer truth. ✽

Notes

[1]See the discussion in B. Ramm, *The Christian View of Science and Scripture* (London: Paternoster, 1955), 144-149.

[2]On the history of concordism, see Davis Young, "Scripture in the Hands of Geologists," *Westminster Theological Journal* 49 (1987): 257-304; and his *Christianity and the Age of the Earth* (Grand Rapids: Zondervan, 1982), chs. 3 and 4; J. Raymond Zimmer, "The Creation of Man and the Evolutionary Record," *Perspectives on Science and Christian Faith* 48:1 (March 1996): 16-95 presents a more sophisticated version of concordism which rightly moves in the direction of considering literary genre; but, I believe, needs more input from ancient Near Eastern thought.

[3]Davis Young, *Creation and the Flood* (Grand Rapids: Baker, 1977), 81-134.

[4]Robert C. Newman and Herman J. Eckelmann, Jr., *Genesis One & the Origin of the Earth* (Downers Grove: InterVarsity, 1977).

[5]Hugh J. Ross, *Genesis One: A Scientific Perspective* (Sierra Madre: Wiseman Productions, 1983).

[6]Chapters 2 and 3 of *Modern Science and Christian Faith* by members of the American Scientific Affiliation (Wheaton: Van Kampen, 1950), 9-57.

[7]John Wiester, *The Genesis Connection* (New York: Thomas Nelson, 1983).

[8]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 87; Young, *Creation and the Flood*, 118; Ross, *Genesis One: A Scientific Perspective*, 4, 5; Wiester (*The Genesis Connection*, 202) identifies the Big Bang with Gen. 1:1-5, particularly noting that it was an "explosion of dazzling brilliance" in accord with Gen. 1:3 "Let there be light."

[9]Edward J. Young, *Studies in Genesis One* (Philadelphia: Presbyterian & Reformed, 1964), 14.

[10]Quoted in Claus Westermann, *Genesis 1-11* (Minneapolis: Augsburg, 1984), 97. The discussion by Westermann (pp. 93-97) is excellent and leaves no doubt in my mind that Gen. 1:1 is unparalleled by any other ancient creation account.

[11]Ross, *Genesis One: A Scientific Perspective*, 4, 5 .

[12]Stoner (*Modern Science and Christian Faith*, 18, 19), also refers Gen. 1:2 with its darkened earth to the earth originating out

of a dark nebula, apparently c. 5 or 6 billion years ago. Wiester (*The Genesis Connection*, 202) having identified Gen. 1:3 and the creation of light as a statement of the Big Bang, skips commenting on Gen. 1:2.

[13]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 70.

[14]Young, *Creation and the Flood*, 118.

[15]Ross, *Genesis One: A Scientific Perspective*, 5.

[16]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 71-2. Stoner said nothing about the ocean in Gen. 1:2; but, his editor added a footnote to his paper, saying, "The description in Genesis 1:2 may picture a molten earth surrounded by an ocean of steam or a barren earth with a crust but still above the boiling point of water shrouded by a dense cloud of steam." (*Modern Science and Christian Faith*, p. 19 n. 22)

[17]Young, *Creation and the Flood*, 119.

[18]Wiester, (*The Genesis Connection*, 50, 52, 202), not only ignores the ocean mentioned in Gen. 1:2, he tells us in accordance with modern scientific theory that when the earth finally did condense out of the nebula c. 4.5 billion years ago, there was no water at all on it. Of course, there could not be since at that point in time the temperature of the earth was far above the boiling point of water.

[19]Paul H. Seely, "The Geographical Meaning of 'earth' and 'sea' in Gen. 1:10," *Westminster Theological Journal* Forthcoming; Moshe Weinfeld, "Gen. 7:11, 8:1, 2 Against the Background of Ancient Near Eastern Tradition," *Die Welt des Orients* 9 (1978): 242-248.

[20]Derek Kidner, *Psalms 1-72* (London: InterVarsity, 1973), 253.

[21]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 70.

[22]Ludwig Koehler & Walter Baumgartner, eds. *Lexicon in Beteris Testamenti Libros* (Leiden: E. J. Brill, 1958), 1019.

[23]St. Augustine, *The Literal Meaning of Genesis* Vol. 1, (New York: Newman Press, 1982), 35; Aquinas, *Summa*, Vol. 10, 95.

[24]Gordon J. Wenham, *Genesis 1-15* (Waco: Word Books, 1987), 16 says "primeval ocean"; Umberto Cassuto, *A Commentary of the Book of Genesis* Part 1 (Jerusalem: Magnes, 1961), 24 says, "primeval world-ocean"; See also S. R. Driver's astonishment and rejection of "such free use of the Hebrew language" when the concordists of his day tried to say that *tehom* meant "cloud," in "The Cosmogony of Genesis," *Andover Review* (Dec 1887): 641-2.

[25]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 72, 73.

[26]Ross, *Genesis One: A Scientific Perspective*, 6.

[27]Young, *Studies in Genesis One*, 120.

[28]"Oceans," *The New Encyclopedia Brittanica, Macropaedia*, Vol. 13 (Chicago: Helen Benton, 1982), 476; Wiester, *The Genesis Connection*, 50, 52, 202.

[29]Ross, *Genesis One: A Scientific Perspective*, 7.

[30]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 75, 76.

[31]Young, *Studies in Genesis One*, 125.

[32]Stoner (*Modern Science and Christian Faith*, 20) also identifies the expanse as space that formed between the ocean and the clouds, the water above as clouds, the water below as the ocean. Wiester (*The Genesis Connection*, 192) seems to agree.

[33]Paul H. Seely, "The Firmament and the Waters Above," Part 1, *Westminster Theological Journal* 53 (1991): 227-240.

[34]*b. Pesah 49a.*

[35]Young, *Studies in Genesis One*, 90, n. 94.

[36]*b. Ta'an 1:9b.*

[37]*The Homilies of St. John Chrysostom (Oxford: J. H. Parkes, 1842), 168.*

[38]For further documentation of the fact that "the waters above" does not refer to clouds, see P. Seely, "The Firmament and the Water Above" Part II, *Westminster Theological Journal* 54 (1992): 31-46; Jody Dillow, *The Waters Above: Earth's Pre-Flood Canopy* (Chicago: Moody, 1981), 48-64.

[39]Ross, *Genesis One: A Scientific Perspective*, 8.

[40]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 76-78.Wiester, *The Genesis Connection*, 203. Gedney, a geologist, takes over from Stoner and identifies Gen. 1:9 with the Archaeozoic Era c. 2.5 to 1.5 billion years ago (*Modern Science and Christian Faith*, 53).

[41]Young, *Studies in Genesis One*, 126.

[42]The issue of the flatness of the earth is not of sufficient importance here to list all of the historical and biblical data. The interested reader is referred to my paper of note 19 in which, incidentally, I also explain the contextual meaning of Job 26:7, "He hangs the earth upon nothing."

[43]Ross, *Genesis One: A Scientific Perspective*, 9.

[44]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 79.

[45]Young, *Studies in Genesis One*, 127.

[46]Wiester (*The Genesis Connection*, 203) identifies Gen. 1:11,12 with what he calls the Age of Blue-Green Algae, from 3.5 billion to 1 billion years ago, but says flowering plants (fruit trees) did not occur until 130 million years ago. Gedney (*Modern Science and Christian Faith*, 53) identifies Gen. 1:11,12 with the Proterozoic era, within dates c. 1.5 billion to .5 billion years ago.

[47]Ramban, *Commentary on the Torah, Genesis* (New York: Shilo, 1971), 40; Cf. *Rosh Hashanah* 11a; *Kelim* 17:14; *Luther's Works, Vol. 1, Lectures on Genesis, Chapters 1-5* (St. Louis: Concordia, 1958), 38; cf. p. 5.

[48]John Calvin, *Commentary on Genesis* (Grand Rapids: Eerdmans, 1948), 82; Even Philo and Augustine, who concordists often cite as not believing in literal days, understood Gen. 1:11,12 to be referring to actual fruit trees which came into existence before the creation of the animals. See Philo, "On the Creation," 41, 42, *Loeb Classical Library, Philo 1* (Cambridge: Harvard, 1981), 30-33; St. Augustine, *The Literal Meaning of Genesis*, Vol. 2 (New York: Newman, 1982), 37.

[49]William Jenks and Joseph Warne, eds. *The Comprehensive Commentary on the Holy Bible, Genesis-Judges* (Brattleboro: Fessenden & Co., 1835), 20.

[50]Ross, *Genesis One: A Scientific Perspective*, 10. Wiester (*The Genesis Connection*, 203-4) identifies the fourth day with the same period that Ross describes. Stoner (*Modern Science and Christian Faith*, 21) gives the same explanation and says the word "create" is not used in Gen. 1:14, 16; and the word "made" means "made to function" or "made to appear."

[51]Newman & Eckelmann, *Genesis One & the Origin of the Earth*, 80.

[52]Young, *Studies in Genesis One*, 128.

[53]Driver, "The Biblical Cosmology," 645.

[54]Meredith Kline, "Because It Had Not Rained," *Westminster Theological Journal* 20 (May 1958): 153; Kline has more fully

developed his opposition to understanding Day Four as referring to anything else but actual creation of the heavenly bodies in his recent paper, "Space and Time in the Genesis Cosmogony," *Perspectives on Science and Christian Faith* 48:1 (March 1996): 8, 9.

[55]Cf. G. Ch. Aalders, *Genesis* Vol. 1 (Grand Rapids: Zondervan, 1981), 63 and Sailhamer in *The Expositors Bible Commentary* Vol. 2, ed. Frank Gabelein and R. Polcyn, (Grand Rapids: Zondervan, 1990), 33-34.

[56]Cf. Matthew Poole, *A Commentary on the Holy Bible* Vol. 1, (London: Banner of Truth Trust, 1962), 2; *Gill's Commentary*, 6; Keil and Delitzsch similarly speak of the heavenly bodies being "completed on the fourth day." See C. F. Keil & F. Delitzsch, *Biblical Commentary on the Old Testament* Vol. 1 (Grand Rapids: Eerdmans, 1951), 59; H. C. Leupold, *Exposition of Genesis* Vol. 1 (Grand Rapids: Baker, 1942), 71.

[57]Theophilus (second century) said, "On the fourth day the luminaries were made ... the plants and seeds were produced prior to the heavenly bodies ..."(*Theophilus to Autolycus* 2:15 in *The Ante-Nicene Fathers* Vol. 2, 100-101); Origen (third century) said that on the fourth day "... God orders lights to come into existence." (*Homilies on Genesis and Exodus* [Washington, DC: Catholic University of America Press, 1981], 53); John Chrysostom (fourth century) said, "Sacred Scripture teaches us that the creation of this heavenly body [the sun] took place three days later, after the growth of all the plants ..." (St. John Chrystostom, *Homilies of Genesis 1-17* [Washington, DC: Catholic University of America Press, 1985], 84); Cf. St. Basil, "On the Hexameron, Homily 6," in *Exegetic Homilies* [Washington, DC: Catholic University of America Press, 1963], 85); Martin of Braga (sixth century) said, "Genesis reports that the lights of the sun and moon were created on the fourth day" ("Easter," in *Iberian Fathers* Vol. 1 [Washington, DC: Catholic University of America Press, 1969], 106); John of Damascus (eighth century) said, "It was into these luminaries that the Creator put the primordial light...as we said, the sun was created on the fourth day" (St. John of Damascus, *Orthodox Faith Book* 2 [Washington, DC: Catholic University of America Press, 1958], 216, 220).

[58]I dealt specifically with creation science's vapor canopy as a rewrite of the Bible in my paper, "The Firmament and the Water Above" Part II, *Westminster Theological Journal* 54 (1992).

[59]Young, "Scripture in the Hands of Geologists," 291.

[60]I have given the biblical basis for this statement in my book, *Inerrant Wisdom: Science and Scripture in Biblical Perspective* (Portland, OR: Evangelical Reform, 1989); Cf. James D. G. Dunn, "The Authority of Scripture according to Scripture," *The Churchman* 96 (1982): 104-122 and 201-225; also Bruce Waltke, "Historical Grammatical Problems" in E. D. Radmacher and R. D. Preus, eds. *Hermeneutics, Inerrancy and the Bible* (Grand Rapids: Zondervan, 1984), 118 and "The Literary Genre of Genesis, Chapter One" *Crux* 27 (Dec. 1991): 10; and note Benjamin B. Warfield's statement in "The Real Problem of Inspiration" in *The Inspiration and Authority of the Bible* (Philadelphia: Presbyterian & Reformed, 1948), 166-7.

[61]John Stott and Robert T. Coote, eds. *Gospel and Culture* (Pasadena: William Carey Library, 1979), 47-68.

Books Received and Available for Review

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

Piero & Alberto Angela, *The Extraordinary Story of Life on Earth*, Prometheus, 1996

Ted Bernard & Jora Young, *The Ecology of Hope: Communities Collaborate for Sustainability*, New Society Publishers, 1997

John Carroll, *The Greening of Faith: God, the Environment, and the Good Life*, New England Press, 1997

Gary Cziko, *Without Miracles: Universal Selection and the Second Darwinian Revelotion*, MIT Press, 1995

Paul Edwards, *Reincarnation: A Critical Examination*, Prometheus Books, 1996

Brian Fagan, (Ed.), *Eyewitness to Discovery: First Person Accounts of More Than Fifty of the World's Greatest Archaeological Discoveries*, Oxford, 1997

Roger Gottlieb, (Ed.), *The Ecological Community*, Routledge, 1997

Milton Heifetz, *Ethics in Medicine*, Prometheus, 1996

R. T. Hughes & W. B. Adrian, *Models for Christian Higher Education*, Eerdmans, 1997

J. J. Kotva, Jr., *The Christian Case for Virtue Ethics*, Georgetown University Press, 1996

Martin Luther, *The Infinite Voyage: A Metaphysical Odyssey*, Marwolf Publishing, 1996

Aaron Lynch, *Thought Contagion: How Belief Spreads Through Society*, Basic Books, 1996

Dan Maguire & A. Fargnoli, *On Moral Grounds: The Art/Science of Ethics*, Crossroads, 1996

Gina Maranto, *Quest for Perfection*, Scribner, 1996

David Millar, *Dictionary of Scientists*, Cambridge University Library, 1996

Larry L. Rasmussen, *Earth Community Earth Ethics*, Orbis, 1996

Hugh Ross, *Beyond the Cosmos*, Navpress, 1996

Edward Shafranske, *Religion and the Clinical Practice of Psychology*, APA, 1996

Zdenek V. Spinar, *Life Before Man*, Thames and Hudson, 1995

M. R. Steele, *Christianity, Tragedy, and Holocaust Literature*, Greenwood, 1995

L. W. Sumner, *Philosophical Perspectives on Bio-ethics*, Toronto Univ. Press, 1996

Ian Tattersall, *The Fossil Trail: How We Know What We Think We Know About Human Evolution*, Oxford, 1996

S. Vyse, *Believing in Magic: The Psychology of Superstitution*, Oxford, 1997

David Wilkinson, *Alone in the Universe?* Monarch Publications, 1997

Arne Wyller, *The Planetary Mind*, MacMurray and Beck, 1996

Natural Theology

John E. McKenna

Ambassador University
Big Sandy, TX 75755

This paper argues that "natural theology" conceived as a conceptual system antecedent to the interpretive framework provided by the self-revelation of the Word of God with us is to be transformed and reconceived at the heart of that revelation. In this way, science and theology may find new powers of integration that can help the modern debates between them, and it may do this in the light of the real historical contexts in which their respective enterprises are pursued. Here scientists and theologians discover a deeper appreciation of their disciplines and perhaps the ground for more creative interaction.

The problem of "natural theology" still vitally impacts the discussions about theology and science and their relationship in our society. Karl Barth, a Swiss theologian, has contended in his *Church Dogmatics* that no particular cosmology is ever embraced by the biblical world.[1] As a result, he is often accused of ignoring "history" with his theology. His theological science is not considered real science at all. Barth was concerned that the "natural theology," which had found support in the German Church and had become the "national theology" of the Nazi heresy, continued to find strong support in the Church of Jesus Christ. Much of the impetus for the focus of his work may be traced to this concern. He never believed that his efforts to free theology from its evil connection with "natural theology" meant that no relationship existed between theological and natural science and the real history of the world. Thomas Torrance has spent much time arguing this point. The transcendence of the free God in Barth's *Dogmatics* does not mean that God has no relationship with history and science. It means that it is not possible to articulate this relationship in terms of the "natural theology" employed by the German Church to justify its embrace of the Nazi.[2] A "natural theology" is possible for Torrance if the relationship between science and theology is properly understood.[3]

After many years of debate, the situation remains today, as far as I can see, pretty much the same as when Barth worked out the science of his theology. Committed to that revealed knowledge of one God rooted in the ground of the Blessed Trinity of the Living Redeemer and Creator of the world, the beautiful symmetry of his theology is ignored by most evangelicals in the American Church. The same resistance—sometimes bitter—that Barth experienced in his lifetime is common today. As one of the last doctoral students of Geoffrey Bromiley at Fuller Theological Seminary, I had the opportunity to ask him about the translations of the *Dogmatics* which he edited with Torrance. He was very blunt with me about their failure to get the American Church to read them.[4] In my own way, I, too, have experienced this resistance to Barth's position, especially among evangelical theologians and scientists. I am persuaded that, unless we can throw some new light upon this problem, we shall not make the kind of progress I believe we must, if we are going to be faithful to the Gospel of God in our discussions about science and theology. This paper will contribute to the clarification of the nature of this problem.[5]

Barth's now famous *"nein"* to Emil Brunner came at a time when this negative assertion seemed most imperative to the Swiss theologian. Adolph Hitler, leader of the Nazi movement in Germany, was approved by their great institutions. Barth personally experienced the results of the marriage between the "natural theology" of the German Christian Church and the national cause of Der Führer. It was an impossible possibility come to life. He campaigned

against such a marriage not only on the epistemological front, but on every front.[6] The Barmen Declaration is the point made in his campaign against the marriage in the political history of the times. The imperative negative ought to be heard in this kind of context.

Civilization has, indeed, judged the marriage an abominable one. Hitler acted in the "vanity of the abomination" and "reaped the whirlwind" because of it. The culture for which civilization has been developed cannot embrace any theology that allows the Church to partner with the State in the way of a tyrant like Der Führer. Whatever the nature of the partnership, it should not be like this one. I believe that both civilization and the Church of Jesus Christ must embrace a truth that judges such marriages as idolatry, the very same sort that the Israelites devised with Baalim in the days of the prophet Elijah. I believe that Barth's position on both the epistemological and political fronts was right—he understood his campaign to resonate with the prophet Elijah in ancient Israel.[7] The "natural theology" that allows such a marriage to occur must and shall be denied any ultimate value for us. It is a heresy whose bloody consequences do not see it for what it actually is, the real nature of the relationship between God and his people.

This was the thrust of Barth's point against the "analogy of being" right at the beginning of his *Dogmatics*. No analogy exists in the world that can be employed naturally to know the Object which is the true Subject of theological science. There naturally exists no "natural theology" that can serve to interpret and judge the nature of the world or God for what they truly are. Outside the revelation of God, there is no knowledge of God in his relational veracity with us as the Creator of the world. No antecedent conceptual system, rooted and grounded in the natural world of God's creative acts, can conceive of him as anyone but who he truly is. He is who he truly is as he reveals himself to be in his covenant with Israel and the Church. Outside this self-revelation, the world's perception of its Creator can only be the source of some idolatry, against which the Bible teaches God's people to stand.

The heavens and the earth as objects in the biblical world are known to exist as what they are under the divine power of God's eloquence. We hear God speaking in the covenant relationship that the Creator has established with his people, giving them deliverance from their idolatry and sin, as their Redeemer. Despite the many pretenders thrown up among the peoples of the world as the One, it is the great I AM, God in covenant with Israel, who provides the basis by which creatures may see the meaning and significance of their redemption in the creation with the true Creator of the world. The reality of their relationship to the Creator and the Redeemer of the world is where true knowledge of God is to be found by God's people. This is the point which Barth was seeking to articulate with his *Church Dogmatics*—the Gospel of Jesus Christ in his generation.[8]

On this point, I believe Barth is more scriptural than his many critics. Much of their criticism of his imperative negation of Brunner's way of relating grace and nature seeks to regard "national theology" as some natural bridge that may be built across the chasm that exists between the transcendence of God and the God of history. However, Barth was quite sure that the Bible teaches that no such gap truly exists between them. The immanence of God in the history of the world as God's creation cannot be divorced from who God truly is in himself and with his people, from his transcendent being. Right from the beginning of our thought, we must learn to consider the two together. "Natural theology" conceived as a system of thought, learned in the world antecedent to what the world actually is as God's creation, posits a chasm between them that does not really exist at all. It is the epistemological dualism of such "natural theology" that is at fault here, says Barth, not the freedom of God to be free with himself in relationship to his creation. Far from

Professor McKenna is presently the Chair of the Department of Theology at Ambassador University in Big Sandy, Texas. He has served as Adjunct Professor of Theology at Azusa Pacific University and at Fuller Theological Seminary, Pasadena, California, from where he earned his Ph.D. in Historical Theology in 1987 and his Master of Divinity in 1979. He is an ordained minister of the Gospel with the American Baptist Churches. John graduated in 1957 from Princeton University in Physical Chemistry. He has been married to Nancy Ann McVicker for 24 years and they have published a book of poetry together, The Burning Green, *(Los Angeles: Wipf & Stock, 1996).*

a denial of history, Barth's position is that history is what it is in the light that God is with us and it. It is an affirmation that history is possible only in the actuality of who God is, in his freedom to be both transcendent over it and immanent within it without threatening his being. Who he is in his eternity and what he does with himself in relationship to what he has caused to exist are bound together with divine wisdom and freedom. The freedom of his uncreated existence means that he is free over and with all created reality. The Church knows her one Lord and Creator as the Redeemer of the world, beside whom there is no other. This One is the Messiah of Israel and the Lord of all history. Barth is convinced that this One of the history of God's people is the transcendent God revealed in Christ with us. Both history and transcendent reality are implicated in the nature of the covenant relationship fulfilled by God in Christ with the history of Israel, the Creator of the world.[9]

In this freedom, God is free to name the very place which is and must be considered the center of this world's history.

This Gospel of God does not and will not necessarily serve the national interests of Germany or any other nation. This Gospel will not serve the interests or common causes of any race, tribe, or peoples other than those creatures in the world called to serve God's chosen One, our Lord Jesus Christ. The Gospel, therefore, must have its Elijah. Without hearing God's "No" against the idol, we cannot grasp the good news of this Gospel. The good news that God serves with his self-revelation in Christ is to make known to humanity the Maker of all things. This Gospel serves the world as the grace and truth of God's salvation with his creation. It will and does serve, in fact, God's judgment and wrath against those who continue to oppose him in his service to the world. It is precisely through this truth and grace that the world must come to know its God. This is, I believe, Barth's point about the transcendence of God and his relationship with the history of the world. Any leader or savior except Jesus Christ is no Lord of time or eternity.[10] It was impossible for him to *heil* Hitler in his classroom. It was idolatry. Like Elijah, he had to stand against any salute to the Nazi leader.

Nothing in this stance suggests that there is no relationship between God in his eternity and the real history of the world. It is precisely because God is true to himself in his acts with and in the world that we are allowed to know him in the humanity he has freely chosen to be with us, even as he is in his eternity. It is interesting that Barth felt there were others much more qualified to write the *Dogmatics* on the doctrine of creation. But even as less qualified than others, he needed to write the doctrine himself because he could not trust the interpretation of its epistemology to anyone else.[11]

In seeking to appreciate appropriately the transcendence of God over history, Barth never meant that history, even the history of the creation itself, could be thought to exist alienated from the divine freedom of the nature of God. For Barth, God and the history of humanity in God's creation was the subject of the covenant relationship as taught in the Bible. It is this divine freedom Barth attempted to articulate as consistently and thoroughly as he was able. In this freedom, God is free to name the very place which is and must be considered the center of this world's history. Both divine and human natures exist with one another in an unique relational veracity that effects all of created time, all history, so that it makes them what they actually are with the world. Though we may not posit any necessary relationship between God and the world in this freedom, there exists a freely created and creative One, the key to which is given us in the way God has actually taken to fulfill his promise to his people in his covenant with the Christ.[12]

Though the world and God's people may not know him, yet God still comes into the world for them. Despite our idolatry and ignorance of him, God freely wills a relationship with us. It is a spiritual relationship whose origins are bound up with the freedom of God to be present with himself in his world. This relationship between God and the world, therefore, must be conceived as a created and creative one, even from the very beginning of all that is creaturely reality. We may not read back into it any necessity which we may discover within the world. The world as God's creation is rooted in who the Creator is and in his freedom to be present with it, not in what creatures, who are alienated from who he truly is with himself, might think him to be. This means that a real "natural theology" (the world explicated as God's creation in light of who God truly is in himself with it) must be grounded in the actual being of God, in his acts with us, and in his freedom to create an interaction with us. The first created place is a space and time the nature of which is uniquely dependent upon God himself. This is the point against the *analogia entis* with re-

spect to "natural theology" that is at the foundation of Barth's thought.

This is also the point that Professor Torrance has sought to make so strongly in seeking the appropriate analogy of faith for "natural theology."[13] Barth is dead right to argue for the impotence of "natural theology" as an antecedent conceptual system. But the Church needs to go beyond Barth's thought and give "natural theology" its rightful place within the light of this self-revelation of the self-naming God. Though there is no "natural theology" appropriate to the Gospel except the light of the Word of God come as a man into the world, there is a "natural theology" which ought to be conceived within the light of this revelation of his Word. Although the world by itself does not and will not know its Creator, it does know him from within the divine light embodied as the person of Jesus Christ, the Word of God become flesh among us. Christ embodies in himself both the uncreated light of the divine Word and the created light of humanity so that in him knowledge is not only given of God's redemption, but also of the Creator of the world and the world, therefore, as God's creation.[14] This is the world that ought to be conceived as God in Christ's creation and is no other thing than the world it is with him who is its Creator. It is precisely in this light that the world is to be known as the object of God's Word. It is to be known through this humanity in it, this humanity that is the Word become flesh among us. In this way, a deep respect for the profundity of the grace and truth of God is established with humanity.[15] Any analogy of being must serve in created correspondence with the way of this light to point away from itself to God himself, if it is to be real "natural theology."

"Natural theology," as an antecedent conceptual system, needs to be transformed and reconceived within the heart to reflect the true light of God's self-revelation. It needs to be removed from its place outside the Word become flesh in the history of the world, where it cannot—except as a means for idol-making—interpret itself, the world, or God. Rather, it needs to be understood within this humanity of God. Here "natural theology" will become a transparent analogy of faith without alienation from created being into something that is truly "natural" and appropriate for the actual relationship that God has created between himself and the natural laws and theology of the world, that is, his creation. "Natural theology" becomes a true servant of the theology of reconciliation that must accompany the self-revelation of God. It will be reconceived in its naturalness to participate with God as the Creator and Redeemer of all creaturely reality. As servants of God, this "natural theology" would help us resolve many problems relating the Kingdom of God to the schemes that the world devises against him. We would be more faithful to the Gospel's universal significance and its confrontation with the national interests of, for example, a Nazi Germany.

In this case, however, no dualism is posited between the God of creation and the triune God of the redemption of creation. They are the same God. With properly differentiated and distinguished natures, a unitary view of God and the world may be articulated with a faithfulness that is natural to the reality of their distinct, and yet unitary, freedoms and orders. This is Torrance's point about the way we ought to seek to move beyond the "*nein*" inherent in the accomplishment of the theology of Karl Barth, for the purpose of establishing a "natural theology" that is truly servant to the revelation of the God of the Bible.[16]

"Natural theology," as an antecedent conceptual system, needs to be transformed and reconceived within the heart to reflect the true light of God's self-revelation.

Indifference or resistance to this point has never ceased to astonish me. It is as if we would persist in crying out for some brand of Nazism in order to argue our particular causes in the world. It is as if the idol must remain just as important to us as God himself. It is as if the Redeemer had not made it clear that he is none other than our Creator. Is it not for all to see, that to believe in the idol rather than the true Creator of the world disastrously effects our endeavors in the development of our civilization? We can find the desolation of this aberrant behavior all around us. We clearly see that our cultures suffer from fragmentation and alienation from the realities of the world because of it. Yet, we persist to produce our own self-justification despite the real interaction of God with us. Because of this interaction, are we not duty bound to work out who we are and what we ought to do and become in this world? Is this not clearly the true light that St. John had in mind in his account of the Gospel of Jesus Christ, the witness to the reality of God with us? How can it be that a "natural theology" would seek to exist so persistently outside the light of this revelation of the Word of God with us?

Our concept of "natural theology" and our perception of its meaning or significance for our freedom in the world are bound up with our doctrines of creation and incarnation. They are effectively worked out with our ideas about the nothingness of the creation and the way that God in his freedom has overcome the negative aspects of the nothingness of creation with his incarnation. This is a point that Torrance sought to make with his students since entering the debates about the relationship between science and theology. We have seen how Barth tried to free theology from any false relationship with the natural world. We have also seen how Torrance would argue that this false relationship belies a profound reality, a true relationship between God and the world. As free creatures, we are faced with the fact that we are duty bound to God and his freedom to be with us. We need to work out our freedom in the divine freedom. We need to see the grace and truth of God in Christ as what natural law or theology ought to be, in common with the world as his creation. Whether it is the laws of the universe or the laws of creatures upon the earth, laws must be comprehended as servants of the personhood of the living God. It is this Person who has overcome the vanity of the world and has given it meaning that only God can give to created reality. It is this Person for whom Elijah made his stance, because it is this Person who stands against the idol.

God is free to be with us and to give meaning to our history. ... Natural law or natural theology (civilization) must serve the reality of this God or the idol.

This is a tremendously important point for the history of our time. What kind of victory did civilization enjoy over Hitler without this point being made? What significance does the Age of the Bomb truly bear among us because of this triumph over evil in our time? To what good is our morality connected? The freedom for which civilized people died is rooted in the truth that God is free to be with us and to give meaning to our history. We are what we are and who we are in the grace and truth of this God with us. Natural law or natural theology (civilization's order) must serve the reality of this God or the idol. The doctrine of God that people embrace cannot be divorced from their meaning, their law, and their science. Depending upon how we perceive our law and our theology, our freedom is employed to establish what ought to exist in the world or what ought not to exist. This "oughtness," inherent in the way that we conceive "natural theology," cannot be ignored in any discussion of the meaning of our freedom in the world and its struggle against the threat of its nothingness as a created reality, independent of who God himself truly is with us. There is a beauty behind what we ought to be and become, bound up freely with who God truly is with us.

Our freedom is bound up with God's choice to come with himself, where he will, as who he is, and be there for us.

When I first grasped the importance of this point, I was excited to think that I might work out some of its significance in my time. I loved the idea that freedom and meaning in existence were bound up with each other in such a happy way that a grateful man was one who spent his time passionately knowing with eternal significance his destiny upon the earth. The threat of the nothingness of my being, with which I had suffered so much in my life, was overcome with a sense of joy and the feeling of God's holy love for me. God can be trusted with the vanity of our existence, truly and freely. Here we can experience the person of Christ resurrected; and, with this goodness, we can see and hear the world as his creation—for what it really is, in its destiny with him. To my surprise, this point was very difficult to explain. We readily use our freedom in ways other than the way God has chosen for us, preferring the idol. We give meaning to life out of ourselves (our self-righteousness) rather than living it in the light of God's Word. Because of this, I soon found that there was more resistance to this point than I had anticipated—both in myself and in many others. I have experienced personal healing and transformation under its compelling reality. We are free, but we are bound to God in a way we do not naturally, as fallen creatures, embrace. We must be transformed to prove any divine will in our lives.

This involves us in a deep and great mystery. Our freedom is bound up with God's choice to come with himself, where he will, as who he is, and be there for us. We must have a doctrine of God whose dynamics correspond to the reality of such freedoms. What is our freedom in relationship to this divine freedom? I have asked hundreds of students in classrooms at every level of the educational process to consider these freedoms with me. God, as the In-

carnation of the Word, the Creator, and the Redeemer, makes us face the most challenging reality. Only in this context, may we conceive that something can be made out of nothing. To make something out of nothing in any other way is to make the idol. My students would literally quake under the impact of this truth. I will never forget the look on so many of their faces when, for the first time, they were asked to take seriously the reality of the relationship between God and humanity in this way. Here is a new center of being, where a divine-human freedom constitutes the space and time of the universe in a new way for us—a way that provides the real relational veracity with God's own eternity that binds us to our destiny with God. I have often found myself quoting to my students the exclamation of St. Paul, "Let God be true, and every man a liar" (Rom. 3:4). The command of the Gospel in our lives creates a relationship between God and us so that we truly can know him, who is the real Creator of all.

The command of the Gospel in our lives creates a relationship between God and us so that we truly can know him, who is the real Creator of all.

I am deeply indebted to the works of Professor Torrance for their help in this reorientation and direction. Repeatedly, he has explained the problem of the nature of this divine-human command which is at the new center of meaning for our being and knowing by referring us to one analogy that he has found in the development of our scientific culture concerning geometry and experience. Just as geometry and experience were thought together in order to accomplish the articulation of the relativity theory by Albert Einstein, so we must learn to think together "natural theology" and "revealed theology."[17] When we learn that the laws of the universe are embedded in the beauty of God's holy love and power in this way, without allowing any dualistic notions about experience and thought to posit a chasm between them, it is possible to conceive of a new integration provided by the relational veracity between them.[18]

Einstein's relativity theory is based upon the assumption that the nature of light's constant speed serves as a defining reality in the universe with us. Light is a primary and given truth in whose nature all the order we experience in the universe is entailed. In contrast to Newton's "System of the World," with its absolute space and time, the space-time of Einstein's universe is defined by this given nature of light, both in its macroscopic and microscopic dimensions. Light occupies a unique space-time place in the universe unlike any other.[19] From this place is defined the space-time of the matter and energy of the world. This is the physical reality codified in the famous formula $E=mc^2$. The invariance of the space-time of the universe of light rests upon the constant speed and field dynamics of the nature of light. No one coordinate system experiences this light in any special way. There exists no absolute space or time from which any experience of light can be generalized into a universal system. All systems must be transformed by definition with the invariance of the space-time of light for objective relationships to be comprehended by them appropriate to this nature of light in the universe. The beauty and simplicity of this world possesses a compelling experience that light itself provides with a singularity that must be respected. The universe is a universe of light whose orders and freedoms are bound up with the unique nature given to us as the space-time of light. It is this given nature of the universe that could cause Einstein to refer to the Ancient One. It was the miracle that we were made to grasp—this kind of nature which was the source of wonder in the epistemic stance of the scientist as he faces the reality of the universe. Reality was grasped in all of its depths with the miracle that understands both the determinate character and the infinite nature of this universe's physical nature. It was fundamental to the experience of this wonder that we ought to understand that "science without religion is blind, religion without science lame."[20]

Causality, as it is understood in the relativity theory, does not appear in the quantum world. ... Science is faced with the fact that it has two very different ways of dealing with what it calls "universe."

But the invariance of light comprehended on the macroscopic level of reality by the relativity theory, possesses a nature that, on the microscopic level of our experience, does not allow us to experience the same causality at all. Instead, we face an uncertainty in very small spaces and micro-events whose nature requires us to deal with its reality with very different

notions—by resorting to probability theory and statistical mechanics which do not permit us to posit causal descriptions of nature. Causality, as it is understood in the relativity theory, does not appear in the quantum world. The quantum event is different from the field of light in Einstein's universe. Science is faced with the fact that it has two very different ways of dealing with what it calls "universe." But to name the world "the universe" is to desire to think these two ways together. This is the dilemma which our creative scientists today seek to overcome by comprehending the "fiery marriage" that must exist between them.[20]

As theologians, we understand this struggle as the surfacing ... of the substantial nature of contingent intelligibility and contingent rationality with which we must learn to grasp the depths of the world's nature.

Scientists of good conscience the world over are now engaged in science in this way. As theologians, we understand this struggle as the surfacing, so to speak, of the substantial nature of contingent intelligibility and contingent rationality with which we must learn to grasp the depths of the world's nature. We know that contingency is a theological category of thought and not one science posits. It belongs to the realms of wonder, beauty, freedom, and the transfinite depths of the universe of light. The laws governing the causality of the universe are such that their nature may not be conceived as eternal. But their "timefulness" cannot be identified directly with any logico-causal necessity inherent within its nature. Its causality cannot be universalized with generalizations of particular relational patterns of logico-causal connections discovered on the determinate levels of its reality. These patterns are made to signify the contingent nature of the world. Their laws are contingent laws rooted in a ground that is quite beyond the laws themselves, creatively dependent upon the freedom of the divine power of the light of God's Word to create, sustain, and give them reality and meaning. In 1932, Kurt Gödel helped us appreciate the nature of rational systems in this way. No mathematical intelligibility consistent within itself is or can be meaningful of itself. His theorem, applied to the universe as a whole, makes this point about contingency evident.[22] The universe of light is a contingent reality the nature of which, independent of the divine nature, is dependent upon it for its explication. The light of the universe and its constancy depend on levels of reality quite beyond the nature that light defines as the universe with us. Thus, the problems we face are bound up with the significance of the contingent freedoms and orders in the world in their real relationship with the divine freedom and order.[23]

The causality does not provide a deterministic world system for us to comprehend. As a created universe, the system of the world must be freely comprehended, and because of this can easily be misconstrued. Human will and imagination are such that they readily make idols rather than worship the living God in spirit and truth. This is the fundamental problem to understanding the relationship between God and the world, between the divine nature and the physical nature of the universe. The metaphysical foundations of the physical nature of the universe may be despised either by indifference or aberration. The history of the Sacramental Universe and the System of the World in the development of thought about the world are lessons in these aberrations and this indifference, but they do not invite us to ignore the relationship or treat its poles as enemies against each other. They teach us that will and imagination need forgiveness and reconciliation in the light of the revelation of God. It is this *need*, and the positive dimension of revealed truth in meeting it, that provides the ground upon which we may build a real understanding of the world as a universe and a creation of God.[24] Therefore, we must understand that it is more precise and pious to go from the communion table to the study of the world as God's creation than from the creation to the communion table. There is nothing in the creation itself which can meet the deepest *need* of the human race. The *need* is met in union and communion with the Creator or it is not met at all. I believe this is the point of Barth's "*nein*" to Brunner and Torrance's direction for us.

For theologians, I believe, this point is breathtakingly beautiful. There is a given nature to the orders of the universe to which we cannot penetrate with any causality that we may discover within the universe. To be a sufficient one, the first cause must exist outside the universe's nature altogether, with the nature and will of the freely living God. Thus, as Einstein liked to put it, the universe's intelligibility compels rationality on our part that rests ultimately upon the will of the Ancient One. Reason incarnate in the depths of the reality of the universe belongs to this One. He may be subtle, but he is not malicious, and he is faithful with his wisdom to what he has been caused to exist. The problem

then simply becomes who or what is this Ancient One, a simplicity to which the world may be indebted, but does not possess. For science to be science, independent of the divine nature, it does not have to ask the question of the Ancient One. Yet it must ask it, dependent upon him, if it is to seek its meaning. The ever increasing demands upon science in our society to deal with what it ought to be and why forces both theologian and scientist to give the question our best attention.

There is nothing in the creation itself which can meet the deepest* need *[forgiveness and reconciliation] of the human race. The* need *is met in union and communion with the Creator or it is not met at all.

I have learned much of my science from my late friends, Professors W. Jim Neidhardt and Boris Kuharetz of the New Jersey Institute of Technology. Jim not only taught me Quantum Physics, but his work with Bohr's complementary[25] and the "strange loop" principle has helped me to see the urgency for conversations between theologians and scientists.[26] Boris Kuharetz was a very great teacher and an accomplished astrophysicist who was very generous with his time with me. His work with Professor Jeffrey M. Cohen of the University of Pennsylvania has yet to be properly evaluated.[27] He often would end our talks with one of his favorite sayings, "If it is not music, it is not real!" Science and theology were friends because of the music the Word of God orchestrated with his creation. He also often quoted Deut. 29:29: "The secret things belong to the Lord our God, but the things revealed belong to us and to our children forever, that we may follow all the words of this law." I would like to dedicate this essay to these men of God and science. ✾

Notes

[1]*Church Dogmatics*, III, no. 2, 3-19, where Barth concludes that "Thus we lose nothing and gain everything if we resolutely refuse to make the doctrine of the creature a doctrine of the universe, a cosmology." Man in the cosmos as a theological creature must be free from commitment to any particular cosmology, as taught by both history and the Bible.

[2]Torrance believes that misunderstanding at this point accounts for much of the resistance to Barth's thought. He has sought to argue for and with his mentor over its significance. See, for instance, the essay, "Natural Theology in the Thought of Karl Barth," in *Transformation & Convergence in the Frame of Knowledge* (Belfast: Christian Journals Limited, 1984), 285-301.

[3]See Torrance's essay on the "Status of Natural Theology" in *Reality and Scientific Theology*, (Scottish Academic Press, Edinburgh, 1985), pp. 32-62, where he writes, "All this must not be taken to mean the end of natural theology, however, but rather its need for a radical re-construction through a profounder way of coordinating our thought with being" (p. 39).

[4]In private conversations, Professor Bromiley told me that one reason he came to the western United States was to help Torrance persuade the American Church to read Karl Barth. When I asked him if they had been successful, his answer rang in my ears and still rings there—the way Barth's response to Brunner must have rung in his.

[5]Torrance has written, "Yet it is also evident that the gap that remains at this crucial point where we are concerned with the fundamental structure of Christian theology will not be closed until Reformed and Roman theologians devote more attention to the *nature* of the epistemological and logical structures that arise in theological inquiry and are thrust upon us from the intelligible reality of God's own eternal being" (*Transformation & Convergence*, op cit., 301). I am simply including evangelical scientists in this struggle.

[6]Right from the start and throughout his *Church Dogmatics*, Barth argues against the *analogia entis* for the development of Christian theology. In its most radical form, it is the epistemology of the anti-Christ. The "analogy of being" is to be denied any value whatsoever for theology and an "analogy of faith," *analogia fidei*, affirmed. But this never meant for Barth—despite much criticism—that faith could be divorced from reason, belief from knowledge, or revelation from history. Both transcendence and immanence, the ontological and the dynamical, are vital for understanding the way Barth sought to create a theology rooted in the reality of God himself in the real history of the world, as the creation of the Creator he actually is.

[7]*Church Dogmatics*, IV, no. 1, 453-58.

[8]One can simply study his exegesis of Ex. 3:14 in the *Dogmatics* to see this point.

[9]Torrance has discussed these issues in his essay, "Natural Theology in the Thought of Karl Barth," where he writes convincingly of Barth, "From this perspective it becomes clear that what Barth objects to in natural theology is not its rational structure as such but its *independent* character, i.e., the autonomous rational structure which it develops on the ground of 'nature alone' in abstraction from the active self-disclosure of the living-God" (*Transformation & Convergence*, op. cit., 293-4).

[10]There is no theologian who has written more brilliantly on Christ and time than Barth (*CD*, III). I believe that we need a fresh assessment of time's nature and its relationship with the divine nature in our generation. Science has made great progress in understanding that the nature of time must be explained from the imageless dimensions of a world whose simplicity is far more profound than positivists or empiricists might have imagined.

[11]*CD*, III, no. 1, ix-x. Barth claimed no competence in science and the relationship of science to the world as God's creation. He claimed, however, that the relationship between

them was such that a theologian could very well proceed to interpret the Bible's doctrine of creation without this competence. The Bible is its own defender.

[12]This is Barth's affirmation of the relationship between covenant and creation. The creation is the external basis for the covenant, the covenant the internal basis for the creation (*CD*, III, no. 3).

[13]Torrance attempts to make this point often throughout his many works. Perhaps a book like *Reality and Scientific Theology* (1985), is a good start toward appreciating the cogency of the point. But Torrance has often argued that, just as Einstein transformed Euclidean geometry from its absolute place in classical mechanics as an antecedent conceptual system for the physics of the universe into a four-dimensional space-time invariance at the heart of its physics, so Barth may be understood as calling for the transformation of "natural theology" at the heart of the self-revelation of God, where it takes on a significance appropriate to the grace of God in Christ as the Creator and Redeemer of the world.

[14]This taking seriously of the prologue to the Gospel of St. John has a long history in the development of thought by the fathers of the Church. The first person to apply these categories to the actual physics of the world was, to my knowledge, John Philoponus, the sixth-century Alexandrian scientist. He employed the category of the divine power of the uncreated light of the Word become flesh as that center around which concepts for the space and motion of the form and matter of the cosmos might be comprehended (see my unpublished Ph.D. dissertation at Fuller Theological Seminary, 1987).

[15]The strong anthropic principle developed in scientific culture in our time is an indication, I believe, of the way we must learn to think of ourselves as both priests of creation and sacraments in the Church (cf. for instance, J. D. Barrow & F. J. Tipler, *"The Anthropic Cosmological Principle"* [1986]).

[16]Torrance writes, "It is at this point that we can discern the effect of rejecting a natural theology as an antecedent conceptual system independent of actual knowledge of God, and of reconstructing natural theology within the positive or revealed theology in much the same way in which geometry now becomes a form of natural science in the heart of physics." ("Trinitarian Structure of Theology," in *Reality and Scientific Theology*, 163).

[17]See, for example, chapter 3, "The Science of God," in *Reality and Scientific Theology*, 64-97, for an effort to make this point. But I have found that there is a beauty to it that, once a student will lay hold of it, shapes a very positive potential for knowledge in our being that is quite exciting. It is not a positivism, but a real grasp of reality so that the problem of nothingness is comprehended in the freedom of the creation that is laid hold of by the real humanity of God in Christ in the world. Here faith and knowledge are married in God so there is no possibility of their divorce and an appropriate exclusion from confusing them with each other. The human imagination is actually free then to will with its knowing the will of God in the world.

[18]See especially Torrance's "The Integration of Form in Natural and in Theological Science," in *Transformation & Convergence in the Frame of Knowledge*, 61-105, op. cit.

[19]I am reminded of the Lord's rhetorical question to Job, "What is the way to the abode of light?" (Job 38:16).

[20]Einstein's famous saying can be found in "Science and Religion," in *Out of My Later Years* (Secauscus, NJ: Citadel, 1956), 26.

[21]Thus, John Archibald Wheeler and his students still seek to articulate the unified field for which Einstein devoted his life, if in a strangely altered manner. Cf. K. S. Thorne, *Black Holes & Time Warps, Einstein's Outrageous Legacy* (New York: Norton, 1994).

[22]The point is much debated among scientists as it is applied to various areas of concerns (cf. F. J. Tipler, *The Physics of Immortality*, [1994], 24-32 and 191-194, where freedom and determinism are discussed in our modern context to produce, I believe, a kind of Gnostic worldview). I am arguing here that freedom means contingency in a way that must point us to a freedom that rests in God's actual divine nature or nowhere.

[23]This is the argument in *Divine and Contingent Order* (Oxford: Oxford University Press, 1981) by Professor Torrance.

[24]This is the reason evil must be considered as something more than the absence of good. It possesses an activity, the force of which is against the personal interaction of God with us, ibid., 85-142.

[25]See *Neils Bohr, A Centenary Volume* (1985), 121-40, for an account of the principle of complementarity and the struggle between Einstein and Bohr. I understand it to be the problem of the principle of causality and of human consciousness and its objective relationships with what exists outside our human knowing and being. Einstein argued for the principle and Bohr embraced it with indeterminacy and uncertainty as fundamental to it. Einstein did not like indeterminacy as a fundamental principle. It could provide only a partial description of reality. He sought for a causality that was realistic and appropriate for the contingency of the universe. Contingency could not mean a letting go of reality into an unknowing from which he had just emerged with his relativity theory. His relativity theory was the way into the future, whatever the future of science would discover for us. The principle of causality would be intact even if in a form quite different from classical causality (cf. Einstein, *Out of My Later Years*, [op. cit.], 59-110).

[26]His book, written with Professor James E. Loder of Princeton Theological Seminary, *The Knights' Move* (Colorado Springs: Helmers & Howard, 1992), is an illustration of what friendship is in this area. Here transformations and knowledge of God would establish our knowing and being so that both subjectivities and objectivities are given appropriate meaning and freedom.

[27]He was especially happy about the paper, "Relativistic hydrogen atom: Wave equation in Whittaker form," *Journal of Mathematical Physics*, 34 (November 1993): 4964-5974. Professor Kuharetz liked the way that the spectrum of atomic structure developed from the hydrogen atom depends ultimately upon a "free parameter."

Communications

Love of Enemy, Natural Law, and Medicine

Igor Kiss

Palisady 46
811 06 Bratislava
Slovakia

Medicine belongs to those vocations which are not possible to implement without altruism. Medicine needs the self-sacrifice of one's own life. In medicine, for example, many radiologists put their own life on the altar of service for their neighbors. The theme of my communication points to another ethical aspect of medicine which is sometimes overlooked. Medicine sometimes asks for the love of enemy from doctors and nurses. This is shown in the Hippocratic oath, in which doctors pledge to help all who need medical care. Sometimes the person who needs the doctor's help could be an enemy. According to the Hippocratic oath, a doctor is required to provide the necessary medical care to *all* patients—even an enemy.

During World War II, a German civilian doctor who was living in Slovakia provided medical care not only to German soldiers, but also to Slovak partisans in the mountains. Information about him came to the ears of the Gestapo. This doctor defended himself to the Gestapo with the words: "The Hippocratic oath binds me to cure all people without differences—also my enemies." This story shows us that medicine is a special vocation and science, which in contrast with many other vocations and sciences, pledges the doctor to the love of an enemy. In moments of combat, soldiers and police do not have this duty. An enemy has to be overcome with the power of guns, bombs, swords, and sometimes knives. But a knife in the hands of a surgeon can be used during surgical combat only for the benefit of the patient—even if this patient is an enemy.

Medicine as a vocation has its own unique ethics. Medical ethics have their end beyond the borders of traditional humanism which does not require the love of enemy. Medical ethics are in some measure transcendental ethics. Their demands are sometimes superhuman. They are not only the strict ethics of natural law; sometimes they are the ethical imperatives of absolute ethics. Theologically speaking, they are the ethics of *lex Christi* (law of Christ) of the Kingdom of God as taught in Jesus' Sermon on the Mount: "Love your enemies." The strict historical understanding of natural law does not know such a principle.

Many people think that Jesus' commandment to love one's enemies is too utopian for this world. We cannot rule the world with the Sermon on the Mount and the love of enemies, says Martin Luther. He tried to solve this utopian character of love of enemy through his doctrine of the two kingdoms. The absolute norm of love of enemy belongs to a Christian's individual and work ethics. Vocations (e.g., medicine) belong to the worldly things. In the secular kingdom, absolute ethical maxims cannot always be valid. The secular kingdom is the area of the principles of natural law. In the historically-understood strict natural law, there is no place for love of enemy. Therefore, natural law knows the use of force and power against the enemy.

Luther's doctrine of the two kingdoms is in my opinion the correct ethical solution to this problem. In this world, we cannot always use the ideals of

the absolute ethics of the Kingdom of God. The ethical imaginations of the Anabaptists in Luther's time, as well as the ideal principles of Tolstoy's ethics, are not implementable in this world. Because of human sin, it is sometimes necessary to defend society from enemies or criminals by power. The ethics of the Sermon on the Mount are usually useless in this world.

If we should apply the principles of strict natural law to medical ethics, the German doctor in Slovakia, of whom we spoke earlier, would not have been able to treat both German soldiers and Slovak anti-Nazi partisans in the time of war. But from the oldest times of the pre-Christian era of Stoic ethics, many humanists have felt that medicine must transcend the strict natural law ethics, the ethics of historically-understood natural law. For this reason, Hippocrates demanded that doctors help all who need medical assistance. Medicine cannot differentiate between friends and enemies in its activities, as do other secular vocations.

This searching for the right medical ethics, whether to see medical ethics under the commandments of absolute ethics (with its love of the enemy) or under the commandments of natural law (with its relative ethics, which do not know the love of enemy), has continued through the ages. Enemies have been denied medical care many times. After battles, the wounded and injured have not always received medical care from the side of the winners. A new milestone in medical ethics was Jean Henri Dunant and his idea which became the Red Cross. The Red Cross has helped soldiers on the enemy side. The theological consequence of its activities is amazing. It showed that in the secular kingdom (if we are thinking in the terms of Luther's two kingdom doctrine), there are some vocations, such as medicine, which are applying love of enemy. In this sense, something is present in medical ethics from the ethical norms of the Kingdom of God. Medicine does not differentiate between friend or enemy. It serves all people equally. In this area, medical ethics are more than ethics of strict natural laws. In the question of healing one's enemies, it is an ethic of absolute moral norms. It knows not only the love of neighbor, but also the love of enemy. Dunant showed us that it is possible to transcend the traditional historical understanding of natural law and to create a new, more humanized understanding of it, which is nearer in some aspects to Jesus' Sermon on the Mount.

Mahatma Gandhi also showed us that the love of enemy is sometimes rational in the realm of natural law. For this reason, Gandhi and Dunant are both significant in the history of humankind. Through them humanity is one step forward in its understanding of the usage of the love of enemy in the world.

All this is in full accord with the healings which Jesus performed. When we watch the healing activities of Jesus, we see that he connected his healing with the love of enemy. When the Apostle Peter cut off Malchus' ear in Gethsemane, Jesus healed Malchus. Even to his enemy, Jesus showed merciful love. Similarly in his parable of the Good Samaritan, Jesus showed the example of a man (a Samaritan), who gave medical help to his enemy (a Jew), despite the enmity between Samaritans and Jews in that time. Jesus ends this parable with the words: "Go and do likewise." We can explain Jesus' words in this sense: "Heal also you your enemies!"

The love of enemy will play an even greater role in medical ethics in the future. Some new medical achievements require the love of enemy. For example, if somebody gives blood for a transfusion, it is given to an unknown person, perhaps even to an enemy. Also, people who give permission to donate their bodily organs for medical transplantation after their death, give them for all people—perhaps even their enemy. So in some situations, medical ethics transcend all common moral norms and stand on the principles of absolute morality, the ethics of the Kingdom of God and Jesus' Sermon on the Mount.

Now we are standing before the final and most difficult question: Are all medical ethics perhaps ethics of absolute norms? We know that, according to Hippocrates, all medical ethics have to fulfill the ideals of absolute ethics. For this reason, Hippocrates rejected medical help in abortions. The Roman Catholic Church stands on the same position: medical ethics have to be led by the principles of an absolute morality. Roman Catholic ethics are strictly deontological, knowing no situational teleology in ethics and, therefore, no exceptions in ethical behavior. Roman Catholic doctors and nurses are forbidden not only to participate in abortions, but also in in vitro fertilization in all forms (even in the framework of matrimony), the prescription of contraceptives, and active euthanasia. On other hand, Protestant medical ethics see the elements of absolute ethics in helping an enemy only as a fragmentary and partial breakthrough of the absolute ethics of the Kingdom of God in medicine. Normally medicine is a secular science guided through the ethics of natural and state laws, which are relativized due to the situation of the sinful world. In fact, Protestant ethics are also deontological, the same as Roman Catholic ethics. They are also against abortions, but

they allow some teleological and situational exceptions. Therefore, Protestant medical ethics acknowledge some situations connected with life problems, where a doctor must deviate from the principles of absolute ethics and participate in an abortion.

It does not mean that Protestant ethics are for free abortions but that they know some situational indications for abortion. In the questions of in vitro fertilization and contraceptive use between husband and wife, Protestant ethics do not see them as the demands of an absolute ethic as Roman Catholics do. Therefore, according to Protestant ethics not all medical ethics are built on absolute moral norms.

Medical ethics must sometimes follow the relativized moral of natural law, but medical help to the enemy is a special case. Here medical ethics fulfill the criterion of Jesus' Sermon on the Mount and apply the principle of love of enemy. From the traditional historical understanding of strict natural law (which does not know the love of enemy) we go to the more humanized understanding of natural law (which in some cases knows the love of enemies). So in the historical development of humankind, there is gradually found the optimal humanized understanding of natural law, which in some aspects is nearer to the norms of absolute ethics than was the historical strict understanding of natural law in the past.

Jesus' teaching on the love of enemy is useful after all. There are vocations and sciences in the world where we must use it, as in medicine. The false solution is only to use it generally, as Tolstoy did. ✱

ASA on the Internet

Discussion on the ASA ListServ

To **subscribe** to this list, send e-mail to majordomo@calvin.edu with the words "subscribe asa" (no quotes) in the body of the message.

To **terminate** your subscription, send e-mail to majordomo@calvin.edu with the words "unsubscribe asa" (no quotes) in the body of the message.

To receive a **help** document for Majordomo software, send e-mail to majordomo@calvin.edu with the word "help" (no quotes) in the body of the message.

ASA-Digest Also Available

In a digest several messages come combined in one e-mail message. Messages from the previous 24 hours are sent out at 7:30 a.m. each day.

To **subscribe** to this digest, send e-mail to majordomo@calvin.edu with the words "subscribe asa-digest" (no quotes) in the body of the message.

To **terminate** your subscription, send e-mail to majordomo@calvin.edu with the words "unsubscribe asa-digest" (no quotes) in the body of the message.

Posts to the lists should be sent to asa@calvin.edu

ASA Web Site

An **archive** of this list is available via World Wide Web at the URL:

http://www.calvin.edu/archive/asa/

The **ASA home page** is located at:

http://www.calvin.edu/chemistry/ASA/

An **index of PSCF articles on line** is at:

http://www.calvin.edu/chemistry/ASA/papers.html

Articles from PSCF are at:

http://www.calvin.edu/chemistry/ASA/PSCF.html

An **index of ASA's on-line resources** is at:

http://www.calvin.edu/chemistry/ASA/resources/index.html

The **ASA Statement of Faith** is at:

http://www.calvin.edu/chemistry/ASA/faithASA.html

ASA List Manager

Terry Gray, in the Chemistry Department at Calvin College, is list manager. He can be contacted by e-mail at grayt@calvin.edu

The Great Experimenter?

James O. Morse*

925 Church Road
McGregor, TX 76657

Those of us who occupy a middle position in the creation-evolution debate are still searching for a satisfactory answer to one question that those at the extremes of the debate do not have to worry with. That is, why would an all-powerful Creator go about populating the Earth in the halting, roundabout ways of theistic evolution or progressive creation, if he knew from the beginning what he wanted and how to get there?

Of course, the fiat creationists have no such problem since for them creation definitely was carried out quickly and deliberately. Their main problem lies in explaining away the fossil evidence for a large variety of creatures that came and went long before humankind ever appeared. The Gap Theory probably provides as good an alternative explanation as any for this purpose.

Secular evolutionists from Darwin to Stephen Jay Gould have argued that imperfections in nature are clear evidence that no superior intelligence could have been involved in their creation. At least no intelligent Creator would have designed so many body parts less well than a present-day engineer could.[1] Why does the human body, for example, have a vertebral column that seems better suited for our walking on all fours than for standing all day, an appendix that seems designed for no useful purpose other than the enrichment of surgeons, gills on embryos which will never swim in an ocean, and a reproductive system that is so inefficient that half of all pregnancies end in miscarriage? If there were an all-knowing, all-powerful Creator, would he not have done a better job of designing for safety and efficiency than what we see in nature? Why would a supernatural Creator have littered the landscape with the remnants of millions of kinds of creatures that long ago became extinct and why would he have left several unusable oddities in the bodies of both embryos and adult living creatures? To secular evolutionists this seems to indicate a ridiculous streak of whimsy in the character of the Creator.

A typical conclusion from the secular evolutionist viewpoint is that of Beverly Halstead, a British scientist: "I personally do not see how the concept of evolution can be made consistent with that of creation by a personal god, or indeed any sort of God."[2] At least, it's puzzling to many why an all-powerful God, who already knew everything, would choose such a haphazard way to design humankind. Also, the picture of a Creator, who could have done better but didn't care to do so, does not appeal to most people.

Of course, a believer can always say that God must have had his own reasons, that that's just the way he did it, or that it's not our job to question his workings. But can we really expect to get even a borderline agnostic to consider the possibility of intelligent design, if we are unable to explain the intelligence behind the design?

Theists could argue that maybe God chose to create living things in the rather halting ways of gradual evolution or progressive creation just to make his involvement in creation less obvious and avoid forcing anyone to believe in his existence against their will. This could be seen as the flip side of the argument from design. The fact that this freedom to disbelieve did not really become widely operative until Darwin came along is against this being an important reason.

It might be helpful if we were to take seriously the advice of the Apostle Paul and look at the details of nature to help us gain a better understanding of the workings of the Creator. "Ever since the creation

**ASA Member*

of the world his eternal power and divine nature, invisible though they are, have been understood and seen through the things he has made" (Rom. 1:20, NRSV). While we don't seem to have much difficulty in seeing the evidences of God's power in the mountains, the seas, and the heavenly bodies that he has created, we may be overlooking what the living creatures he has made can tell us about the limitations imposed on the creative process by his divine nature.

Edward Fredkin, one of those largely self-taught pioneers in computer science, has compared the task of creating and operating the universe to that of running a computer program. From such a comparison, he has drawn a rather unconventional theological conclusion:

> There is no way to know the answer to some question any faster than what's going on ... Suppose that there is an all-powerful God. And he's thinking of creating this universe ... Okay, now, if he's as all-powerful as you might imagine, he can say to himself, "Wait a minute, why waste the time? I can create the whole thing, or I can just think about it for a minute and just realize what's going to happen so that I don't have to bother." ... I can say I don't care how powerful God is; he cannot know the answer any faster than doing it. Now, he can have various ways of doing it, but he has to do every ... single step with every bit or he won't get the right answer. There's no shortcut.[3]

Could God's knowledge of the future actually have been that limited when he set out to create the universe? It is no longer unusual to question whether God could actually have foreknowledge of the decisions that human beings may make in the future without destroying their free will. (For example, see Richard Rice's *God's Foreknowledge and Man's Free Will*.[4]) Fredkin gets into a related area when he denies his hypothetical Creator foreknowledge in the process of creation.

Is there any evidence to back up Fredkin's claim other than making analogies with the functioning of computers? Does the universe itself suggest that he is right? If a supernatural Creator were subject to the limitations regarding knowledge of the future that Fredkin believes that he would have to have been, could he have predicted exactly what would happen in response to each of his creative acts? Might we find a clue if we consider how such a Creator might have gone about creating the universe and filling the earth with living things, if his foreknowledge of the results were actually as limited as Fredkin believes?

The usual fiat creationist pictures God as architect and engineering designer. First he planned exactly how all things—from the smallest nuclear particles up to the largest star—were going to be constructed and how they were to function in his new universe. Then he created it all from nothing and set it in motion. Unfortunately for the creationist case, such a Creator may not have been in the same situation as human planners are when they set out to design a building or a machine and then build it. They, at least, have had some experience in similar designs or have books by other, more experienced designers to fall back on. They also know something about the materials they will use.

On the other hand, the creation of the universe could have been a new experience for even an eternal God unless, of course, he had experimented earlier (as the Gap Theory implies). The results, however, favor this universe's being the original experiment. In Fredkin's terms, God is still waiting for this "computer" to grind out the final answer.

Since even God may not have been able to predict exactly the behavior of particles that had never yet existed, much less what would result when they were placed together, a logical place to start might have been to create some undifferentiated matter and see what could be done with it. Maybe just take a lump of nothingness and split it into matter and anti-matter. Then wait until the dust had settled from the resultant explosion before proceeding to shape it into the universe we know.

When it finally came to making living creatures, a Creator with limited experience likely would have begun with simple organisms and gradually added more complicated features. To save time he may have tried a variety of approaches almost simultaneously (as in the Cambrian Explosion). He may even have used natural selection to make improvements in some and to discard what was unpromising in others. Some creatures would be allowed to become extinct, while others would be left to just occupy a niche that suited them and change very little over the years.

François Jacob, a French geneticist, has concluded that the designer of the creative process did not work as an engineer might but rather as a tinkerer would. He used parts available from earlier model machines to produce an improved, but still workable object. "Evolution does not produce novelties from scratch. It works on what already exists, either transforming a system to give it new functions or combining several systems to produce a more elaborate one."[5] Isn't

it likely that a Creator without previous creative experience in the area would do the same?

Professor Halstead partly agrees: "If the process were directed it suggests that God was continually learning from his mistakes."[6] Perhaps, except that "mistakes" or "errors" are not the usual terms we use when an inventor (or a cook) tries something that has never been tried before and does not initially get the results that he or she had hoped for. "Experimentation" better describes the process.

Actually human engineers are not always as successful in designing new pieces of equipment as we would like to think. This is particularly true if the new structures bear little resemblance to anything already in existence. Some of the most notable recent flops have been in military hardware. The results have generally been more satisfactory (and with fewer cost overruns) whenever engineers have been allowed to gradually improve the design of equipment that was already in use. Similarly an intelligent Creator might have worked just as the tinkerer that Jacob describes, if that were the most reliable way to arrive at workable structures given the paucity of prior experience with anything similar.

If scientists such as Fredkin and Jacob are reading the record correctly, it may be more accurate to think of the Creator, not as the Great Designer, but as the Great Experimenter. It may well be that God utilized the gradual development of organisms by mechanisms of both natural and guided selection or that he actually created a series of progressively more complex organisms because that was the best way to get the desired results.

Fortunately God did not wipe the slate clean after each stage and leave us in the dark about our origins. He has left the remnants for us to discover and interpret. God as experimenter rather than God as designer might be a more useful paradigm for understanding his workings.

To some it may seem heretical to suggest any limits on the foreknowledge of God, but actually Judaism and Christianity have always claimed that God is all-knowing only of things that are knowable. He is all-powerful only to do things that are doable. We hardly honor him to claim things about him that could not be so. We need to take into account the actual Universe that we have as we try to understand better the Creator who made it. This is not to build a natural theology from scratch as much as it is to use the facts found in nature to clarify the revealed theology we already have. The result should be more scientifically defensible and might even remove a few of the stumbling blocks that keep some scientists from considering religious faith as a personal option. ✱

Notes

[1]Stephen Jay Gould, *The Panda's Thumb: More Reflections in Natural History* (New York: W. W. Norton & Co., 1980), 26.
[2]L. Beverly Halstead, "Evolution—The Fossils Say Yes!," *Science and Creationism*, ed. Ashley Montagu (New York: Oxford University Press, 1984), 240.
[3]Robert Wright, "Did the Universe Just Happen?" *Atlantic Monthly* (April 1988): 43.
[4]Richard Rice, *God's Foreknowledge and Man's Free Will* (Minneapolis: Bethany House, 1985).
[5]François Jacob, "Evolution and Tinkering," *Science* 196 (June 10, 1977): 1161-1166.
[6]L. Beverly Halstead, "Evolution—The Fossils Say Yes!" 240.

"Planet Earth"? or "Land"?

William F. Tanner*

Florida State University
Tallahassee, FL 32306

Ancient Greek and Hebrew words which are commonly translated as "earth" ("Earth") or "world" in the English Bible, do not refer to the planet on which we live, but rather to "land," "country," "ground," "soil" or "dirt." The meaning of "all the Earth" is vastly different from "all the land." The concept of our home as a planet *was not known until many centuries later, because it was not known that any planet was anything more than a point of light. The discovery that the Earth is essentially a sphere (e.g., "round") is not closely related to the equally important discovery that it is one of the planets. Modern English-English dictionaries do not invariably make the necessary distinctions, in some instances even citing "earth" (without an initial capital E) as the* name *(identification) of our planet, although other planets, such as Venus, are identified with a capital initial letter.*

Many letters of the Greek alphabet can be represented, at least in an approximate way, by English (e.g., Latin) letters, such as "k" for the Greek *kappa* and "t" for the Greek *tau*. Several others become ambiguous when rendered in English. For example, both *epsilon* and *eta* are commonly shown by the English "e," though the former (as in "met" and "set") is quite different from the latter (roughly as in "day" and "say"). In this communication, *epsilon* is represented by "e" and *eta* is indicated by "ê." Likewise "omicron" (as in "dog" or "log") is shown as "o," whereas *omega* (as in "go" or "slow") is indicated by "õ."

The English words "earth" (or "Earth") and "world" are commonly used to translate various ancient Hebrew, Greek, and Latin words, which did not actually carry the same meanings as the popular modern renditions suggest. These popular mistranslations appear to be based on presuppositions and/or modern observations, rather than on the meanings of the ancient words themselves. That is, these translations may show what the translator believed the record *should* have shown, rather than its actual meaning. This may be the error of *over-editing* in the process of making the translation; it is an error that is very difficult to avoid.

Two main classes of examples are discussed here: (1) those words that are translated as "earth" (or "Earth"), and (2) those that are translated as "world." Regardless of the intent of the translators, the typical reader takes the English rendition, in either case, to mean "the planet on which we live." Unfortunately, this is not the meaning that should be associated with either of these words.

The three main topics in this communication are (1) words that are commonly rendered as "earth" (or "Earth"), (2) words that are commonly translated as "world," and (3) the concept of our home as a planet, in certain important ways like other planets such as Venus and Mars, rather than merely as a flat platform on which we live ("flat earth" idea). This last idea is central to the ancient earth-centered (geo-centric) model of the universe, even though it may not be stated explicitly.

Earth

The pertinent ancient Greek word is *gê* (with an *eta* rather than an *epsilon*). This word also appears as *gea*; and, in poetical or metaphysical writings, as *gaia*. It is correctly translated as earth (*not* Earth), that is, as loose earth, dirt, soil, ground, land, or country. It refers to something that an observer can see, at least in good part, in the immediate neighborhood, by simply looking. In some English renditions of the Old Testament, it has been taken to mean "Earth" (that is, the planet on which we live). In some translations the ambiguous word "earth"

*ASA Member

is used (not capitalized, but perhaps with the definite article), but the reader is then free to assume that "Earth" was intended, rather than "land" or "ground," especially if the definite article was present ("the earth" rather than "the land"). The reader is therefore likely to make a global inference which is not warranted. This poor choice may be reinforced by the fact that some modern English-English dictionaries list the *name* of our planet with an initial lower case letter "e": planet earth (even though the names of other planets, such as Venus, are capitalized). Nevertheless the ancient Greek word did not mean "our planet," regardless of the preferences we may have for capitalization in English. The fact that both meanings are capitalized in German, is not pertinent here; *all* nouns have initial capital letters in German, whether dirt, ground, land, countryside, or the name of a person or a planet.

Definitions of *gê* in five selected Greek-English dictionaries (or lexicons; see References) are tabulated here:

earth (opp. to sky, air, fire, water)	5
land	5
ground	5
country	4
opposite to sea	4
soil	3
field	1
arable land	1
inhabit earth	1
The Earth	4

The last item (which at first glance might be thought to require the meaning "globe" or "planet") was illustrated by citing Luke 21:35. Examination of this reference, in either Greek or English, shows that "land" is a much better choice, and that "globe" or "planet" could be adopted only with (1) a total ignorance of, or disregard of, the meaning of the Greek word, (2) a total disregard of the Greek expression for planet, as discussed in some detail below, and (3) a blind projection of modern knowledge back into an era in which it had not yet been promulgated. The shape of our "land"—whether flat, round, or perhaps something else—does not identify it with the planets; however, the casual reader is not likely to attach this caveat to the impression that one receives from the text.

The Greek word *gê* (and its variants) occurs roughly 3,000 times in the pre-Christian Greek (Alexandria, LXX) version of the Old Testament (and about 40 times in the Greek New Testament). Its meaning is generally "land," "country," "ground," or "soil." Where it is translated as "earth," the reader is left to make the decision about whether a capital letter was intended (or the decision about whether or not the translator generally made this distinction). The choice which any one person makes may reflect the personal bias which one brings to the task, but if one should choose to adopt an initial capital letter, one would do so without any support from the Hebrew or Greek words. Moreover, there was nothing in the general body of knowledge, 2,000 or 3,000 years ago, to indicate "planet," rather than "land," "country,""ground," or "dirt."

The ancient Hebrew words *erets* and *adamah*, like the Greek word, have "land," "ground," "soil," or "country" as primary meanings, but not "planet" nor "Earth." Classical Latin had a word that served essentially the same purpose: *terra*. Some modern Latin-English dictionaries give this word two quite different definitions ("land" and "our planet"; see References). However, it is highly unlikely that the second definition was in use in the Roman Empire; it would not have made sense to the people of that day because it was obvious to them that we do not live on a tiny speck of light. In this case, the second definition ("our planet") has been projected backward in time from modern knowledge. Contemporary Spanish uses *tierra* (derived from Latin) in both senses, generally without any capitalization, but modern usage does not define the meaning of a word, or its stem, 2,000 or 3,000 years ago.

The ancient Greek word *era* is closely related to the Latin *terra*, but does not appear in either the New Testament or the pre-Christian Greek version of the Old Testament (LXX). In no case should the Greek *era* be confused with the Late Latin word *aera*, meaning a time period of unspecified length, marked—in some way—by an unusual event or a distinctive set of conditions: the modern English derivative, and equivalent, is "era."

World

A Greek New Testament word that is commonly translated as "world" is *aiõn*, which means "age" or "era," but not "planet." Another New Testament word is *gê*, which is discussed above, and which commonly means "land," but not "planet." A third Greek word which may be translated as "world" is *kosmos* which means "order" or "arrangement" and which might be well rendered at some points, in view of the context, as "social order." And a fourth such word is *oikoumenê* which identifies either "inhabited area" or "habitable area" (but not a planet with people on it).

The first ("era" or "age") and the third ("social order") are very closely related. An "era" (or "age") is necessarily characterized by some distinctive event or feature, perhaps a certain type of social order. In New Testament thought patterns, the present "age" or "era" is marked by a distinctive social order, and the "coming era" will be marked by a different kind of social order; hence "era" and "social order" are, in some sense, interchangeable.

The popularity of the translation "world" with the corollary that this is really our planet, hence "the Earth," raises a question about the English word. What does "world" really mean? Any given English-English dictionary might list one or more of the following meanings: planet earth (commonly given first and thus providing a priority for translation), whole universe, humankind, people in general, some part of history, individual experience, individual outlook, and others. This is nevertheless not a list of meanings of the ancient Greek words, and should not be extended backward into time.

Planet

What word might ancient writers have used, if they had really intended to convey the idea of a planet?

Many modern English words have been taken from ancient Greek, so that (for example) "geology" might be assigned to *gê* and *logos*, the combination presumably meaning, as is commonly stated in print, "the Earth" and "the body of knowledge about," hence "knowledge about our planet."

But this construct requires the use of a concept which had no currency more than a few centuries ago. To be clear at this important point, one needs to recall the ancient Greek expression for the English word "planet." Planets were observed in the night sky by ancient astronomers, who worked without optical telescopes of any kind. Without magnification, planets were only points, or dots, of light. The Greek label (two Greek words) is properly translated as "wandering star(s)," referring to the fact that the planets "wandered" (apparently aimlessly, or erroneously, compared with the other stars which were observed to move in systematic and predictable fashion). This "wandering" was caused by the fact—not known at that time—that the planets revolve around the sun, as well as exhibiting the *apparent* motion caused by the rotation of the Earth on its own axis, whereas the "regular" stars have the latter motion only, as seen in an observational time frame longer than a few days, and do not have the former motion (around our sun). That is, our solar system, including all of the visible planets, is centered (roughly, but not precisely) on the sun, and revolves around it, but other stars (non-wandering, or regular, stars) do not exhibit this local motion. This is an elementary condensation of observed facts, but nevertheless it was not generally known as recently as four centuries ago. The concept of a more-or-less spherical Earth does *not* carry with it the concept of the Earth as a planet, and the two ideas should not be joined inseparably with each other, as if they necessarily belong together.

The Greek verb which is the basis for "wandering" or "going astray," when cast in a commonly-cited form, is *planáō*; this means to wander, to go astray, to lead astray, to mislead. From this verb, one can derive a noun (*planêtês*), and then one can derive an adjective, which is similar; they describe a more-or-less aimless wanderer, vagabond, rover, or person who is straying or mistaken in his path. In ancient Greek writings, the adjective is then combined with a noun meaning "star" resulting in "straying star," "erratic star," or "wandering star." In English, we have taken the adjective only, and from it we have developed the word "planet," which we use as a noun. But in ancient Greek the pertinent noun is "star," and the concept of a planet—as something quite distinct from a star—is not present. A "planet" was only one variety of star: the dot of light that wanders aimlessly in the sky. Both were merely points of light in the night sky, distinguishable from each other because of the two different kinds of paths.

Ancient writers of Greek had available to them the expression "wandering-star" (meaning planet), if they had chosen to use it to refer to the place where we live, but they did not do so.

The idea that humankind lives on the surface of a dot of light (a planet or wandering star) was not present; instead, people were known to live on "the land." This means that there were actually three main, and possible, categories of location; (1) "regular," "systematic," or "predictable" stars (all of which were only dots in the night sky), (2) wandering or "erratic" stars (likewise dots), and (3) the large land on which we live (*not* a dot). The three were not to be confused with each other, although the first two were closely related (two kinds of stars). A fourth category included the sun and moon, which were thought to be "special purpose" bodies (e.g., to illuminate the day and to illuminate the night).

This basic four-fold division is the framework for the earth-centered (geo-centric) model of the uni-

verse. This model was so strongly embedded in human thought that Galileo's effort to present a different model, based on observations with the newly-invented optical telescope, brought down on him the wrath of the authorities much less than four centuries ago. It is important to note that, in this model, the "earth" (meaning land) is the immobile center of everything, and is not a mere planet (which moves, as everyone can see).

The derision that greeted Columbus only five centuries ago, because of his proposal to sail west in order to reach an eastern destination, was not only a reflection of a widely-held opinion that he would surely fall off of the edge of the fiat earth (meaning land), but also indicated the common idea that there were indeed three categories, one of which was a single-member class: the flat "land" on which we live. Even in the twentieth century we have had a hard time eradicating the ancient notion that the Earth is a more-or-less flat tract of land (something like a breakfast waffle, or a piece of toast, but much larger). The contempt commonly attached to the term "Flat Earth Society" does not change the fact that some people still adhere firmly to the basic philosophy of this inferred "organization."

The modern category of planets specifically includes the one where we now live: "Earth" (because it is a proper name, rather than "earth"). This idea does not appear in the ancient Greek; there was no recognition by the poets and sages that the "land" on which we live is the surface of one of the "wandering stars." The modern identification came into popular thought centuries later, after the invention of the optical telescope, so that planets (but not the other stars) could be observed as tiny discs, each one having a visible diameter.

Eratosthenes

It is true that the Greek geographer, mathematician, land-surveyor, and administrator, Eratosthenes (about 275-194 B.C.; in Egypt) made a very clever inference about the diameter of an Earth which he thought was spherical, by observing how the sun's rays illuminated different parts of two widely-separated water wells, on a north-south line in Egypt. He noted that the two wells were not illuminated in the same way at noon of the same day. In one well, a much larger proportion of the bottom was illuminated by a sun which appeared to stand directly overhead. If the sun's rays were assumed to be parallel with each other, because the sun is located at a relatively great distance, then the necessary inference is that the surface of the Earth is convex-outward. His logic was correct, and his numerical result was reasonably close to the modern value, considering the uncertainties in his work. (In the last few decades, many a college student, with the cooperation of an assistant at another location on a north-south line, has repeated this simple experiment, with fairly good numerical results, showing again that our planet is indeed essentially a cylinder, a globe, or some similar shape, and that we live on the *out*side.)

The statement about "outside" is necessary from the geometry of the experiment. It is, however, diametrically opposed to the central theme of those people who hold that we live on the inside of a hollow planet, with the sun at the center. This, and slightly-different but closely-related ideas, were advocated more-or-less independently by—among others—John Alexander Dowie, Wilbur Glenn Voliva, John Cloves Symmes, Marshall B. Gardner and Cyrus Reed Teed in the interval since about 1820. Shortly before 1900, Teed's followers established a town south of Ft. Myers, Florida, where his teachings ("Koreshanity," from *Koresh*, a Hebrew version of his first name) were preserved.

The result obtained by Eratosthenes had not crept into popular thought 2,000 years ago, and it does not alter the derivation of "geometry," which means to measure the land, not to measure the Earth. (In any case, Eratosthenes did not measure the Earth; he measured—or adopted the locally-accepted value of—the north-south distance between two water wells, and then he developed very simple geometrical logic that led to an estimate for the circumference of the Earth).

Nor does the inference made by Eratosthenes have anything to do with whether or not our home is also a planet. The concept of the planets, as seen in the night sky without telescopic magnification, is not dependent on the shape of the land surface on which we live, and in fact is not related to the shape of that surface. The demonstration by Eratosthenes (that our "land" is really essentially a sphere) provides a single concept; the idea that it is also a planet is quite a different matter, which was not demonstrated until much later.

In each of these instances, *gê* refers primarily to what we would call "land," or "country," but does not refer to the planet. As landscape or countryside, it includes the rocks immediately below the surface. In this sense, "land" is a good basis for the word "geology," but the connection between "Earth" (the

planet) and "geology" must be inferred *after* the latter word has been coined.

Conclusions

We should translate the ancient Greek word *gê* as "land," "country," "dirt," "soil," or "ground." This restriction makes a big difference in the apparent meaning of certain verses in the Old Testament. The expression "all the land" might, or might not, be very restrictive. It some cases it might be limited to the area within a few tens of kilometers of the writer. But if we render it "all the Earth," we present a markedly different concept, one which was not in the mind of the writer. There was perfectly good terminology available to identify the "planet" in contrast with the "land," if the writer had wished to do so. "Land" is local or regional, although it might extend in an extreme case to many days or weeks of journeying. "Earth" or "planet" is global; its use, in translation of ancient manuscripts, marks the insertion of a concept which was not generally known at the time of writing, and which would have been seen as irrational.

One result of this review is to note that the word "geology" is not derived from an ancient expression, meaning "the study of the Earth," but rather from words meaning "the study of the land." A parallel expression having a similar derivation, "geometry," did not mean, initially, "measurement of the Earth" (which is a formidable task, even today), but "measurement of the land."

In the first chapter of the book of Genesis, in the pre-Christian Greek version (LXX), the word *gê* appears many times. As an example, it is used to distinguish one category of location (e.g., dry land) from "seas" or "oceans." This clearly does not mean "planet." It is also used in the same chapter, as in many other places in ancient Greek writings, to distinguish "land" from "skies" or "heavens." Therefore the first chapter of Genesis recognizes three major classes of location: land, sea, and sky. In this setting, it is not appropriate to translate either the Greek word or the Hebrew word—each of which is limited to other meanings—as "planet," "the earth," or "Earth."

The use of either "world" or "earth" blurs the translation by introducing a term which (in either case) is ambiguous in English. At each point, "land," "ground," "country," or "soil" would be a better choice. Refusal to use "earth" (and by implication, "Earth") or "world" has the consequence that overly-broad interpretations are not suggested, and the correct focus can be maintained: "all the land" instead of "all the planet." ✽

References

Arndt, W. F., F. W. Gingrich and F. W. Danker, *Greek-English Lexicon of the New Testament* (Chicago, IL: University of Chicago Press, 1979).

Liddell, H. G., and Scott (no initials given). *An Intermediate Greek-English Lexicon* (Oxford: Oxford University Press, 1986).

Marchant, J. R. V., and J. F. Chartes. *Cassell's Latin Dictionary* (New York: Funk and Wagnalls Co., no date given).

Newman, B. M., Jr.; in K. Aland, M. Black, C. M. Martini, B. M. Metzer and A. Wikgren. *The Greek New Testament*, Third ed. (New York: American Bible Society, 1975).

Pershbacher, W. J. *The New Analytical Greek Lexicon* (Peabody, MA: Hendrickson Publishers, 1994).

Thayer, J. H. *Greek-English Lexicon of the New Testament* (New York: American Book Co., 1882).

Essay Review

Dennis L. Feucht*

14554 Maplewood Road
Townville, PA 16360-3404

AMERICAN MILITIAS: Rebellion, Racism & Religion *by Richard Abanes, Downers Grove, IL: InterVarsity Press, 1996, 296 pages.*

Many evangelical Christians are rightly concerned about the degradation of moral values in America and direct their political efforts against secular or pagan liberalism. But to complicate matters, enemies of truth and goodness come in a multiplicity of forms. With growing discontent over increasing government influence and control in most aspects of life, conservative Christians sometimes find it easy to side with quasi-Christians who share a common liberal enemy and who even use Christian terminology. The Constitution of America, not God in Christ, is their highest priority. For others more extreme, it is white supremacist doctrine and an obsession with hate. Abanes has been studying religion and cults as founder and director of the Religious Information Center of Southern California. He provides the results of copious research on the rise of the "patriot" movement in this book.

The patriots are by no means a unified movement. While commonly opposed to socialism, communism, and liberal politics, their common thread is a growing dissatisfaction with and alienation from government, the willingness to use military force to defend their rights, and a conspiratorial eschatology. Abanes describes the various patriot factions and their relationships to each other, and patriot-related events of national significance such as Waco, Ruby Ridge, and the Oklahoma City bombing. He also contrasts the movement with Christian attitudes, beliefs, and behavior.

"Patriots" can be unorganized militia members, tax protesters, sovereign or state citizens, white supremacists, quasi-Christian apocalypticists, or any combination. Abanes uses a funnel analogy to describe the movement. At the wide end is general complaint about gun control, taxes, declining economic opportunity, government control, and environmentalism. The sovereign citizen movement is near this end. State citizens argue that there are two classes of citizens in America, the original citizens of the states and U.S. citizens. I find Abanes's description of state-citizen claims to be in accord with sovereign-citizen leader Richard McDonald's material. McDonald has established State Citizen Service Centers around the country. Fourteenth Amendment (U.S.) citizens have civil rights, legislated to give the freed black slaves after the Civil War rights comparable to the unalienable constitutional rights of white state citizens. The benefits of U.S. citizenship are received by consent in exchange for freedom. State citizens consequently take steps to revoke and rescind their U.S. citizenship and reassert their *de jure* common-law state citizen status. This involves removing one's self from federal jurisdiction and relinquishing any evidence of consent to U.S. citizenship, such as a social-security number, driver's license, car registration, use of zip codes, marriage license, voter registration, and birth certificate. Also included is refusal to pay state and federal income taxes because citizens not under U.S. jurisdiction are not required to pay them. Only residents ("resident aliens") of the states, not its citizens, are income-taxable, state citizens argue. And as a state citizen land owner, one can bring forward the original land patent and file it with the county for absolute or allodial property rights. Such allodial ownership is held "without recognizing any superior to whom any duty is due on account thereof" (*Black's Law Dictionary*). Superiors include those who levy property taxes or who hold mortgages or liens against the property.

My recent discussion with one of McDonald's state-citizen leaders suggests that the courts, while at first at a loss on how to respond to the detailed legal arguments of these *pro se* citizens, are beginning to develop formidable counter arguments. State citizenship now requires keeping a legal step or two ahead of the courts. Abanes suggests that state-citizen legal arguments, while superficially impressive, are like biblical proof-texting by Christian fundamentalists; they fail to sufficiently examine the

*ASA Fellow

context of the case laws from which they cite, and ignore adverse evidence, such as *The Federalist Papers* (No. 15), in which Alexander Hamilton expressed that the Constitution placed everyone personally under federal authority. The key to the sovereign-citizen approach appears to be in the exploitation of legal tumult after the Civil War and the questionable constitutionality of ratification of the fourteenth amendment.

Further into the funnel, theories are encountered that explain societal woes in terms of a singular enemy (such as international bankers) working through a conspiracy of disparate and troubling events. A typical apocalyptic belief about the immanent end of the world targets takeover of the U.S. by U.N. forces under a one-world government run by the Antichrist, probably in A.D. 2000. Hal Lindsey's books, especially *The Late, Great Planet Earth,* have had a major influence on these patriots, such as Randy Weaver of Ruby Ridge.

Deep in the funnel, Abanes traces conspiracy theory to a five-volume work of 1797 written by French Jesuit Abbè Barruel. He claimed that the cause of the French Revolution could be traced to the Middle Ages, blaming the Order of Templars, who were officially disbanded by Pope Clement V in 1312. A remnant went underground, Barruel claims, and infiltrated the Freemasons (formed in 1717) and the Illuminati (founded in 1776 by Adam Weishaupt). These secret organizations, Barruel claims, contributed to the ascent of political figures who were instrumental in the overthrow of the French monarchy. Later, Barruel's theory merged with a long-lasting European anti-Semitism to form the most influential story about Jews conspiring to achieve world domination, *The Protocols of the Learned Elders of Zion.* This work was shown in 1921 by English journalist Philip Graves of the *London Times* to be a fraud, with sections taken verbatim from a previous French satire by Maurice Joly in 1864, *Dialogues in Hell,* aimed at Napoleon III. *Protocols* was first published by the Russian secret police to influence Tsar Nicholas into blaming the Jews for Russia's turmoil.

By 1880, belief in a Jewish world conspiracy began to gain ground among the extreme Right in France, Germany, and Russia. It was after the Russian Revolution that the forgery became popular in Europe, and fell into Adolph Hitler's hands. By 1933, 28 editions were circulating throughout Germany. During the 1920s, a well-known American figure first popularized the anti-Semitic book in America and published another such book, *The International Jew,* which won Hitler's admiration. The Fuehrer once said, "I regard Heinrich Ford as my inspiration." Henry Ford received favorable mention in *Mein Kampf,* and his picture hung in Hitler's Munich office. Today, the *Protocols* are a best-seller throughout the Arab Muslim world. Major American anti-Semites today are the Aryan Nation and Christian Identity.

The patriot movement differs from evangelical Christianity in its epistemology. Patriots fail to distinguish between theories and facts, and wholeheartedly believe in their powerlessness before the imminent domination of the world by overwhelming evil. They get their information largely from each other, with little independent means of verification. Observation of events, such as tanks on railroad cars or "black U.N. helicopters," are interpreted to fit their conspiracy theory instead of simpler, more plausible explanations based on investigation. Many are convinced that implanted biochips will replace money and lock individuals out of the world economic system. Ranches and small towns of patriots are forming, largely in the mountain West, to go it alone.

In the latter part of the book, Abanes traces the "tangled web" of connections between the militias and racist strands of the patriot movement, and evangelical Christianity. He argues that most militia leaders, while downplaying racism, are in sympathy with it. Named are Militia of Montana leader John Trochmann, former Green Beret James "Bo" Gritz, who ran on the David Duke presidential ticket in 1988, and his ally Jack McLamb. Some evangelical leaders have not been careful to avoid basing their apocalyptic views on the same anti-Semitic literature used by white supremacists. Pat Robertson's 1991 book, *The New World Order,* introduced the distinctive conspiracy theories of the militias to a wide audience. The book often appears in patriot circles. Typical of patriot theories, scant and often unsupported (or unverifiable) evidence is offered as a sufficient basis upon which to make bold assertions. Robertson had to go to significant lengths to demonstrate that he was not anti-Semitic. Others named as having patriot connections include Chuck Missler, Don McAlvany, Texe Marrs; and even "Beverly LaHaye (leader of Concerned Women of America) and Pastor Chuck Smith (founder of the well-respected Calvary Chapel system of churches) have promoted works that rely on white supremacist propaganda" (p. 218). Abanes does not accuse them of racism but implies a lack of discernment. Before the book ends, conservative talk radio is discussed and even Rush Limbaugh is criticized by the author. In view of what the book presents, it appears that President Clinton's criticism after the

Oklahoma City bombing of talk radio hosts was aimed at the patriot movement. Bombing suspect Timothy McVeigh was heavily involved in the patriot movement and the bombing was modeled after one of the missions in a white supremacist novel, *The Turner Diaries*, a "terrorist Bible" by William Pierce, and one of McVeigh's favorite books.

Abanes has done a remarkable job of amassing a comprehensive and researched account of the patriot movement. The text is heavily supported, with 60 pages of references. The book is well-suited for a wide audience, including non-Christians; minimal knowledge of Christianity is assumed and the necessary background is well presented. While the book paints the patriot movement in dark colors of hate and ignorance, degrees of extremism are recognized and the black/white picture typical within the movement is avoided in its description. The book was motivated in part by a need for Christian youth to be informed about American militias and their often Christianesque seduction into a world incompatible with Christian belief or practice. ✾

Contrasting Views on Behe

DARWIN'S BLACK BOX: The Biochemical Challenge to Evolution *by Michael J. Behe. New York: The Free Press, 1996. 307 pages, index. Hardcover; $25.00.*

Braxton M. Alfred*
Professor of Biological Anthropology
University of British Columbia
Vancouver, BC V6T 1Z1

Michael Behe, a biochemist at Lehigh University, has written *Darwin's Black Box: The Biochemical Challenge to Evolution*, which all in the ASA should read. It is a testament to his writing skill that Behe has made the impossibly complex accessible to the irredeemably obtuse. The book is in three parts. Part 1 is an introduction to "Lilliputian" biology; Part 2 contains five examples, replete with "eye glazing and mind numbing" biochemical details of the central concept, irreducible complexity; and Part 3 contains some interpretation. Without doubt, we will be indebted to Behe for many years for providing the phrase and definition, if not the concept, of irreducible complexity. What is added to the concept, which others have used more clumsily and without the specificity, is the notion that biochemistry is the final arbiter of the existence of the condition.

The concept of a "black box" has been around for many years and is due to computer engineers. It refers to an entity—a subroutine, a panel, etc.—that receives input and produces output but no one knows how. For Behe, the ultimate black box is the cell; biochemistry has opened the box. It is gifted to Darwin because he was compelled to ignore the internal dynamics of the cell. Presumably, had he been able to see inside, he would never have been so rash as to argue as he did.

"Irreducible complexity" is defined as a single system composed of several interacting parts that contribute to the basic function such that the loss of any one part causes the system to fail. "An irreducibly complex system cannot be produced ... by slight, successive modifications of a precursor ..." (p. 39). The homely example used throughout the book is the mousetrap. A mousetrap has minimally five components: platform, hammer, spring, release catch, and holding bar. Lose any one of the parts

Continued on p. 120, Alfred

**ASA Member*

Alice Fulton*
Department of Biochemistry
University of Iowa
Iowa City, IA 52242

One of the profound gifts that accompanies a life in biology is a deep and continually growing reverence for the intricacy and beauty of life. Many biologists are moved to awe in the face of such grace and power; biologists who are also Christians see in the loveliness of life an image of the loveliness of its Creator. In *Darwin's Black Box: The Biochemical Challenge to Evolution*, Behe has explored whether some parts of life are sufficiently intricate or inherently complex that the most parsimonious explanation for them is the action of a Designer.

This is a valuable book for two reasons. In it, Behe has done a very good job of making accessible several examples of the beauty and complexity of biochemical systems. It seems likely that anyone who reads this will come away with an increased appreciation for the glorious order of living things, and that can only be a gain for both science and faith. He has also made an explicit statement of neglected, but important, questions. He has drawn attention to two areas that have not been extensively examined: the evolution of complex biochemical systems and the evolution of regulation. These are genuinely challenging questions. If his book stimulates more thought about them, then that will be a real gain.

Background Disagreements

There are several aspects of the necessary background where Behe and I disagree. These need to be discussed before his central thesis because one's judgment of these points will considerably affect how one weighs the absence of convincing evolutionary scenarios.

First, I believe that Behe overestimates biochemists' interest in evolution. I am a cell biologist in a

Continued on p. 120, Fulton

**Fellowship of Scientists Member*

Alfred, continued from p. 119

and there is no mousetrap. Behe argues that it is impossible to assemble one from the clutter in a common workshop. It could be embellished with gimcracks and gewgaws, but the core system, exclusive of the add-ons, is, like many (all?) artifacts, irreducibly complex. The examples that are worked up in detail are cilia and bacterial flagella (the only true rotatory action known in nature), the magnificent biochemical cascade resulting in blood clotting (the most beautifully complex system I have ever understood), vesicular transport, immune function, and biosynthesis of AMP. The latter is treated at the atomic level and the atom-by-atom changes required to get from the precursor, ribose-5-phophate (four carbons, one oxygen), with ATP available, to AMP are shown. Amazingly, an intensive search of the literature turned up less than a dozen attempts in the last decade (literally thousands of papers) to provide an explanation of the coming into existence of any of these systems. He provides many more examples in less detail, e.g., the eye, for those of us who are innocent of biochemistry.

Behe's work is fatal to Darwinism, for he compellingly shows the impossibility of producing irreducible complexity by a Darwinian step-by-step process; and it is unthinkable that any one of the steps occurred as a saltation. Further, "the straightforward conclusion is that many biochemical systems were designed ... not by the laws of nature, not by chance and necessity; rather they were planned" (p. 193). Since it cannot be shown that something, anything, has *not* been designed, the scientific problem becomes the detection of design. If there is not a gradual route to the production of a physical system, irreducible complexity is taken as evidence of design. The problem is that Dawkins, or one of his clones, will pop up and say that it is simply an argument from "personal incredulity." We are quickly back staring at the metaphysical hydra—materialism vs. creationism. Of course, Behe has put the onus on materialists to show the *precise* pathway by which a system might have developed and then to do it. This book certainly takes the design argument to a new, atomic level. However, as endearing and powerful as it may be, I do not agree with the proposition that biochemistry is the only way to show design complexity. For example, Hugh Ross has shown, to my satisfaction, design for the universe; Thaxton, Bradley, and Olson showed it for the origin of life arguing from thermodynamics as well as "specified complexity" which characterizes proteins and linguistic structures. Both admittedly use an argument from improbability, which is standard for arguments from design, but if the probability of the naturalistic occurrence of an event is "effectively" zero ...

An insert from the publisher contains a quotation from David Berlinski with which I agree completely: "*Darwin's Black Box* is an extraordinary piece of work that will come to be regarded as one of the most important books ever written about Darwinian theory." ✾

References

Hugh Ross (1991) *The Fingerprint of God: Recent Discoveries Reveal the Unmistakable Identity of the Creator*. Promise.

Charles B. Thaxton, Walter L. Bradley and Roger L. Olsen (1992) *The Mystery of Life's Origin: Reassessing Current Theories*. Lewis and Stanley.

Fulton, continued from p. 119

department of biochemistry. My formal background in evolution includes both undergraduate and graduate study, including quantitative population genetics. This means I have more formal background in evolutionary questions than the average biologist (with particular emphasis on cellular evolution) but less than a real evolutionary biologist. I would guess that this may also reflect my relative level of interest in evolutionary questions.

Now, the most likely person to generate a good evolutionary scenario for the systems that Behe talks about would be a biochemist. The biochemists I know well (from fifteen years working together) don't think about evolution very much; they resemble chemists much more closely than they do evolutionary biologists. They are very capable people who know a great deal about NMR, enzyme mechanisms, transcription factors, and protein structure (much more than I do), but most of them know nothing about even the simple descriptive facts of evolution. For many, I doubt they think about evolution from one year to the next.

As evidence for their lack of knowledge, I get called on occasionally for simple facts about evolution. Based on these requests, typical biochemists don't know the following descriptive aspects of evolution: when the dinosaurs died; the difference between protostomes and deuterostomes; which came first, vertebrates or flowering plants; the relative time that the procaryotes and eucaryotes appeared within a factor of five; why the end of the Permian is even more exciting than the end of the Cretaceous; and why the similarities in homeobox genes between

mice and humans are satisfying, between mice and fruit flies amazing, and between mice and plants astounding. Readers who know what these mean will appreciate how little of the simple pattern of evolution has caught their attention. Readers who don't know what these mean are offering evidence of how little the descriptive facts of evolution are known in general, much less the theories of how it occurred. If biochemists know so little of what is known about the evolutionary pattern, is it reasonable to expect them to ask probing new questions about its mechanisms?

Second, I believe that Behe has seriously underestimated how hard it would be to produce a good scenario for the evolution of the kinds of systems he wants explained. Evolutionary studies are never easy, and the kind he wants done are harder than the comparative anatomy that most evolutionary scientists do, for two reasons:

1. The biochemists would have to work with fewer data. When people do comparative anatomy, they have *fossils*, real examples of at least some intermediates that may have played a role in the evolution of the structures they are thinking about. When biochemists attempt an evolutionary scenario, they have, at best, "living fossils" which may or may not have preserved the real primitive state. Often the intermediates will be lost because the newer form was more efficient (that's what a Darwinian explanation is, after all, and it is the case for structures that fossilize). When this is true, the biochemists are reduced to what the linguists do in thinking about the origins of languages. They look at a number of existing languages, try to note similarities, use those to reconstruct the precursor, and then perhaps repeat the process to reconstruct that language's ancestor. Now, linguists mostly agree about Indo-European, some have attempted to reconstruct Indo-European's ancestor (with less unanimity), and at least one person has tried to reconstruct elements of the "mother of languages," but few people are persuaded by this because it involves so many nested reconstructions. Yet, that is what would be needed for an evolutionary account of these complex biochemical systems.

2. The biochemists have more to explain in the face of harder experimental conditions. If we think about a comparative anatomist examining a cube 10 cm to a side, he or she is unlikely to want to account for details less than a millimeter across. When we go down to finer levels of resolution, every decrease in scale involves an increase of detail. However, the difficulty also goes up with the decrease of detail, because the things being studied are smaller, less massive, etc. Therefore, there may be something like the Heisenberg uncertainty principle here, with a tradeoff between resolution and information.

In any case, to obtain the data for comparative studies, the original biochemistry largely has to be repeated; it may be 20% as difficult the second time, but it can be even harder on the second organism than on the first just from idiosyncrasies of the organism. There is no way to know in advance which organism on which to repeat the biochemistry; perhaps one in three or as few as one in ten guesses will be right, but the biochemist won't know until most or all of the work is done. All these combine to make my estimates of the difficulty of such studies considerably more pessimistic than Behe's.

Behe's Central Thesis

Behe makes three main points: (1) Darwinian explanations have not been given for "irreducibly complex" systems, (2) Darwinian explanations cannot account for "irreducibly complex" systems, and (3) intelligent design is the best explanation for "irreducibly complex" systems.

Behe's definition for an "irreducibly complex" system is a system that is "composed of several well-matched interacting parts that contribute to the basic function, wherein the removal of any one of the parts causes the system to effectively cease functioning." At first, this definition seems clear, but I think there are problems with it that only appear later.

1. Darwinian explanations have not been given for "irreducibly complex" systems.

This claim is probably true. My primary research focus is not in evolutionary studies, but I am not aware of any system with the degree of complexity that Behe discusses for which there is a complete (or even substantial) account. Behe interprets this as the failure of an attempt; I interpret it as the combined result of the low level of interest in and knowledge of evolution by biochemists and the increased difficulty of such explanations for biochemical systems.

2. Darwinian explanations cannot account for "irreducibly complex" systems.

Here is where trouble begins (for me) in being clear about what Behe wants to claim. Taking all

his examples together, an "irreducibly complex" system is not just one with an essential element in it, because he discusses some cases which to him do not seem "irreducibly complex" but which do have an essential element. Therefore, there only seem to be two possible senses for this claim: either (A) Darwinian explanations cannot account for "irreducibly complex" systems because we can't think of such explanations, or (B) Darwinian explanations cannot account for "irreducibly complex" systems because they cannot work without all the parts there.

If A is his claim, then this is a claim about all conceivable explanations. Behe shows that several scenarios he tries won't work, but just showing that several don't work isn't the same as showing that none can. If B is his claim, then it amounts to affirming the consequent, i.e., making the thing you want to prove part of the definition. Finally, it is still not clear how to identify which systems are "irreducibly complex" systems and which ones aren't. It would seem that unless this is unambiguous, most of his arguments are hard to support.

3. Intelligent design is the best explanation for "irreducibly complex" systems.

Although it is not clear to me just what qualifies as an "irreducibly complex" system, Behe's claim here is that for such systems intelligent design is the best explanation. Again, this claim depends upon some confidence that we know what the set of possible explanations is, and the relative probabilities of each. Furthermore, Behe wants to claim that "intelligent design" is a meaningful attribute in the absence of any statements about the designer. But it seems that without some specification about what constitutes "a designer" or how "a designer" would act, attributing complex structures to "a designer" is like saying that opium makes you sleepy because of its "soporific powers."

Concerns

There remain two other concerns about this argument. Behe makes extensive use of referring to the scientific literature itself to give a sense of whether or not scientists examine these questions and what kind of answers they come to. However, it was very surprising to see no discussion of Cairns-Smith's "Seven Clues to the Origin of Life," an excellent book about the origins of life, written several years ago by a senior, and very thoughtful, scientist. Cairns-Smith faces the difficulties of complex systems straightforwardly, and proposes that intermediate steps might be quite different from the final product. He also used analogies well, and his analogy for this part is that of an arch with a keystone. Seeing it standing, you might wonder how it came to stand free of support. However, there could have been an intermediate stage where there was a scaffold that was later removed, and there might be no traces of that scaffold now. Another analogy he used for the transition between types is that of a rope that might be all hemp at one end and be gradually replaced with nylon along its length until by the other end it was all nylon.

I am *not* saying that Cairns-Smith's book answered all of Behe's concerns. It did, however, address the concerns directly and has a proposed strategy for approaching them. Behe did not discuss it. If it is because the Lehigh library doesn't have it, then Behe's search may be seriously incomplete. If Behe knew about it and did not discuss it, it is a serious shortcoming in his discussion.

I also see considerable potential for misuse of the thesis that Darwinian explanations cannot account for "irreducibly complex" systems. There is an *enormous* amount known by someone about a great many systems—the last time I looked, *Bioabstracts* was covering 100,000 articles a year. If people who do not allow any room at all for Darwinian evolution pick Behe's thesis up without thinking hard about it, they may range over the whole body of biological thought, picking up examples incompletely and then claim to have confirmed the argument when that particular point is not answered. The more likely explanation is that people who know enough to answer all, or even most, points that might be raised didn't happen to see the claim made.

In short, an interesting book, a potentially valuable one if it convinces biochemists to start the hard work of evolutionary analysis, but in the end one that did not convince me that a new paradigm of explanation is justified. ✾

Book Reviews

RELIGION AND SCIENCE: History, Method, Dialogue by W. Mark Richardson and Wesley J. Wildman, Eds. New York: Routledge, 1996. 450 and xx pages, appendixes, index. Paperback; $29.95.

In the last decade there has been a marked increase in the number of science-religion studies. These works have been addressed to audiences as diverse as the laity in particular denominations, religiously oriented academics, and the scientific community. Their goals include encouraging and instructing the faithful in proper interpretation, religious apologetics, and a less easily defined desire to examine "relations," hold "dialogue," examine "implications," and construct "world views." Most of these works have been individual contributions necessarily limited by the authors' understanding and idiosyncrasies of interpretation. As the science-religion field has broadened to include everything from eugenics to economics, it is increasingly difficult to "put it all together." Studies such as *Religion and Science* which include specialists from various disciplines are much more effective in exploring options and raising interdisciplinary questions and the complications that lie beneath the surface of any issue if there is editorial effort toward overall coherence and unity.

Richardson and Wildman have drawn together a diverse set of contributors whose theological commitments and disciplinary specialties are wide ranging. They offer the well-worn "building bridges" metaphor to describe their task. The introductory examination of the motive for science-religion studies and the characterization of this new "academic" specialization is especially well done. The first section presents several papers on historical themes plus Holmes Rolson's prophetic note. Part two considers the comparative methodology of science and theology in a valuable four-participant, round-robin discussion. Part III offers six case studies illustrating various *constructive* links between theology and science. The rich relationship between cosmology and creation, chaos theory and divine action, quantum complementarity and Christology, molecular biology and human freedom, and social genetics and religious ethics are explored in a fashion that does not minimize differences nor discount the tentative nature of the discussion.

Space limitations allow only a limited sampling of the rich diversity of offerings. John Brooke's Enlightenment study notes the dangers of accepting traditional interpretations. I was impressed by his treatment of the role of science as an agent of secularism. Claude Welch casts a skeptical eye on contemporary attempts to derive scientific notions on origins or time and eternity from theology. Wesley J. Widman stresses the question of "divine action" as being in need of a critical breakthrough and emphasizes the educational implications of science-religion studies.

The value of unifying editorial hands is clear in this work. In spite of the diversity (and attendant disagreement) among the writers there is a clear line through the discussions, a recognition of limitations in understanding, and a welcome absence of the polemic often found in the field. I would have welcomed dialogue on the historical papers; things are no more settled in this field than with the themes debated later.

Readers of *PSCF* will be pleased that such familiar names as Nick Wolterstoff, Nancey Murphy, Chris Kaiser, the late Jim Neidhardt, John Polkinghorne, and Robert John Russell are among the many contributors.

Religion and Science is designed for interdisciplinary courses at the advanced undergraduate and graduate levels and is a valuable statement of the current discussion. One leaves this work with the impression that this is an exciting time for science-religion studies and that evangelicals need to hone their skills if they wish to participate.

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

EINSTEIN, HISTORY, AND OTHER PASSIONS: The Rebellion Against Science at the End of the Twentieth Century by Gerold Holton. Woodbury, NY: AIP Press, 1995. 240 pages, index. Paperback; $14.00.

This book aims to set aright society's current disenchantment with science. The first section, "Science in History," is a collection of five seemingly unrelated chapters that respond to society's "rebellion on the life of the scientist, on the education of the young, on pubic understanding of science generally, and on the legislation of science support ..." (p. 3). The second section is a survey of Einstein's thought and, as the title suggests, contains an implicit call to be "Learning from Einstein."

From Holton's perspective, the "good old days" of science have been in decline since the late 1940s. The first chapter, "What Place for Science at the 'End of the Modern Era,'" surveys this decline with a sampling of various attacks that have been waged on science over the last century. Just so that the reader knows who the heroes are in this story, the author opens the second chapter, on science's poor public image, by extolling the virtues of science:

> When future generations look back to our day, they will envy our generation for having lived at a time of brilliant achievement in many fields, and not least in science and technology. We are at the threshold of basic knowledge concerning the origins of life and the universe itself ... With current technical ingenuity one could in principle hope to implement many of the utopian dreams of the past (p. 40).

The public who disagree with this view, Holton believes, categorize science into one of seven delightful cate-

gories: "Ethical Perversion," "Sorcerers Apprentice," "Magic," etc.

If society doesn't trust science, then is science trustworthy? Well, yes, according to chapter 3, "The Evolution of Trust in Scientific Findings." What is trust? The author argues that there are varying degrees of trust. He uses a selection of examples: the inaccuracy of Copernicus' tables of planetary motion, Millikan's "selective" collection of only data that "agreed with the results of other observations" (p. 70), and "golden events" that occur in particle physics.

Science is replete with examples of revolutionary thinking, but how does "Imagination in Science" (Chapter 4) arise? Holton believes there are three tools: the visual, metaphoric, and thematic imagination. The next chapter shifts the emphasis from imagination to a description of how stimuli from several different areas of science, personal and cultural events, and intellectual growth can influence an individual's discovery of a revolutionary theory.

The second part of the book signals a change to a more philosophical style beginning with "Einstein's Influence on the Culture of Our Time" (Chapter 6). Einstein's way of thinking and his view of science are presented as ideals that Holton believes scientists should emulate in their own disciplines (Chapters 7 and 9). Placed in the middle of this analysis is an absorbing account of Einstein's personal life (Chapter 8). The author uses his familiarity with Einstein's archived correspondence to deftly reconstruct a personal history of Einstein's early years. Holton quotes letters from Einstein to his fiancée to portray Einstein as a very warm and devoted person in contradistinction to the dry public image that exists: "I long terribly for a letter from my beloved witch" and builds a picture of an individual in love with his fiancée and science: "My only diversion is studying, which I am pursuing with redoubled effort, and my only hope is you, my dear, faithful soul" (pp. 180-81). This chapter uses the author's knowledge of Einstein to build a fascinating, and well-crafted, personal account of Einstein. It is undoubtedly the best section in the book.

Einstein, History, and Other Passions is an unusual title for an unusual book. Several chapters contain material that is seemingly unrelated to the author's stated purpose of examining "the rightful place of science in our culture" (p. ix). The impression is given, to this reviewer at least, that the author wanted to publish a book and then collated all his resources to secure enough material for a 200-page manuscript. Holmon admits as much in the acknowledgments section where he acknowledges Joan Laws and then himself for several lecture series and articles on which the book was based!

A lofty tone pervades this book that tends to obscure and detract from the author's main points. For example, "It was my luck to have known, and to have learned my trade under, one of the last physicist philosophers, P. W. Bridgman—a Nobel Prize winner (1946) ..." (p. 75). Another minor frustration is the lack of references, particularly when referring to other authors (e.g., Toynbee, p. 44). However, the main criticism of this book is that there is no clear theme developed over the course of 200 or so pages. The perseverant reader can expect to glean a few pearls in an ocean of random thoughts.

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

UNDERSTANDING THE INFINITE by Shaughan Lavine. Cambridge, MA: Harvard University Press, 1994. 372 pages, bibliography, index. Hardcover; $39.95.

Lavine is an associate professor of Philosophy at Columbia University. In this book, he tries to explain the meaning of infinite in the set theory invented by German mathematician Georg Cantor.

Lavine shows that the common story about the history of the infinite is not true. The common story is that formal axiom systems were developed to salvage Cantor's naive theory from paradoxes, and Cantor's set theory does not correspond to our intuition about collections. It was not the product of idealization, but of the failure of an attempted idealization. Contrary to this common story, Lavine shows that the set theory developed by Cantor and Zermelo is connected to a kind of idealization from human experience much like the theories of natural numbers or Euclidean geometry are.

When Cantor created the original set theory in the 1880s, it was neither naive nor subject to paradoxes. He tried to clarify the foundation of calculus. The idea was a coherent one that sets are collections which can be counted. Bertrand Russell was the inventor of the naive set theory which ran into paradoxes. In Chapters 2-5, Lavine describes in considerable detail the correct historical sketch from ancient times to modern with three purposes: (1) to counter the harmful influence of the common account on many philosophers of mathematics that our intuitions are seriously defective and the axioms of mathematics are arbitrary and historically determined; (2) to show that the clear and universal intuitions definitely lead to Cantorian infinite; and (3) to make clearer the nature of intuition.

In Chapter 6, Lavine surveys some accounts of mathematical knowledge of the infinite that attempt to show how it can come out of experience. These accounts begin with a theory of knowledge and try to fit mathematics to it. Intuitionism, various forms of formalism, and Hilbert's finitist philosophy of mathematics are discussed.

Lavine describes the views of Godel, Quine, and Putnam in chapter 7. They begin with mathematics and try to fit a theory of knowledge to it. Lavine concludes that none of them could solve the problem of the infinite because they could not explain the source of our intuitions concerning the Cantorian infinite.

In Chapter 8, Lavine proposes that the source of our intuitions concerning the Cantorian infinite is our expe-

rience of the indefinitely large. Here he makes use of a mathematical theory of the indefinitely large developed by Jan Mycielski. Cantor understood his theory as drawing an analogy between the finite and the infinite; we can understand Cantor as extrapolating from the indefinitely large to the infinitely large.

Blending history, philosophy, mathematics, and logic, Lavine explains with clarity how the infinite, a subject so remote from our finite experience, can be an indispensable tool for working mathematicians. He successfully shows that the infinite in the set theory does relate to our intuition, hence it is comprehensible. He points out that mathematical infinity is just an extrapolation from the concept of indefinitely large.

This is an interesting work which presents a new and demystifying way of understanding the mathematical infinite. His explanation puts Cantor's infinite as Aristotelian potential infinite. He does not discuss the infinite in the metaphysical sense which is Aristotelian actual infinite.

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

THE QUOTABLE EINSTEIN by Alice Calaprice, Ed. Princeton, NJ: Princeton University Press, 1996. 269 pages. Hardcover.

If you do not know much about Albert Einstein, but would like to, this book is a good place to start. It has all you need: a chronology with biographical information, a family tree, answers to questions most frequently asked, a bibliography, key word and subject indices, and primary source documentation. In addition, Princeton University physicist Freeman Dyson writes a revealing foreword, and editor Alice Calaprice provides a preface with insightful commentary.

In 1879, Einstein was born in Germany. He entered a Catholic primary school where he was the only Jew; religious instruction in Judaism was given at home. At age 17, he gave up his German citizenship to show his dislike for the German military mentality. At age 27, he received a doctorate from the University of Zurich. He made his first trip to the United States in 1921 where he gave lectures at Princeton University; in 1940 he became a US citizen. In 1944, a handwritten copy of his theory of relativity was auctioned off for six million dollars as a contribution to the war effort. In 1952, he was offered the presidency of Israel (he refused). In 1955, he died of a ruptured arteriosclerotic aneurysm of the abdominal aorta.

Some readers may be surprised to discover in the 550 quotes included in this volume that Einstein was a witty, thoughtful, gifted, and prolific writer. He left a vast source of material from which to draw quotes: there are 40,000 documents in the Einstein archive. The intent in this volume was to select the most important and interesting quotes. Some quotes will elicit pleasure and delight from readers. Others "may distress readers who have worshipped Einstein as a compassionate, tolerant, and flawless hero ..." (p. xvii).

Einstein's humanity is seen in the paradoxes of his personality. He could be "irascible and benign, warmly humorous and coldly dismissive, one who was at first bemused by the fame the world bestowed on him but who came to abhor the glare of publicity" (back flap). If you're undecided about reading this book, perhaps a few quotes will help. First, here are some of Einstein's thoughts on religion. "The idea of a personal God is quite alien to me and seems even naive" (p. 156). "I am a deeply religious nonbeliever ... This is a somewhat new kind of religion" (p. 158). "The Lord God is subtle, but malicious he is not ... I have second thoughts. Maybe God is malicious" (p. 169). Here are some observations on science. "The more success the quantum theory has, the sillier it looks" (p. 166). "Science will stagnate if it is made to serve practical purposes" (p. 181). "An hour sitting with a pretty girl on a park bench passes like a minute, but a minute sitting on a hot stove seems like an hour" (p. 184).

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

THE NEANDERTHAL ENIGMA: Solving the Mystery of Modern Human Origins by James Shreeve. New York: William Morrow and Company, Inc., 1995. 342 pages, bibliography, and index. Hardcover; $25.00.

Shreeve, a contributing editor to *Discover* magazine, wrote fiction before pursuing a career in science writing. In *The Neanderthal Enigma*, he addresses some of the more profound and hotly debated questions concerning human origins. Shreeve tackles not only those questions pertaining to the *whens* and *hows* of human evolution—he also addresses the much more elusive mysteries surrounding the *whys* of *Homo sapiens* success as the only surviving hominid species today, for it is apparent that a number of potential outcomes are suggested by the evolutionary record. In answering these questions, Shreeve's strategy is to identify and explain the very essence of "humanness"—those qualities that distinguish modern humans from ancestral forms and from our other cousins in the primate order.

The Neanderthal Enigma is impressive in the scope of its subject, in the sheer amount and variety of data the author incorporates into the narrative, and with respect to the originality and plausibility of the explanatory models he suggests. In reading this book, it becomes apparent that Shreeve's purpose is two-fold. *The Neanderthal Enigma* is as much a personal quest for meaning on the author's part as it is an opportunity to propose a new interpretation of the varied—and often conflicting and confusing—evidence pertaining to modern human origins. Most impressive of all is that Shreeve manages to synthesize such an array of archaeological, fossil, and genetic data into a coherent and highly absorbing account. It is rare enough for a science writer to effectively communicate the minutiae of an often arcane and esoteric field to a more general audience (comparisons to Carl Sagan or Stephen Jay

Gould come to mind); but to do so in a manner that is illuminating and entertaining is rarer still.

By the conclusion of the first chapter, Shreeve has established his contention that *Homo sapiens* as a species is qualitatively distinct from all others. The thesis developed by the end of the book is that this is why we are here and Neanderthals are not. Shreeve argues for a separate species designation for these hominids—a position not shared by all anthropologists. His passion (or "obsession" as he puts it) regarding the subject of Neanderthals is obvious, however, and so he does not blithely dismiss these "players" from the evolutionary "stage." Instead, he wades through the considerable array of science fact and fiction concerning Neanderthals and constructs an admirably thorough and balanced perspective on this group which, in the end, amounts to a sympathetic and somewhat poignant assessment as well.

Shreeve's considerable talents as a story-teller are evident throughout. The text unfolds like a mystery or detective novel of the highest order. There are twists and turns woven into the skillfully crafted "plot" and the narrative propels the reader forward in anticipation of the next revelation. Shreeve raises numerous hypothetical possibilities and then proceeds to dissect and refute them, often taking the reader quite by surprise in the process. The author's penchant for humor is also apparent. Some of the more amusing segments reveal the passions and loyalties of those men and women for whom these issues have deeply personal as well as professional significance. The issues and arguments surrounding modern human origins comprise one of the major "arenas" of debate in anthropology—an arena not only of clashing ideologies, but of clashing reputations and egos as well.

In reviewing *The Neanderthal Enigma*, one must not disclose too much of its content; to do so would thwart the author's considerable accomplishment in crafting a mystery about a mystery, and ultimately undermine a large part of the pleasure in reading this book. *The Neanderthal Enigma* should prove absorbing and provocative reading for any person intrigued by the issues of modern human origins and the fate of the those who were almost, but not quite, "us."

Reviewed by Janice Drodge, Assistant Professor of Anthropology, University College of Cape Breton, Sydney, NS B1P 6L2, Canada.

BODY, SOUL, AND BIOETHICS by Gilbert C. Meilaender. Notre Dame, IN: University of Notre Dame Press, 1995. 134 pages, notes, index. Hardcover; $21.95.

Meilaender recently joined the faculty of Valparaiso University. He has published extensively in the field of theology and ethics. His recent publications include *Bioethics: A Primer for Christians, Limits of Love: Some Theological Explorations*, and *Faith and Faithfulness: Basic Themes in Christian Ethics*.

In this book, Meilaender addresses only a small range of topics within bioethics. He raises the question whether bioethics as a new discipline has developed in a way beneficial to the individual and society. He laments the increasing focus on public policy in bioethics which obscures the importance of beliefs about human nature and destiny. By drawing our attention to those beliefs, he shows us what is at stake in many of the debates about bioethics.

In chapter one, "How Bioethics Lost the Soul: Questions of Method," he considers from where the direction for bioethics should come. Since medicine is a profession, it is important that its norms be generated from within the practice itself, not from applying more universal norms to it. But the development of bioethics in recent years has been moving away from this principle which was perceived as paternalistic, arrogant, and elitist. Meilaender criticizes the communitarian approach of Emanuel and the principlism approach of Beauchamp and Childress, which treat morality as rooted in general communities. These approaches fail to explore in detail the world view underpinning their principles of respect for autonomy, nonmaleficence, beneficence, and justice. They also fail to provide wisdom and guidance about questions of human life and personhood. They only provide a minimal morality and consensus in a pluralistic society. Meilaender also criticizes the casuistic approach of Jonsen and Toulmin in abandoning principles and in settling for probabilistic opinions to gain public support.

In the second chapter, he explains "How Bioethics Lost the Body: Personhood." Augustine first described the human being as "animated earth." This idea can be extended to mean that the human body has a trajectory, and every person shall live out a history. Meilaender criticizes the recent development in bioethics which separates a person from the body and which considers only a body with cognitive ability as a true person. He concurs with Paul Ramsey that the human is an embodied soul or an ensouled body and that the soul is inseparable from the body until death. It is impossible to point to some moment in a person's history when he is no longer a person. He concludes that only God can see us as person and we should not truncate according to our own criteria of personhood or our own desire of autonomy.

Meilaender then discusses the beginning of a person in "How Bioethics Lost the Body: Producing Children." He analyzes the arguments in John Robertson's *Children of Choice* about decisions to produce and finds them wanting. The arguments of Robertson have a very thin understanding of human life. The body is separated from the person, and it can do whatever it wants for fulfillment. However, a true understanding of procreation within a marriage bond, as a mystery, is good for the loving relationship between husband and wife and good for the dignity of a child.

In chapter four, "Bioethics as Public Policy: A Case Study," Meilaender uses the Report of the Human Embryo Research Panel as an example of bioethics in search of a public policy. He decries the marginalization of religious and philosophical perspectives in the deliberation of this issue, and points out the impossibility of purely

scientific or philosophically neutral consideration of this issue.

In the concluding chapter, "The Issue That Will Not Die," Meilaender revisits the abortion issue and discusses the two arguments, personhood and bodily support, for the rights to choice. He points out that neither argument is sufficient, and they need mutual support. The basic issue is the concept of humanity.

This is a book which discusses bioethics from a traditional Judeo-Christian world view. It analyzes issues in depth and contrasts different approaches sharply. It is useful for reminding Christians that biblical thinking is different from the prevailing ideas. In a pluralistic society, Christians should seek out books like this which explain the outworking of biblical truth and try to reflect and integrate the faith into their daily lives.

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

THE VALUE OF LIFE: Biological Diversity and Human Society by Stephen R. Kellert. Washington, DC: Island Press, 1996. 280 pages, figures, table, index. Hardcover; $24.95.

Kellert has conducted over twenty years of research into the relationship between human values and the diversity of life on this planet. Following a brief introduction that outlines the parameters which he established for examining the differing values that people associate with nature, the extensive second section shows how various social and cultural factors can shape the content and expression of these values. The final section examines how the understanding of these values can be applied through government policies and management practices, to ensure a long term harmony between humankind and all other species.

While much of this book is descriptive in nature, there is also a prescriptive element. "The great majority of Americans fail to appropriate the extent to which the intellectual quality, emotional value, and material well-being of their lives depend on an abundant, healthy, and diverse living world" (p. 63). Many of the chapters consist of evidence taken from surveys that demonstrate how one or another factor lead to this conclusion. So, for example, we learn that most Americans possess a highly utilitarian perspective toward animals, while the young and better educated have a much broader appreciation of nature and wildlife. Similarly, people show a greater appreciation for animals that are large, intelligent, and express emotion while, by and large, they fail to see the importance of insects.

The diversity of perspectives towards nature is highlighted by comparing the attitudes of, for example, hunters with those of bird watchers. Similarly, a presentation of the attitude of Americans, Japanese, and Germans demonstrates the importance of national differences while material from Botswana is less convincing. Despite the variety and complexity of views and interests that different groups of people hold toward nature, Kellert advocates a more active role for government in guaranteeing a better future for humankind. He sees this taking place through a process of incremental change accompanied by increased education and the adoption of a more ethical attitude toward all forms of life.

Perhaps the greatest feature of this book is the author's prologue, where we gain an insight into the intense passion that Kellert has for his subject. It is in these few pages, and briefly in the final chapter of the book, that we are presented with a holistic view of nature as possessing an order and purpose that is as spiritual as it is intellectual or material. Unfortunately, I do not think that the rest of the book lives up to the author's expectations. Though this book is not intended for specialists, the scientific tone of the text is tedious and uninspired, and the figures and tables are more distracting than convincing. For those readers interested in learning about biodiversity and society's attitudes towards living things, I would recommend Kellert's more technical articles or works for a more general audience by others.

Reviewed by Robert A. Campbell, University College of Cape Breton, Sydney, NS B1P 6L2, Canada.

THEOLOGY FOR EARTH COMMUNITY: A Field Guide by Dieter T. Hessel, Ed. Maryknoll, NY: Orbis Books, 1996. 292 pages, bibliography. Paperback; $20.00.

In the preface, we read: "The purpose of this collaborative volume is to comprehend state of-the-art scholarship and teaching across the fields of theological education in response to the environmental challenge. ... These essays evolved from carefully crafted papers that were prepared for and discussed at an October 1994 conference on 'Theology for Earth Community.'"

Some authors are not Christian, others are not orthodox. The editor uses four short essays by other authors to stress the fact that our ecological, physical, and social environment touches everything that theological schools teach. The book has twenty chapters in six parts. Hessel wrote short introductions to each of the six parts. That the book has no index is an indefensible omission.

Some writers in this book appear not to know church history. As a result, viewpoints are hollow. Others seem to know no writings of the last decennia. Some writers accuse the Christian community of originating the degradation of our environment. However, they base it on a false interpretation. In spite of these objections, several articles in this book are excellent.

Theology deals with God and his relationship to creation. Is it necessary to teach the ways in which man destroys the environment in seminaries? The fact that the writers felt the necessity to write this book may be a sign of our deficiencies as church members. We have become comfortable pew-sitters, waiting for the preacher to decide what the Christian life requires of us.

It is true that many scientists fail to consider the damage that may result from their work. Scientists knowledgeable in the affected areas should address these problems, not theologians. For that reason it is, for example, a serious omission that the book mentions Calvin DeWitt only once. He is a professor of environmental studies at the University of Wisconsin. I also miss the name of Bob Goudzwaard, professor of economics and a former Minister of Economics in the Dutch government. He wrote several books in English about lifestyles that waste natural resources.

Some scientists might want to read this book to realize their inadequacies as scientists. On the other hand, it may be a dangerous book for ecclesiastical practice, if pastors are required to be competent in all disciplines.

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

THE CHOICE: EVOLUTION OR EXTINCTION? A Thinking Person's Guide to Global Issues by Ervin Laszlo. New York: A Jeremy P. Tarcher/Putnam Book, 1994. 216 pages. Hardcover; $17.95.

Ervin Laszlo, a member of the famous Club of Rome and author of twenty-seven books, discusses again global themes, planetary trends, and the future of the world.

In Laszlo's view, the driving force in the world today is computers ("informatization of life and society") that allow us to extend globally the scope of activities of any sort, in particular, politics and business ("globalization in government and business"). There is a growing consensus, says Laszlo, concerning maintenance of peace and security on a global scale, of environmental protection, and the regulation of the world financial system.

In the twentieth century the world underwent four shock waves—communism, fascism, decolonization, and glasnost—that permanently affected the global political scene. Each shock wave begins with destabilization of the existing system and through emerging chaos it leads to new possibilities. However, the world must be prepared for the fifth wave that will be caused by increasingly acute problems of population, poverty, militarization, waste, pollution of the environment, climate change, and food and energy shortages. Underdeveloped countries would like to catch up with the prosperous nations. However, "the consumption and waste levels presently attained by the industrialized countries could never be duplicated in the developing ones. Our planet would be depleted and overpopulated within a generation" (p. 50).

Laszlo presents a list of "obsolete beliefs and misguided practices" that prevent humanity from resolving existing problems. These beliefs include a "Neolithic illusion" that nature has inexhaustible resources, a belief in the ability of science to solve all problems, and a belief that an unrestricted free market economy should be adopted by all countries. Laszlo sees a solution not just in toleration of cultural diversity of others, not in mere coexistence, but in what he calls interexistence, which is "an active mutually constitutive relationship, instead of a passive, purely external one," living "not merely side by side, but with and through one another" (pp. 107-08). This can be accomplished by following three rules: thinking globally which is seeing one's own role in the ongoing transition processes, acting morally, and living responsibly. Laszlo outlines a strategy that in his view everyone can follow. It consists in founding groups that prospectively can grow to national and global prominence. The goal of such groups is to promote global consciousness. Thus, not surprisingly, a proper name for such a group is a Center for Planetary Consciousness and the approach is called the CPC strategy. Spiritually, this is a direction advocated by Laszlo.

It is undeniable that there is a growing global problem, and scores of facts and figures quoted by Laszlo confirm that. However, the proposed planetary consciousness solution is less disputable. The signs of hope listed by Laszlo include the new age movement, and it appears that, according to him, this is the most prominent sign of hope. He champions "reinterpretation of nature of the divine" so that "God is immanent throughout the universe," We have to "get in touch with our innermost spirituality," whereby we can "revitalize society" (p. 192). This final accent of the book significantly undermines the message of the book by creating an illusion that by pantheistic thinking and by spreading the new age world view—not to mention "championing sexual rights"—the world can be saved. Thus, not surprisingly, the Christian religion is seen by Laszlo as a negative force. It is blamed for "lending support to the Neolithic illusion," unlike Hinduism and Buddhism (pp. 72-73), and for promoting a misleading ethics as expressed in the Golden Rule. Laszlo sees proper formulation of ethics in Kant's categorical imperative (pp. 123-24). He, however, does not mention the Christian origin of this imperative, nor postulates of practical reason, which hardly could be reconciled with the new age thinking.

Renewed by Adam Drozdek, Duquesne University, Pittsburgh, PA 15282.

SEEING NEW WORLDS: Henry David Thoreau and Nineteenth Century Natural Science by Laura Dassow Walls. Madison, WI: University of Wisconsin Press, 1996. 301 pages, index. Hardcover; $42.00. Paperback; $22.95.

Few names invoke such images of nineteenth century natural history as Thoreau. He remains one of the giants of both literature and science. *Seeing New Worlds* is a book on the history and philosophy of science, not the sort of volume a biologist like me would pick up for recreational reading. As a botanist I have always enjoyed Thoreau's careful description of plants. But I had little idea of some of the ideas and personalities that shaped his thinking. Walls' treatise examines Thoreau in light of both the intellectual histories of his time as well as ours.

Like all of us, Thoreau's thinking was shaped by the great minds of his day, including Coleridge and Agassiz.

According to Walls, two men in particular had a defining influence on Thoreau. The first—the one I seem to recall from what appeared at the time in college freshman English as an interminable study of Walden—is Emerson. Harvard's prominent poet, Emerson was a transcendentalist having taken a strong public stand against the established religion at Harvard in his "Divinity School Address." Considering the influence Emerson had on Thoreau, it is not surprising that Thoreau read widely in yoga literature. Is this a link to the pantheism that is found in many of the conservationist organizations today that boast of a lineage to Walden?

Of especial interest to me was the influence of Alexander von Humboldt on Thoreau. Humboldt refused to acknowledge God and is reported to have been a practicing homosexual. The careful, painstaking science that Humboldt practiced and so enthusiastically espoused in his voluminous writings found a ready recipient in Thoreau. One of the great travelers of history, Humboldt measured everything, recording in detail all possible natural phenomena. Thoreau, as a surveyor was already predisposed to measuring. His method of observing nature draws heavily on Humboldt.

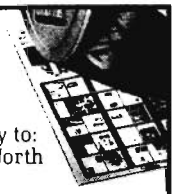
Humboldt's final work was his *Cosmos*. In it, he explored the link between the poet and the scientist. Thoreau followed his mentor. Walls writes:

> The naturalist too can pursue his study with love, but he is liable to barren dryness; the typical botanist's manual is "dry as a *hortis siccus*.—Flowers are pressed in the botanist's service." Such work is sterile because it presumes a nature that is passive and quiescent, that can be "pressed into service"—and a student of nature willing to do the pressing. Thoreau's ideal is far different ... The poet must yield to love, ravish and *be* ravished, if the marriage is to be consummated.

Those of us who espouse a biblically-based ecoconscience realize how vacuous our thinking about nature and the environment is and how tenuous the link between our faith and our science! Thoreau and Humboldt have had a tremendous affect on ecology and observational science that forms, in part at least, the philosophical basis of the current environmental concern. We are so far behind in articulating a biblically based concern for the environment.

The author is in the department of English at Lafayette College. In addition to students of Thoreau, anyone interested in the roots of the ecology movement will find this book of interest. Heavy going at times, I nevertheless concur with a comment on the jacket. "... well written, even eloquent."

Reviewed by Lytton J. Musselman, Professor of Biological Sciences, Old Dominion University, Norfolk, VA 23529-0266.



GOD WITHOUT THE SUPERNATURAL: A Defense of Scientific Theism by Peter Forrest. Ithaca: Cornell University Press, 1996. 256 pages, index. Hardcover; $39.95.

Scientific theism is the "belief in a god as the explanation of various features revealed by, or implicit in, modern science" (p. 1). Assuming the stance of scientific realism, Peter Forrest, a professor of philosophy at the University of New England in New Wales, Australia, attempts to defend scientific theism and to argue *against atheism*—though not specifically agnosticism—in his book. This is his first aim. The method he uses is "an appeal to inference by best explanation" (p. 2), that is, theism offers the best explanation for the various truths we take for granted. By speaking of theism "without the supernatural," Forrest should not be taken as *necessarily* denying, for example, angelic beings or miracles. Rather, he begins with entities that are generally *familiar* or *publicly accessible*—such as the laws of nature—in order to establish a common ground for discussion. This is his second aim. His third aim is "to illustrate a Kant inspired, but not Kantian, account of the role of metaphysics as speculation" (p. 5), arguing about the way things *might* be or "how is it possible?"

This sophisticated, philosophical book is both thoughtful and thought provoking. Forrest casts a wide net in the array of subject matter covered and, true to his promise, does a good bit of illuminating speculation in an attempt to show how theism offers a better explanation than its rivals. There are certainly points of disagreement, and I raise only three of them: (a) whether one really needs to take methodological naturalism for granted; (b) whether one cannot opt for a more integrated and organic mind-body interaction (e.g., like that of Aquinas rather than Descartes) instead of a non-reductive physicalism (p. 191); and (c) whether his questionable version of pantheism, in which our minds are part of the divine mind (p. 202), genuinely succeeds.

Despite some of my concerns, the book in many ways offers a rich *apologia* of theism. The first chapter, "The Apologetics of Understanding," lays the groundwork for the book. It mentions, among other topics, the need for apologetics, the merits of probability, and various epistemological considerations. The second chapter, "The Theocentric Understanding of Life," brings up the life-friendly nature of the universe—which is most elegantly accounted for by theism, the goal of creation (which is "for the sake of embodied persons" [p. 6]), and important issues related to creation.

In chapter 3 "The Naturalistic Understanding of Life," Forest sees naturalism as concerning "the role of the natural sciences in our understanding" (p. 89); however, naturalism does not thereby have an *advantage* over theism, which *also* utilizes the natural sciences. Instead of God's being

posited as an extra explanatory entity, Forrest shows that God explains far more than naturalism when we look at the *whole* range of available phenomena.

Chapter 4, "The Breadth of Theocentric Understanding," maintains that a *cumulative* case can be made for theism's explanatory power: the universe's "ubiquitous regularities," our capacity for intellectual progress, our basic moral convictions, and the universe's beauty. These features of our world cannot be adequately accounted for by naturalism. Forrest's discussion of beauty as theocentric is particularly insightful. Beauty, he says, has a transcendent quality, pointing beyond itself. How do we explain "the special quality of the appreciation of beauty"? Or why is there such an abundance of beauty—whether sensuous and nonsensuous (e.g., the elegance of certain physical laws) (p. 135)? I think chapters 3 and 4 are the high points of the book.

Chapter 5, "Non-naturalistic Rivals to Anthropic Theism," is a response to world views such as pantheism, polytheism, idealism—among others. Chapters 6, "The Theoretical Niche Argument," and 7, "Speculating About Consciousness," are closely connected. Chapter 6 attempts to reveal some of the gaps in reductive physicalism. (For example, knowing a physical description of things does not "enable us to know what it is like to be in different states" [p. 171]; also, unlike a self-monitoring camera, human consciousness cannot be understood in solely physical terms.) These gaps make room for thinking about God. Chapter 8 ("The Speculative Understanding of Evil") attempts to address the problem of evil with two speculations: "Leibnizian plenitude theodicy" and John Hick's soul-making theodicy. Among other points, Forest takes pains here and elsewhere to argue for God's care for *individual* creatures, not simply the whole of them. Despite this care, there may be people who "deprive themselves of the good that God intended for them" (p. 225).

Forest writes, "Belief in God enables us to understand much" (p. 213). In this insightful book he does an admirable job of showing how this is so.

Reviewed by Paul Copan, Marquette University, Coughlin Hall, 132, P.O. Box 1881, Milwaukee, WI 53201-1881.

HIGHER SUPERSTITION: The Academic Left and Its Quarrels with Science by Paul R. Gross and Norman Levitt. Baltimore, MD: The Johns Hopkins University Press, 1994. 314 pages with index. Hardcover; $25.95.

Older scientists are sometimes nostalgic for a time when science was generally considered good. Of course there were religious opposition to evolution, fringe adherents to astrology, and the Soviet eccentricities of Lysenkoism. Nuclear energy showed the dangers of science-based technology. But in American academia, even humanists, who did not much like science, thought that scientists learned something about reality. Those of the academic left were often the strongest supporters of free scientific investigation.

The subtitle of *Higher Superstition*, "The Academic Left and Its Quarrels with Science," shows the change which has taken place. Ill-defined post-modernism movements such as deconstructionism, and radical aspects of women's and minority studies, multiculturalism, and environmentalism have developed an antipathy to science and try to discredit the belief that science can discover truths about the world which are not merely cultural constructs. Indictments of science sometimes assume extreme form.

The authors are scientists, Gross a biologist and director of the Center for Advanced Studies at the University of Virginia and Levitt a mathematician at Rutgers. Their response to the criticisms of science is civil but blunt and sometimes devastating. As they argue in their final chapter, "Does it Matter?" the stakes are high: the integrity of academic communities and the possibility of liberal education. It is necessary to call a spade a spade, not a geotome.

Higher Superstition can be read on two levels. Its introductory chapter attempts an analysis of causes for the academic left's negative attitudes toward science. Despite the progress toward a more just society which science, the Enlightenment, and political liberalization once seemed to have produced, academic leftists found themselves, shortly after their heady days in the sixties, irrelevant to the real political process. It is not surprising, then, that they "are in a sullen mood, a mood in which it seems that the most immediate solace comes from devising reasons for discounting and minimizing the proudest accomplishments of the smug society that surrounds them" (p. 26). Science is one of the proudest accomplishments of our society. It can be discounted by claiming that it is a tool of oppression, a cultural construction which enables white males to retain power. Such assertions are made by many authors who, though isolated from the rest of the world, hold prestigious academic positions.

Gross and Levitt make it clear that they are not claiming to be professional historians. Their foray into this field is justified by the need for analysis by people who know something about science. Their study of the historical roots of leftist attitudes seems *at least* as competent as those of most of the literati, discussed later in the book, who feel competent to discuss science.

The detailed discussion of these critics suggests another way in which one can read this book—simply as a source of horrible examples. The authors are fair in their citations and try to avoid quoting out of context those they criticize. But many scientists who read what is said about their field of competence will simply conclude that the critics are not competent to open their mouths about the subject. For example, the statement by literary scholar N. Katherine Hayles (discussed on p. 101) that by midcentury, special relativity, quantum mechanics, and quantum field theory had all "been played out or had undergone substantial modification" seems simply ludicrous to a theoretical physicist like me.

Of course, it is true that science has been dominated by white males, so that women and minorities have largely been excluded from positions of power. The way

to remedy this situation is to open up the sciences to broader participation. As Gross and Levitt argue, just the opposite result will be achieved by the notion that each group has its own distinctive science. A young woman persuaded to study "feminist science" instead of the supposedly oppressive masculine variety is likely to be cut off from the possibility of making any genuine scientific contribution. The only people empowered by pseudoscience are pseudoscientists.

This is a valuable study by scientists who are sympathetic to traditional liberal concerns, but who are not willing to put up with intellectual sloppiness or dishonesty in dealing with them. I would recommend it to anyone who cares about the state of science in American society.

Reviewed by George L. Murphy, Pastor, St. Mark Lutheran Church, Tallmadge, OH 44278.

TIMES OF THE TRINITY by Duane H. Larson. New York: Peter Lang, 1995. 213 pages with index. Hardcover; $45.95.

For centuries, western theologians affirmed and defended the doctrine of the Trinity, and then did little with it. It had slight influence on the rest of theology and none on the interaction of theology with other areas of thought and practice. That has changed in the past fifty years. Today, Trinitarian theology is a lively area in which Roman, Protestant, and Orthodox theologians are working.

Times of the Trinity by Duane Larson of Gettysburg Lutheran Seminary is part of this new work on the Trinity. It is, however, more than a treatment of purely theological issues because Larson believes that new trinitarian theologies have the potential for significant interaction with science, and intends his book as a contribution to that interaction. It is, as the subtitle says, "A Proposal for a Theistic Cosmology," a trinitarian contribution to the science-theology dialogue. Larson's "aim is to show that a reappropriation of the classic Christian doctrine of the Trinity is a theologically coherent and intellectually fruitful way to describe God's action in the world" (p. 5).

Both theology and science have moved from emphasis upon stoic "substance" to stress dynamic *relationships*. In addition, the Incarnation and the temporal experience of the Second Person of the Trinity raise questions about the assumption inherited from Greek philosophy, that God is immune to time. The resulting concepts of divine temporality propounded by various theologians have opened Christian thought to insights from thermodynamics, relativity, quantum theory, and cosmology. In turn, the doctrine of the Trinity will come to be seen as crucial for distinctively Christian engagement with science.

Larson presents his work as a "research program," following the ideas of Lakatos for which Nancey Murphy has argued. The "core thesis" of this program is, "The eternity of the Trinity is essentially temporal" (p. 7). That calls for reflections on Christian ideas about time and eternity to which chapter 2 is devoted. This survey of Christian thinkers concludes with the crucial contribution of Karl Barth. It is followed by chapters on contemporary trinitarian theologians and comparison and contrast of their work with process theology, on modern physical theories, the ideas of three cosmologies and the trinitarian theology of Jürgen Moltmann. The concluding chapter sets out the theses of different levels in this research program, providing a summary of the argument and a model for how theology may be done in Lakatos-Murphy fashion.

It has been common to think of the eternity appropriate to God as loving a "simultaneous" possession of all temporal instants, following a classic definition of Boethius (p. 22). But this need not mean, as Barth emphasized, that all instants for the eternal God are collapsed into an undifferentiated point. God is "supremely temporal." For God, past, present, and future are distinguished but are possessed together. Acceptance of this type of distinction has given rise to an emphasis upon the future which is characteristic of modern theology: There is an "arrow of time" in God's eternity as well as in the created world.

A concept of time involves relationship; and temporality of the divine life is connected with the relationship of Father, Son, and Holy Spirit. Because God relates to the world in trinitarian fashion, the world is temporal. Such, in brief, is the connection between trinitarian doctrine and scientific understanding of the world.

The basics of relativity and quantum theory are sketched in the fifteen pages of chapter 4. This is probably too brief for readers not already familiar with those areas of science, who may simply be puzzled by unexplained references to light cones or the Stern-Gerlach experiment. One has to commend the author, though, for taking these theories seriously and trying to summarize them. As he points out in his generally favorable discussion of Moltmann's trinitarian ideas, that theologian avoids real engagement with modern science in his treatment of creation and time. In contrast, Larson examines the cosmological speculations of Grib, Hawking, and Isham with a view toward dialogue with contemporary science precisely at points where its implications for his core thesis seem most challenging.

For scientists, *Times of the Trinity* will probably be most useful as an introduction to the new climate of trinitarian theology and divine temporality. Theologians familiar with those developments will find it helpful as a proposal for ways in which theology can, and must, interact with the natural sciences.

Reviewed by George L. Murphy, Pastor, St. Mark Lutheran Church, Tallmadge, OH 44278.

HOW CAN YOU TELL IF A SPIDER IS DEAD? by Don Glass, Ed. Bloomington, IN: Indiana University Press, 1996. 192 pages. Hardcover; $25.00. Paperback; $12.95.

For what audience is this book intended? It is "designed for the young whose curiosity hasn't waned, and

for those of us whose curiosity is still there but who have chosen other, nonscientific lives." This book will be especially appealing to those who like to learn their science in small doses, because it caters to "those with unlimited curiosity but a limited amount of time." Each of its dozens of short pieces stand alone and can be read in any order.

What kind of topics are included? In addition to information on spider autopsy, there are intriguing discussions on how to cure hiccups, why your knuckles crack, why a single log is hard to burn, why dogs eat so fast, how to explain deja vu, why you can heat an ice cube, what Jell-O is made from, how your pupils show, where bulbs go in the winter, how socks disappear in the dryer, and why a fastball rises.

This is an excellent book to give to the budding young scientist in the family, or the older one who still doesn't know all the answers to how things work. Since most of the articles are about one page in length, it would be a good book to keep handy for spare moments. Its handy index can direct you to a topic of specific interest. Read a page a day, and you are prepared to amaze your friends with startling insights and information.

This book is a sequel to *Why You Can Never Get to the End of the Rainbow and Other Moments of Science.* The author is director of Indiana University's public radio station and producer of *A Moment of Science,* the program upon which the book is based. Four writers assisted the editor in preparing this volume. Thanks to the Indiana University Press for serving the lay reader so well.

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

WEIRD WATER AND FUZZY LOGIC by Martin Gardner. Amherst, NY: Prometheus Books, 1996. 260 pages. Hardcover; $25.95.

Gardner is well known in science circles: he is a fellow of the Committee for the Scientific Investigation of Claims of the Paranormal, for many years wrote a column in *Scientific American,* and has written numerous books including *Science: Good, Bad, and Bogus.*

The publisher's press release indicates that "books on angels, parapsychology and questionable New Age remedies outnumber books of truth and reason by more than 1000 to 1." This volume by Gardner is presented as a candle in the dark which seeks to challenge pseudoscience and the shameless promotion of the paranormal.

The book's 46 chapters come from book reviews and articles, many of which were previously published in *Skeptical Inquirer.* In addition to discussing parapsychology, Gardner also dips into philosophy, theology, and science. His writing style is somewhat that of a curmudgeon, albeit a witty, authoritative, and informative one.

Among the books Gardner reviews in this volume are those by Richard Morris, Robert Wright, Freeman Dyson, Heinz Pangels, Stephen Jay Gould, and Joseph Campbell. His columns which may interest readers of this journal include "Big Bang Is Alive and Well," "Margaret Mead's Great Samoan Hoax," "Science vs. Beauty?" and "Pealeism and the Paranormal."

Gardner is critical of both orthodox ("Is The Second Coming Coming?") and unconventional "Doug Henning and the Giggling Guru") faith. On some topics, Gardner does come across as a "voice of sanity amid the deafening babble of the gullible." However, people of faith may take issue with Gardner's view that religion is based on fuzzy logic. Gardner speaks approvingly of Michael Martin's "deadly" attack on religion in *Atheism.*

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

SCIENTISTS OF FAITH: Forty-Eight Biographies of Historic Scientists and their Christian Faith by Dan Graves. Grand Rapids: Kregel Resources, 1996. 192 pages, bibliography, glossary, and index. Paperback; $9.99.

Many teachers have recognized the need for a collection of short biographical essays on Christians who contributed to science. This inexpensive book makes an important contribution to the task. Graves has embraced the widest possible chronology by drawing on individuals over a 1600 year period. These biographical sketches offer candid two to four page snapshots of real people—virtues and faults—packing a large amount of information in a short space, enough for the instructor to present a picture in the limited time available in the classroom.

The first section "A New Look at the Universe: Philosophical Science Before 1500" offers eight precursors to modern science including Robert Grosseteste, John Philoponus, and Nicole Oresme. A preliminary statement deftly sketches the theological and philosophical context of the period and links it with the present. For Graves:

> Today many despair of science because they feel it has no soul, looking instead to Eastern religions and to New Age mysticism to give it a religious identity. Others cling tenaciously to scientism, refusing to consider the reality or relevance of the Creator. Both groups would do well to recall that it was God-fearing men like those introduced on these pages, who brought into being today's scientific methodology (p. 13).

Hugh of St. Victor (c. 1096-1141) was one of the first to advocate the use of the study of nature in order to understand scripture. He also emphasized the intrinsic value of physical labor—an appropriate point for students.

The next section "The Picture Turns Modern: Descriptive Science 1500-1830" cover a period when many of the major and minor players were Christians. Here we meet familiar figures such as Robert Boyle, Blaise Pascal, Johannes Kepler and Carolus Linnaeus and the less known Thomas Young, Augustin Catchy, and Ewald George von Kleist. Naturalist John Ray's *Wisdom of God in Creation*

fused science with faith in a way that characterized British science well into the Nineteenth century. It is instructive how geologist William Buckland modified his views of the Noahic flood as scientific data was obtained.

The final section "Science Without Limits: Effectual Science After 1830" closes at 1950. It's nineteen biographies include the well-known Michael Faraday, Philip Gosse, Clerk Maxwell, and Gregor Mendel and lesser lights such as Matthew Maury and John Adams. Contributions from Americans such as George Carver, Asa Gray, and Edward Morley appear in this period to join their European counterparts. Graves treats evolution in irenic fashion in the context of an investigator's discipline and time period rather than arguing a particular position.

His choice of characters was reasonably even-handed in the light of the many candidates available. I would have added (say) William Harvey and a few more life scientists to provide a better balance with the physical sciences and mathematics. Sadly there are no woman listed. Although there were few active before the current era their inclusion would have offered role models for the women who are a large part of the potential audience for this work. The author's statement "today ... the needless rift between science and Christianity runs deep" (p. 43) does not stand up in the light of historical analysis and the participation of a large number of Christians in every level of the scientific enterprise.

Graves is concerned about the expression of Christian character in his actors as well as their professional contributions. They often faced opposition and in declining to press their claims lost priority of discovery and fame. Some were sons of clergyman and were hard pressed whether to serve God in the pulpit or the lab. All of us can profitably read this book. Teachers in Christian institutions at all levels have a valuable and low cost link with the past. A very complete bibliography proves sources of more information on the chosen "forty eight" and beyond. We look forward to a similar account covering the period after 1950.

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

HABITS OF THE MIND: Ten Exercises to Renew Your Thinking by Archibald D. Hart. Dallas: Word Publishing Company, 1996. 187 pages. Hardcover; $17.99.

Archibald, professor of psychology at Fuller Theological Seminary, has written 18 books relating the findings of psychology to biblical perspectives. This present book will be of primary interest to the neophyte and layman, because it contains mostly elementary and obvious recommendations. The book promises the reader insights on how to accomplish more, make wise choices, keep a clear conscience, and control thoughts. The 17 chapters coalesce around three sections: understanding the power of thought; the ten habits of a healthy mind; and exercises for developing your thinking habits. The book provides many useful scripture verses, quotations, and anecdotes. Hart writes in an engaging and compassionate way; his advice may help readers rejuvenate their lives via changed mental habits.

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

WOODROW: Apostle of Freedom by Fred Kingsley Elder. Two Harbors, MN: Bunchberry Press, 1996. xv + 183 pages, appendix, bibliography, index. Paperback; $14.95.

James Woodrow (1828-1907), uncle of Woodrow Wilson and president of Carolina College (now the University of South Carolina) from 1891 to 1897, was one of the leading Christian evolutionists of the last century. Ordained a Presbyterian minister before the Civil War, he aided the Confederate cause by manufacturing medicines and explosives. Woodrow also served as pastor of the postbellum Southern Presbyterian Church and Perkins Professor of Natural Science in Connection with Revelation at Columbia Seminary until his removal from office in 1886 after a heresy trial. As occupant of that chair, he taught and wrote extensively on issues such as the antiquity of the earth and its inhabitants, the origin of death, the unity of the human race, and the extent of the flood—not to mention organic evolution, which he viewed as mediated divine creation.

These remain interesting subjects for many readers of this journal, which is the principal reason why Elder's brief intellectual biography may be worth a glance. A good portion of its pages are devoted to expositions of Woodrow's views, illustrated with substantial quotations from his writings, which are not readily available to most readers. The questions Woodrow addressed, the answers he gave, and the charges leveled at him by more conservative foes within his denomination will ring familiar to members of those contemporary churches in which evolution is still seen by many as "evilution." Indeed, the Woodrow case is still a live topic in certain Presbyterian circles, as a bit of surfing on the internet will show.

Apart from the opportunity to peruse the arguments and to review the details of Woodrow's dismissal, however, there is little reason to read this book, rather than the recent biography by Robert Gustafson. The author died in 1963—his son (Tait Elder) is the editor and publisher—and the book itself is based on a dissertation written in 1939. Consequently, there is no attempt to engage the historiography of religion and science in America, which has since been completely reconceptualized in ways that most people reading this review would appreciate. The "warfare" of religion and science, Elder's dominant conceptual scheme, has been given a proper burial. Furthermore, the book is rather narrowly focused on Southern Presbyterianism and the heresy trial, with little attempt to contextualize the Woodrow affair or even to place his work in the broader story of American science in the nineteenth century. And the highly sympathetic treatment of Woodrow seems, at least to this reader, to border on hagi-

ography. Recommended only for those who want to know Woodrow's views on particular topics.

Reviewed by Edward B. Davis, Professor of the History of Science, Messiah College, Grantham, PA 17027.

WHY BELIEVE? by C. Stephan Evans. Grand Rapids, MI: William Eerdmans Publishing Co., 1996. 149 pages. Paperback; $13.00.

Evans, a professor of philosophy at Calvin College, has written 12 books, several of which deal with the theme of apologetics, notably his *Philosophy of Religion* (1985). The present book is an updated version of an earlier work entitled *The Quest for Faith* (1986). Evans clearly has an abiding interest in relating Christian faith to reason. The book's 13 brief chapters deal with typical apologetic issues. He addresses the question of the origin of the universe, the origin of morality, psychological arguments put forth which deny the existence of God, the problem of evil, the nature of Jesus, miracles, and other topics.

On the whole, I was very pleased with this book. Evans tackles the questions with which unbelievers struggle in a helpful manner. Throughout the book, he adds some innovative apologetic statements. Evans makes the point that the faith of some Christians may not be based on reason, but may nevertheless be valid. He also argues that the Christian faith is a reasonable faith. His point is that people who lack intellectual skill may be Christians though they may not be able to make a rational case for faith. Faith may be learned at home or in church and still be valid even though believers cannot explain Christianity rationally.

Evans uses the "beyond reasonable doubt" criteria used in the courtroom to state, that while the arguments for the truth of Christianity may lack absolute certainty, there is an abundance of evidence which is most compelling, but not so as to violate the freedom of the inquirer. If God's reality could be proved in an absolute sense then everyone would be Christian. He suggests that people should consider the fact that the Christian world view explains a wide variety of facts which cannot be explained adequately from a non-Christian perspective.

In his chapter on morality, Evans borrows heavily from C. S. Lewis. He argues persuasively that moral order cannot be sufficiently explained culturally. Like Lewis, he defies anyone to explain the human sense of "oughtness" through evolutionary theory. Once God is assumed as the Creator, the idea of moral obligation makes perfect sense.

The chapter on miracles is quite good. Evans reminds us that human beings have typical ways of acting, but we may deviate from the norm for a special purpose. While God has clearly established regular ways of operating in the world through what we call "natural law," why should it be thought unusual if he chooses to act in an atypical manner for a particular purpose? Those who dismiss miracles *a priori* are not being reasonable.

I liked the way he related to the problem of evil. His story about his wife arriving home later than promised, leaving him to care for the children when he had some important work to do, was quite helpful. He pointed out that while he had no knowledge of why she was late, he assumed she had a good reason based on his knowledge of her character. We believe in the goodness of God although evil things occur, which we may not be able to explain. We assume God has a good reason for allowing evil based on our knowledge of his character though we do not always understand his ways.

Freud argued that humans invented God because we need to believe in a "big daddy in the sky." Evans points out that Freud was guilty of the "genetic fallacy" which is making a decision concerning the truth or falsity of a viewpoint based on its origins. Evans turns the argument around and argues that our psychological need for God may be an indicator that God is real, having placed this need for himself within human nature.

Evans's main audience would probably be intellectuals who cannot believe in God because they think faith is irrational. One of his major concerns is to point out the cumulative effect of the various Christian arguments. Just as a jury cannot decide a case based on one piece of data but must consider the overall evidence, so Evans makes a similar plea in regard to the evidence pointing to God. While the unbeliever might dismiss a single piece of the evidence, the cumulative effect of all the evidence is compelling.

I highly recommend this book for ministers and Christian teachers to buy in quantity to give to struggling intellectuals. There are other similar books on the market, but I thought this one was exceptionally persuasive.

Reviewed by Richard M. Bowman, Co-founder, Disciple Heritage Fellowship, Lovington, IL 61937.

INVITATION TO THE PSYCHOLOGY OF RELIGION, Second edition by Raymond F. Paloutzian. Boston, MA: Allyn and Bacon, 1996. 303 pages, index. Paperback.

Invitation is designed to be a college and graduate level introductory text in the field of psychology of religion. Paloutzian, a professor in psychology at Westmont College in Santa Barbara, openly emphasizes two claims. First, psychological research will never explain away religion. Second, different approaches to studying religion should yield complementary insights. An unemphasized third claim underpins the book: scientific research is defined by procedure and measurement.

Invitation summarizes academic research for a wide array of topics, including religious development, conversion, and attitudes as well as religion's relationship to health. For me, the best parts were descriptive, such as the chapter on religion and experience. Also interesting were survey results which seemed to defy logic. For example, when asked to agree or disagree with statements that would logically be regarded as demonstrating an at-

titude of "using one's religion" versus "living one's religion," respondents often agreed with both. Of the few experiments reported, one amusingly explained the behavior of the priest and the Levite in the good Samaritan parable: They were in a hurry. Overall, *Invitation* succeeds as an introduction to the current state of professional study of the psychology of religion, a state which is strongly conditioned by historical development and may be limited by an unhealthy emphasis on method.

The revival of the field comes after a precocious beginning at the turn of this century. Henry James wrote the interpretive-analytic *The Varieties of Religious Experience* (1902) and his pupil Edwin Starbuck attempted the first questionnaire-based survey on the psychology of conversion. A long, dry period followed, brought on by many factors, including psychologists' antagonistic view of religion, religious professionals who wanted to cure "sick souls," and the philosophy department which once housed the field. Freud and Jung are mentioned only in passing.

During the past 25 years, a methodology-based psychology of religion emerged as a field of interest as new applications of ideas emerged from general psychology. Today, the goal of this field is to provide "the means whereby we can begin to understand the 'personal universe' just as physics allows us to understand something of the physical universe" (p. 66). This is one of several instances where the text sounds woolly. Does behaviorism really equate reward and punishment training to cause and effect (p. 56)? Is the probabilistic nature of scientific statements (e.g., in geology) the same as in psychology (p. 62)? Of greater concern is the fuzzy interpretation of questionnaire results. Dimensions of variability are introduced, developed, then found inadequate. One gets the impression that the only theories allowed are ones that can be "tested" by those slippery questionnaires. For example, several logic-based (deductive) models of development are presented, then evaluated as inadequate. So, though *Invitation* is well written and well documented, the field itself does not inspire confidence.

My unease may be framed by the following analogy: Suppose we wanted to know why some canines escape through invisible electronic fences and others do not. Would we learn much by formulating theories based on questionnaires designed to reveal each dog's "needs" for social interaction, security, exploration, etc.? Or would we learn more by pondering biological theories and predicting what psychologies might have been adaptive for the social and ecological niche in which dogs evolved?

This leads to the problem of defining "science." *Invitation*, reflecting current research, emphasizes complementarity rather than reductionism. To me, reductionism is part of science. Returning to the analogy, the way a dog "thinks" is founded on ancestral adaptations to a particular social and ecological niche. Dogs think like (juvenile) wolves. If the study of human psychology is to be "scientific," then it needs to integrate with the burgeoning fields of animal behavior, experimental cognitive psychology, and evolutionary biology. Consistency with other fields is the hallmark of the natural and, increasingly, the evolutionary sciences. Should it not also be for the social sciences?

Near the end, the author confesses: "One of the greatest challenges to any science is the generation of good theory. This is missing in the psychology of religion" (p. 269). This admission aptly summarizes the somewhat barren results of ritual emphasis on methodology at the expense of integration with the natural and evolutionary sciences. As a supplement to this text, a Christian student interested in the psychology of religion would benefit from reading *The Moral Animal* by Robert Wright, *Evolution of Desire* by David Buss and *The Adapted Mind* by John Tooby, Leda Cosmides, and Jeremy Barkow. These books suggest biological and physiological approaches upon which cross-cultural questionnaires on the psychology of religion may be grounded.

Reviewed by J. Raymond Zimmer, 540 W. Roscoe Apt. 170, Chicago, IL 60657.

A FUTURE FOR SOCIALISM? Political Theology and the Triumph of Capitalism by Harold Wells. Valley Forge, PA: Trinity Press International, 1996. 220 pages, index. Paperback.

Scientists are not just scientists. Members of ASA know that natural scientists are religious and political people. For that reason, I recommend reading Harold Wells' book.

Wells, a theologian, claims that the book is a theological book. However, it treats much more than theological subjects. The great strength of this book is that it shows how economic decisions influence the quality of life of many people. He specifically discusses the economic life of the North American continent. Wells does not hesitate to say that economic sins in North America are causing many problems all over the world. Even if we do not agree with his conclusions, we should think about the problems he mentions.

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

NATURAL GRACE by Matthew Fox and Rupert Sheldrake. New York: Doubleday, 1996. 210 pages. Hardcover; $22.00.

Fox and Sheldrake have written a total of ten books; among them are *Conversations with Thomas Aquinas on Creation Spirituality* by Fox and *The Presence of the Past* by Sheldrake. Everyone will find something in this book to raise the blood pressure. Sheldrake, a biochemist and former Methodist, will be remembered for the principle of "morphic resonance" which claims that there are no natural laws, only habits; Fox, a former Dominican priest and current president of the University of Creation Spirituality in Oakland, is known for "creation spirituality" which asserts pantheism. This odd couple came together as a result of their both knowing, and revering the memory

of, Bede Griffiths, the leader of a Christian ashram in India and one-time correspondent of C. S. Lewis.

Natural Grace is called a series of "dialogues on creation, darkness, and the soul in spirituality and science," so each chapter begins with a statement by one of the authors and then a contribution by the other followed by something like conversation; Fox is in normal type and Sheldrake in italics throughout. In many places it reads like conversations graduate students have while drinking beer in the wee hours, i.e., basically silly. It is clear from exchanges like these that the two genuinely enjoy the interaction; they feed off each other. But because of the format, the book suffers from a lack of structure and focus. However, otherwise it could not be called "dialogues." There are chapters on "Living nature and creation spirituality," "Grace and prose," "The soul," etc. Both authors speak highly and respectfully of the Gaia hypothesis of James Lovelock.

In spite of all the limitations and reservations, I thoroughly enjoyed reading the book. For example, Sheldrake argues that the religion of the Middle Ages was Christian animism and that the Protestant Reformation, along with Sir Francis Bacon and Rene Descartes, suppressed this "natural" state of affairs. The world became deanimated. In the old view (pre-Reformation), the soul was "not in the body, but the body in the soul." After Descartes, the soul became restricted to the pineal gland. The God of the resulting world machine was conceived of as a "designing intelligence, engineer, and mathematician," that is, in the image of man. Quantum theory and chaotic dynamics have made the old idea of determinism untenable at all levels of the phenomenal world. He also argues that there are three levels of soul, the animating principle: vegetative, animal, and rational. In the chapter on darkness, he describes the light and dark patterns produced by diffracted light to argue that darkness is included in light; this is then extended to sound, that is, silence is included in sound. And then to establish the incompleteness of modern science, he comments on the dark matter which composes a large (90% or so) portion of the mass of the universe. This discovery established "the existence of the cosmic unconscious" and is connected somehow to Jung's collective unconscious.

Both authors, but especially Fox, repeatedly refer to the fourteenth century Christian mystic, Meister Eckhart. Fox makes a great deal of Aquinas' observation that "God is life." (And presumably, though it is not stated, he would accept that the converse is true as well.) He also says that the "issue of Jesus as Redeemer is not enough. We must include the cosmic Christ," or cosmic wisdom (Sophia) that "permeates all creatures and the whole universe." (Anyone who has the sense to have a dog as spiritual advisor for seventeen years is not to be dismissed.) Creation spirituality is defined in terms of four paths: the *via positiva* or the experience of awe; the *via negativa,* or the darkness, suffering, silence, letting go; the *via creativa,* or creativity to honor our images, our deepest experiences; and the *via transformativa,* or the path of compassion and the realization of our interdependence. After stating that the experts on prayer are the mystics, he quotes a lovely little poem by Rumi, one line of which is "The leaf of every tree brings a message from the unseen world."

This is a readable, if superficial, book. All the topics need further development. But these are two very creative and highly literate writers so I am sure that this will not be their last workbook.

Reviewed by Braxton M. Alfred, Associate Professor of Biological Anthropology, University of British Columbia, Vancouver, BC V6T 1Z1.

THE OXFORD COMPANION TO ARCHAEOLOGY by Brian M. Fagan, Ed. New York: Oxford University Press, 1997. 844 pages. Hardcover; $55.00.

The 700 alphabetically-arranged articles in this volume address the who, what, when, where, why, and how of archaeology. Written by 300 worldwide scholars, the articles provide entertaining and informative information on the history of archaeology, eminent archaeologists, excavation methods, human evolution, and cultures from past civilizations. Helpful cross-referencing charts, maps, bibliographies, and an index are included.

Fagan is professor of anthropology at the University of California in Santa Barbara. His many books and articles have popularized archaeology for lay readers. While most of the article writers are affiliated with large universities and organizations, some come from small schools such as Westmont College.

This book provides the most up-to-date, wide-ranging, and extensive coverage available to the general reader. Archaeology sites all over the world, including the United States and underwater, are covered in the *Companion.* Egyptian hieroglyphics, luminescence dating, the Mayan calendar, Herculaneum, and the "Ice Man" are all covered. Biographies of influential archaeologists like Heinrich Schliemann, Louis and Mary Leakey, and Max Uhle are given.

A check of the article topics indicates a plethora of topes of potential interest to readers of *PSCF.* These include Darwinian Theory, Dead Sea Scrolls, Jerusalem, religion, the Roman Empire, and the scientific method. In order to cover the field, most of the articles are reasonably brief. However, some of them, such as the one on North America require about 20 pages of small print in two columns.

Easy reading of this work requires a broad grasp of history and a fairly large vocabulary. However, even the curious neophyte will find this book beneficial and enchanting.

I highly recommend it. The price is not unreasonable for such a large book. For those with limited resources, perhaps a gentle request that their school or public library purchase *Companion* would be in order.

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

RELIGION VS. TELEVISION: Competitors in Cultural Context by Jay Newman. Westport, CT: Praeger, 1996. 150 pages, index. Hardcover; $55.00.

As part of a series on media and society, this book offers a philosophical perspective on the cultural relationship between religion and television. The author presents his analysis in the context of his own long-term project aimed at understanding how religious bigotry is to be confronted and minimized. At the heart of this project is the conviction that authentic religion is at the core of a civilized and civilizing culture.

This brief work consists of four chapters devoted to examining basic issues, motives and strategies, religious television, and religion and television as competing forms of experience and culture. Newman's analysis relies heavily on the work of Neil Postman, and his fundamental argument is that, while traditionally religious institutions were largely responsible for the transmission of culture and values, television is taking over this role. The problem is that television is not capable of adequately performing this task, primarily because of the need for silence and solitude in our relationship with God and with each other.

Newman offers a number of proposals for dealing with this situation. For example, regulation of religion and television could be handed over to some third party such as government, or the two parties could seek ways to cooperate in the delivery of their products. Alternately, religious institutions could take a more constructive approach by expending energy in effectively performing their traditional duties, rather than devoting resources to attacking television. Another possibility is for religionists to infiltrate the television industry.

Newman is critical of much of what presently passes for religious television, particularly televangelism, in that it more closely represents and advocates the values of commercialism rather than those of traditional religion. It is difficult to reconcile traditional religious teachings with personality cults and the pursuit of fame and fortune. Much secular television programming also represents a degree of moralizing and pseudo-religious teaching, but this is all carried out in a very "feel good" nonthreatening way. Television can thus be seen as a minor instrument of secularization, especially in its presentation of religion.

Newman argues that television, like philosophy, has the potential to undermine or at least liberalize religion. While religion survived the rationalizing tendencies of philosophical speculation, the question is whether religion can survive the immediacy and mass appeal of television. Traditional religion has failed to provide an adequate theodicy, while television is able to present a seemingly endless graphic stream of suffering and death. What people will accept as the reality of the human condition is an open question, but it is also the greatest challenge facing religious institutions.

While I found this book to be more prescriptive than descriptive or analytical, it should appeal to those scholars who are interested in examining the role of media in the creation and maintenance of modern culture, and to anyone seeking a better understanding of the apparent demise of traditional religion.

Reviewed by Robert A. Campbell, University College of Cape Breton, Sydney, NS B1P 6L2, Canada.

EVANGELICALISM AND THE FUTURE OF CHRISTIANITY by Alister McGrath. Downers Grove, IL: InterVarsity Press, 1995. 209 pages. Hardcover, $16.99.

The thesis of this book is that evangelicalism will outlive both fundamentalism and liberalism to become the mainstream Protestant Christianity of the future. In this book, McGrath characterizes "Evangelicalism" by its several distinctives (paraphrased from the list on pp. 55-56):

(1) Proclamation of the Gospel—salvation by God's grace and our acceptance of it by faith—presupposing our felt need for personal conversion.

(2) the deity and Lordship of Jesus Christ, recognizing both the propositional and relational aspects of Christ's centrality.

(3) Authority of the Bible as God's Word in believers' daily lives and in their communities.

(4) The presence of the Holy Spirit in the life of the believer and communities of believers, focusing us on the Person of Christ and guiding us into truth.

Another important distinctive is the evangelical's tolerance of, but not acquiescence to, various other religious views and cultural customs. We can love others with whom we agree to disagree. Evangelicalism allows for diversity. It is also transdenominational. It is already a trend in mainstream denominations and as such is ecumenical as well as individual, e.g., even loyal Roman Catholics may and do accept evangelical beliefs.

In a chapter entitled "The Appeal of Evangelicalism," McGrath chronicles the bankruptcy of the modernist, liberal position which is fundamentally naturalist, denying any element of supernatural reality, and humanist, denying the real data of human behavior. Historical, orthodox, classical Christianity, i.e., evangelicalism "makes sense" and satisfies human needs for meaning. The postmodern generation is less interested in "truth" as such, but the good news of a right relationship with Spiritual Reality, God, is appealing.

In a chapter entitled "The Dark Side of Evangelicalism" he catalogs and discusses several matters that are not so appealing.

(1) The laying on of "guilt trips" at best is related to failure to apprehend the concept of grace, and at worst related to power trips by church leaders.

(2) Evangelical dogmatism refuses to "allow disagreement or doubt," and so implicitly claims absolute

knowledge. "Evangelicals need to rediscover the pastoral consequences of an excessive emphasis on certainty, make the vital distinction between *intellectual* and *existential* certitude clearer ..." He points out that liberal theologians are also often guilty of this same kind of dogmatism.

(3) Radio and TV evangelists, and other cult personalities, have scandalized the faith and disillusioned many. Power-hungry media preachers are able to take advantage of many people's desires for authority and certainty. Reformation leaders, Luther, Calvin, et al., effectively challenged this distorted picture of "priesthood," or special privilege before God.

If evangelicalism is to become the mainstream Protestant Christianity of the future, several other hindrances come to mind that must be overcome or abandoned:

(1) Anti-intellectualism, a tendency to denigrate systematic logic in favor of more immediate personal gratification.

(2) Poor treatment of, and attitudes toward, the poor, outcasts of society, prisoners, and others whom Jesus declared "blessed."

(3) Abuse of its mainstream status, i.e., Phariseeism, e.g., in national as well as in ecclesiastic politics.

(4) Insistence upon "literal," "face-value" interpretation of biblical data, ignoring the many literary devices therein, and claiming absolute truth for this interpretation. I believe this stems from a failure to recognize (a) that we are finite beings with partial knowledge, and (b) that biblical statements are data, in much the same way that observations of nature are data. If all truth is God's truth, then the biblical and physical world data need to be interpreted together, and the subtleties of both original and modern languages and cultures accounted for.

(5) Failure to disciple those who convert to Christ's Lordship, and instead encourage them to stay in "hothouses"—spiritually comfortable communities.

McGrath teaches theology at Oxford University and at Regent College. He is a prolific author and, since the late 1980s, has published extensively in the area of evangelicalism. I heartily recommend this book to ASA members and others who seek the middle ground between fundamentalism and liberalism. I also recommend his book, *A Passion for Truth—The Intellectual Coherence of Evangelicalism*, as a companion piece to this book.

Reviewed by David L. Dye, Consulting Physicist (Retired), 9105 Fortuna Dr. #8415, Mercer Island, WA 98040.

Letters

On Moreland

Regarding J. P. Moreland's article in *PSCF* ("Complementarity, Agency Theory, and the God-of-the-Gaps" March 1997, pp. 2-14), I raise some questions and offer some comments.

1. Moreland's entire case rests on the assumption that libertarian agency is the solution to the age-old dilemma of free will vs. determinism, but isn't that agency precisely what Calvin and Reformed theology generally emphatically rejected? Doesn't this mean that for someone who takes Reformed thinking seriously (I myself do not) Moreland's approach is simply theologically unacceptable?

2. If Moreland is correct, then every act attributed to God's will in Scripture is an entree for a scientifically legitimate discontinuity in the affairs of the universe. Hasn't Henry Morris been saying just this for years? By insisting that what we "know" to be true from Scripture must take precedence over "naturalistic" scientific theories, doesn't Morris's creationism fit Moreland's criteria for theistic science exactly? Or can mutually contradictory theistic scientific theories possess equal validly, as in Morris's and Hugh Ross's versions? How can they possibly be tested or compared if non-naturalistic explanations are themselves accepted as scientifically valid?

3. Moreland seems to assume that a god who is compatible with Christian theism will be the only agent called upon to fill his "gaps in the causal fabric." In today's fragmented multicultural world such a view would be very naive. Legion are the "isms" out there that will be delighted to find out that a philosopher is arguing that the intrusion of unnatural powers into scientific practice is legitimate. Once Moreland makes those gaps available will he also accept the scientific legitimacy of any and all of the non-naturalistic influences and powers that will certainly be proposed to fill them?

Of course, the naturalist assumptions of science are limiting. Those limitations constitute the *only* reason that science has become the most successful culturally transcendent, and unifying intellectual enterprise in all of human history, open to any and all who are willing to share those liberating assumptions. In the increasingly fractured world in which we live, the last thing we need—scientifically or religiously—is yet another contribution to fragmentation. This Moreland offers, and his is a prescription for chaos.

David J. Krause
839 Country Road
Ann Arbor, MI 48103

Moreland's Response

I want to respond to the three issues raised by David J. Krause in connection with my article in *PSCF* ("Complementarity, Agency Theory, and the God-of-the-Gaps" March 1997). I shall address his concerns in the order in which they were presented:

1. Krause claims that my case rests on the assumption that libertarian agency is the correct account of the free will vs. determinism debate and, thus, my approach will not be acceptable for, e.g., a Reformed thinker. I offer two responses to this argument: (1) Krause's claim is false, since a Reformed thinker could accept my characterization of the difference between libertarian and compatibilist freedom, deny that humans have libertarian freedom, but accept this account for Divine acts. In fact, historically, some Reformed thinkers have done just this. Since my article contends for the scientific relevance of Divine libertarian acts, compatibilist accounts of human freedom are not directly relevant. (2) Even if Krause is correct, his claim reduces to the obvious assertion that if someone does not accept libertarian agency, then he or she will not think that such agency can be appropriated to explore or explain various phenomena. But who would deny such a thing? If someone does not believe in phlogiston, he will not appeal to it to explain something. But how is that relevant? It certainly does not follow from this that phlogiston chemistry was not science. In my article I make two claims quite clear. First, Divine libertarian acts do not exhaust the features that constitute theistic science, so that even if someone denies such acts, it does not follow that theistic science is illegitimate. Second, I state explicitly that, due to space considerations, I argue for the following condition and not for the truth of the antecedent: if libertarian agency is a good model for Divine primary causal miracles in "natural" history and if God has exercised such agency, then the ensuing gaps could figure into scientific practice in certain specified ways.

2. Krause's second point is actually a patchwork quilt of not altogether related assertions. For example, he seems to use a sort of guilt by association, discrediting me by associating my views with those of Henry Morris and we all are supposed to know that Morris's views are egregious. Again, he straps me with the view that every act attributed to God's will leaves a gap in the natural world, but this is just false. Only those primary causal acts of God leave gaps and not his employment of secondary causes, or so I have argued. Krause seems to think that I believe primary causal miracles are all over the place, perhaps so frequent as to place regular, lawlike connections in the world in the minority. Nothing could be further from the truth and I make clear that God's use of secondary causes is far more frequent than his primary causal activity. Finally, Krause opines that my position implies that contradictory theistic scientific theories (Morris's and Ross's views) have equal validity. I am not even certain what this is supposed to mean, but I ask Krause to find one statement in my article that implies the outrageous thesis that contradictory theories can be equally valid! I am simply claiming that Divine libertarian acts leave gaps that can figure into scientific practice, but I am not arguing that any view which merely asserts such activity by God is to be accepted willy nilly. We should decide what views to accept based on an overall assessment of the entire set of epistemically relevant factors. C.S. Lewis once said that he was suspicious of critics who claimed to be able to read between the lines when they showed no evidence of being able to read the lines themselves. After reading Krause's letter to the editor, I found myself wondering time and time again whether he had actually read my article.

3. Krause's final point is the familiar bromide that, if correct, my views open up the doors for Hindu science or for any other "ism" to invent an agent to fill gaps. Now this assertion is just incredible. I make clear that one ought to have good reasons (philosophical, theological, and scientific) for claiming that a gap exists and is to be explained by the primary causal activity of God. If some religious view contains a depiction of some phenomenon or its origin in a way that could directly interact with scientific methodology, then that religious view should have the right to be evaluated on solid epistemic grounds and not be excluded from the party just because it has a religious association. After all, truth and reason should prevail. Krause seems to be conflating two issues: (a) Does some paradigm (religious or otherwise) depict an act of God in libertarian terms? (b) Is there any good reason to think that the paradigm and its depiction are true? In my article, I address question one, not question two. I argue that the gaps which result from a primary causal Divine action could factor into scientific practice in certain ways I indicate. It does not follow from this that any bald assertion that this has happened should be taken as true or epistemically justified simply because it is asserted. In short, (b) does not follow from (a) and Krause is wrong if he thinks otherwise. Just because scientific theories regularly employ naturalistic mechanisms, it does not follow that we should accept an explanation of the moon's luminescence by claiming that it is made of cheese and all objects composed of cheese are luminescent! Accepting naturalistic mechanisms does not require us to embrace every conceivable assertion that some phenomenon is to be explained by any silly mechanism someone invents. Likewise, accepting the scientific relevance of Divine libertarian actions that leave gaps in the natural causal fabric does not require us to embrace every "ism" that offers a "non-naturalistic influence and power" to explain something.

J. P. Moreland
Talbot School of Theology
Biola University
13800 Biola Ave.
La Mirada, CA 90639

"What is Truth in Science?"

I am a very new member of the ASA and have received the latest volume of *PSCF* (Vol. 49, No. 1) in which the debate regarding methodological naturalism (MN) rages.

It appears that Christian (I use this classification purposefully rather than the term "evangelical") scientists desire some way of finding their way back to the broader scientific community. I'm afraid that debating MN is a waste of time in this correct pursuit.

As Christians, our first responsibility is to serve our Savior. We are then called to live completely integrated lives—living out our spiritual lives in a fallen world—so that all might see Christ. Obviously, such a position has placed committed Christians who are also trained and disciplined scientists at odds with our colleagues in the scientific community. A debate wherein science for science's sake versus science with a metaphysical twist only serves to broaden the gulf between the aforementioned parties.

Let me suggest a far more simple gangplank, which is considerably less fun but much more effective. The current debate that is being fought within the scientific community is "What is truth in science?" Please reference Representative George Brown's attack on what he terms "skeptic scientists" in the March 1997 issue of *Environment* (Volume 39, Number 2, pp. 12-31). This frontal attack is upon a faction within the community that believes that science is the pursuit of Truth, which of course can inconveniently muddle the plans of those on the Hill who might have specious interests (there is also a faction within the scientific community that is guilty of this—reference Alston Chase's editorial in the Friday, March 7, 1997 edition of the *Washington Times*).

Scientists who also happen to be Christians believe that there is an absolute Truth and that science is a vehicle for exploring God's creation. This debate surrounding truth and Truth is central to the culture wars being fought today. I would implore ASA members to step into the fray. There are risks, of course. We all know how folks are marginalized—ostracized and often not published. Join with the ranks of scientists that I term as "purists." This is a simple way back on a bridge of love and mutual understanding.

I have long held a vision that Christians should not be reactive to culture, but rather to command culture; that we must take every thought captive for Christ. If Truth is that gangplank, let's use it.

David C. Nutter
ASA Member
Deputy Director
George C. Marshall Institute
1730 K Street, NW
Suite 905
Washington, DC 20006-3868
nutter@marshall.org

God, Eternity, Time and Personality

Karl M. Busen, in "Eternity and the Personal God" (March 1997, pp. 40-49), presents an interesting solution to some problems raised in recent discussions of the nature of the deity. However, when we examine the presuppositions of the difficulties, we may ask whether a solution is necessary.

First, on an unmarked sheet of quadrille paper, a spot has no determined coordinates. Any origin and any unit per square may be assigned. Similarly, if we posit an extended, empty four-dimensional space-time continuum and ask what the coordinates of a point within it are, there is no answer unless, beyond the continuum, we have appropriate scales to which we can refer the point. Time 1 or objective time is one dimension of the continuum, or a similar dimension within other scientific disciplines.

If the continuum contains material entities, then we can reasonably ask for relative coordinates. Indeed, within science, we may ask for no better. However, such a specification of time requires that we deal with creation, not the Creator.

Time 2 or subjective time requires a person, someone who is aware of change. But it is a logical fallacy to turn this around in order to claim that personhood implies Time 2. This last is required for the problem Dr. Busen intends to answer. As a matter of fact, human personality involves Time 2. But we have not established that the only type of personality which we can demonstrate empirically, namely our own, exhausts the limits of personhood. May I suggest an analogy here. Neither integers nor real numbers exhaust the meaning of "number," nor do imaginary and mixed numbers. There are also transfinite numbers with very different characteristics. Theism requires at least a "transfinite" being. Thus, requiring all personality to involve change is applying finite characteristics to the Infinite.

From these considerations it follows that neither Time 1 nor Time 2 is even marginally relevant to considerations of a personal God, especially the deity revealed in Scripture and recognized by traditional orthodoxy. For those who have constructed a deity in their own image,[1] the problem remains.

[1]See Siemens, "Don't Tar Van Till: A Response to Anderson and Mills," *PSCF* (March 1997): 70.

David F. Siemens, Jr.
ASA Fellow
2703 E. Kenwood St.
Mesa, AZ 85213-2384

HOW DO I JOIN THE ASA?

Anyone interested in the objectives of the Affiliation may have a part in the ASA.

Full, voting membership is open to all persons with at least a bachelor's degree in science who can give assent to our statement of faith. Science is interpreted broadly to include anthropology, archeology, economics, engineering, history, mathematics, medicine, psychology, and sociology as well as the generally recognized science disciplines. Philosophers and theologians who are interested in science are very welcome.

Associate membership is available to interested nonscientists who can give assent to our statement of faith. Associates receive all member benefits and publications and take part in all the affairs of the ASA except voting and holding office.

Full-time students may join as Student Members (science majors) with voting privileges or as Student Associates (non-science majors) with no voting privileges. Spouses, who also wish to join, qualify for a redued rate. Full-time overseas missionaries are entitled to complimentary Associate membership in the ASA.

An individual wishing to participate in the ASA without joining as a member or giving assent to our statement of faith, may become a Friend of the ASA. Friends receive all member benefits and publications and take part in all the affairs of the ASA except voting and holding office.

Membership Categories and Rates

Category	Rate
Full Member	$55
Friend of the ASA	$55
Associate Member	$55
Student Member	$20
Student Associate	$20
Spouse	$10

Subscriptions to our journal, *Perspectives on Science & Christian Faith*, are available at $30/year (individuals), $45/year (institutions) and $20/year (students). The journal comes automatically with your membership.

MEMBERSHIP/FRIEND OF ASA APPLICATION/SUBSCRIPTION FORM

(Subscribers complete items 1 & 2 only)

American Scientific Affiliation, P.O. Box 668, Ipswich, MA 01938-0668

1. Name (please print) _____ Date _____

2. Home address _____

_____ Zip _____

Office address _____

_____ Zip _____

Please leave blank any numbers you do not wish published.

Home phone _____ Office phone _____

Fax _____ e-mail _____

I would prefer ASA mailings sent to: ❑ home ❑ office

3. Sex _____

4. If married, spouse's name _____

5. Academic Preparation

Institution	Degree	Year	Major

Major field of study _____

Area of concentration within the field (2 word limit) _____

Briefly describe what your present or expected vocation is _____

_____

_____

_____

Please complete back of this form ☞

AS A MEMBER YOU RECEIVE:

Publications. As a member, you receive ASA's quarterly journal, *Perspectives on Science & Christian Faith*, and bimonthly Newsletter. The journal has become the outstanding forum for discussion of key issues at the interface of science and Christian thought. It also contains news of current trends in science and reviews of important books on science/faith issues. The Newsletter brings you news of the scientific work and Christian witness of ASA members, reports of ASA activities, and other items of current interest. It also carries notices of ASA members seeking employment and of positions open to Christians trained in science.

Books. ASA titles such as *Teaching Science in a Climate of Controversy* and the *Membership Directory* are sent to all new members when available. From time to time other books and resources are available for purchase through the home office.

One book which can be purchased is *Contemporary Issues on Science and Christian Faith: An Annotated Bibliography*, which offers an expansive book list, as well as a Speaker's Bureau listing, book service information and other science/faith resources.

Fellowship. The spiritual and intellectual stimulation of ASA meetings is a distinctive feature of ASA membership highly valued by those who participate. An Annual Meeting, which usually includes three days of symposia, papers, field trips, and worship together, is held each year (since 1946) in late July or early August. For the convenience of members, the location moves across the country on a regular cycle. Local and regional meetings are held throughout the country each year. Members keep in contact with each other through the Newsletter, Internet, and at ASA get-togethers at national scientific meetings.

Church Affiliation _____

How did you learn about the ASA? _____

If you are an active overseas missionary, please give the name and address of your mission board or organization to qualify for complimentary membership.

Name _____

Street _____

City _____ State _____ Zip _____

I am interested in the goals 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 ASA 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)

I have enclosed (Please check one):

____ $55, Full Member ____ $55, Friend of the ASA ____ $55, Associate Member

____ $20, Student Member ____ $20, Student Associate ____ $10, Spouse

Please mail to: American Scientific Affiliation, P.O. Box 668, Ipswich, MA 01938-0668

Opportunities for Service. The ASA sponsors and encourages individual and group efforts to serve both the Christian community and the scientific community. Major efforts are made to clear up misunderstandings of one group by the other, but speaking and writing are not the only forms of ASA ministry. We seek opportunities to witness as a body of people with a grasp of biblical truth wherever that witness is needed.

Affiliations and Commissions. Each member is asked to choose a primary and secondary affiliation or commission from the list below. Affiliations are autonomous but usually meet in conjunction with the ASA Annual Meeting. Commissions help plan Annual Meetings, report to the membership through the Newsletter, and have a chair with four to five other members as a steering committee. Each of the commissions is asked to relate its discipline toward science.

a. Affiliations

Affiliation of Christian Biologists
Affiliation of Christian Geologists

b. Commissions

Bioethics	Industrial
Communications	Philosophy and Theology
Creation	Physical Sciences
Global Resources and Environment	Science Education
History of Science	Social Sciences

The ASA is a member of The Evangelical Council for Financial Accountability.

WHAT EXACTLY IS THE AMERICAN SCIENTIFIC AFFILIATION?

The American Scientific Affiliation (ASA) is a fellowship of men and women of science and disciplines that can relate to science who share a common fidelity to the Word of God and a commitment to integrity in the practice of science. ASA was founded in 1941 and has grown significantly since that time. The stated purposes of the ASA are "to investigate any area relating Christian faith and science" and "to make known the results of such investigations for comment and criticism by the Christian community and by the scientific community."

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 mission is to integrate, communicate, and facilitate properly researched science and biblical theology in service to the Church and the scientific community. 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." 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. It is the only American evangelical organization where scientists, social scientists, philosophers, and theologians can interact together and help shape Christian views of science. The vision of the ASA is to have science and theology interacting and affecting one another in a positive light.

American Scientific Affiliation
P.O. Box 668
Ipswich, MA 01938-0668
phone: (508) 356-5656
fax: (508) 356-4375
e-mail: asa@newl.com

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 and 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 01938-0668, USA or Canadian Scientific & Christian Affiliation, P.O. Box 386, Fergus, ON N1M 3E2, CANADA or by contacting the CSCA website at: http://avatar.uwaterloo.ca/~mann/cscahome.htlm

Chicago–Wheaton	D.C.–Baltimore	Guelph, ON	Indiana–Ohio	Los Angeles
New York–New Jersey	North Central	Oregon	Pittsburgh	Rocky Mountain
San Diego	San Francisco Bay	Southwest (AZ)	Washington	Toronto, ON

INDICES to back issues of *Perspectives* are published as follows:

Vol. 1-15	(1949-1963)	*Journal ASA*	15	126-132	(1963)
Vol. 16-19	(1964-1967)	*Journal ASA*	19	126-128	(1967)
Vol. 20-22	(1968-1970)	*Journal ASA*	22	157-160	(1970)
Vol. 23-25	(1971-1973)	*Journal ASA*	25	173-176	(1973)
Vol. 26-28	(1974-1976)	*Journal ASA*	28	189-192	(1976)
Vol. 29-32	(1977-1980)	*Journal ASA*	32	250-255	(1980)
Vol. 33-35	(1981-1983)	*Journal ASA*	35	252-255	(1983)
Vol. 36-38	(1984-1986)	*Journal ASA*	38	284-288	(1986)
Vol. 39-41	(1987-1989)	*Perspectives*	42	65-72	(1990)
Vol. 42-44	(1990-1992)	*Perspectives*	44	282-288	(1992)
Vol. 45-47	(1993-1995)	*Perspectives*	47	290-296	(1995)

A keyword-based on-line **subject index** is available on 5 1/4" or 3 1/2" 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.

"Upholding the Universe by His Word of Power" — Hebrews 1:3

Volume 49, Number 2 **June 1997**