

PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

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Scientific Status of Creation Science:
A Discussion

Al-Ghazali Against Aristotle:
An Unforeseen Overture to Science
In Eleventh-Century Baghdad

In Search of the
Historical Adam: Part 2

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

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Putting Things Into Perspective

Our first paper presents J. P. Moreland's case for the scientific status of "creationism." He asserts that this approach provides methodologically legitimate answers to questions problematic for evolutionary theory. Stephen C. Meyer and Richard Bube then offer contrasting views on Moreland's position. Moreland wraps up this mini-debate with his response to Bube's strong note of dissent. The place of the philosopher in the practice of science has long been controversial. Whether philosophers should (can?) be the arbiters of what constitutes science remains problematic for the working scientist. Unfortunately, the context from which this discussion arises raises such red flags for evangelicals and the scientific community that polemics rather than reason often rules the day. I suspect that we have not heard the last of this matter.

Richard P. Aulie next turns our eyes back 900 years to the intellectual world of Abu Hamid al Ghazali. This young Islamic scholar shook the foundations of the Aristotelian understanding of nature in articulating a theistic affirmation of creation. Aulie deftly links past and present in providing a rich context in tracing notions that frame modern science.

Dick Fisher closes his two-part discussion of the place of the biblical Adam in human history. He offers an analysis which should be carefully compared with more conventional evangelical interpretations.

In our first Communication, Beverly Howard Johnson offers a mother's perspective in responding to her eleven-year old daughter's questions about origins. She argues that the conclusions of science, however unexpected and challenging, should be viewed with the eyes of faith and a note of celebration.

Barry W. Hancock and Paul M. Sharp argue that the debate over the death penalty should be a matter of morality rather than deterrence. They offer a biblical case against death by state sanctioned executions.

A set of reviews of books relevant to the discussion of science-Christianity topics follows. Two timely letters are also included. This issue of *Perspectives* contains an unusual measure of provocative topics. We value your reasoned response.

— J.W. Haas, Jr.

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Conceptual Problems and the Scientific Status of Creation Science

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Among other things, scientists try to solve both empirical and conceptual problems. Conceptual problems, in turn, are of two basic types: internal and external. In this article, I offer a taxonomy of both types of conceptual problems that have constituted scientific practice throughout its history and argue that certain activities done by creationists fit this taxonomy nicely. I then conclude that these creationist activities cannot be faulted as being non-science or pseudo-science once we see how they fit a proper scientific pattern of addressing conceptual problems in other areas.

The history of the interaction between theology and science is a complicated affair, and it is generally recognized today that a warfare metaphor is inadequate to capture the multifaceted nature of this interaction. Nevertheless, skirmishes have been present from time to time, and in recent years we have witnessed an intense controversy over the scientific status of scientific creationism, alternatively called creation science. A number of advocates of complementarity approaches to the integration of science and theology have frowned on these skirmishes because, in their view, they represent an inadequate understanding of the nature of both science and religion.

It seems to be widely agreed by complementarity advocates and others that "creation science" is a term which resembles the term "jumbo shrimp" — it is a contradiction precisely because creation science is not science, but religion or theology masquerading as science. Thus, Robert C. Cowen, the natural science editor for the *Christian Science Monitor*, says this:

It is this many-faceted on-going science story [the theory of evolution] that should be told in public school biology courses. Creationists want those courses to include the possibility of — and "scientific" evidence for — a creator as well. There is no

such "scientific" evidence. The concept of a supernatural creator is inherently religious. It has no place in a science class.¹

Such claims are not limited to the popular media, but appear in scholarly circles as well. Michael Ruse claims that

... even if scientific creationism were totally successful in making its case as science, it would not yield a scientific explanation of origins. Rather, at most, it could prove that science shows that there can be no scientific explanation of origins.²

Elsewhere, Ruse states that "the creationists believe the world started miraculously. But miracles lie outside of science, which by definition deals with the natural, the repeatable, that which is governed by law."³

This view of science and theology, especially of creation science, is also widely held among evangelical scholars. John Weister asserts: "Science does not have the answers to all the world's questions. The question of ultimate origins is an unsolved problem that transcends science. There are no data we can gather. It leads to questions of philosophy and religion, which do not fall within science's domain."⁴ In a similar vein, Paul de Vries and Howard J. Van Till have stated that science requires the adoption

Conceptual Problems and the Scientific Status of Creation Science

of methodological naturalism in such a way that broad questions of philosophy like ethics, ultimate origins, and abstract metaphysical speculation, as well as theological concepts like "God" or a "direct, miraculous act of God" are outside the bounds of science properly understood.⁵

Statements like these could be multiplied, and it should be obvious that they are not first-order scientific assertions that merely state that, although the hypotheses formulated by creation scientists are scientific, they have not been adequately confirmed by scientific observations and experiments, or they do not embody other epistemic virtues (e.g. simplicity, novel predictions) that a good scientific hypothesis ought to exemplify. These statements make a far deeper claim. They assert a second-order philosophical view about science, namely, that creation science is not a science at all, but something else. Thus, my assessment of the merits of these statements will draw heavily from insights in the philosophy and the history of science.

My intention here is not merely to raise another round of controversy about creation and evolution. Rather, I would argue that the nature of creation science provides an occasion for examining the much broader and more far-reaching issue of whether and how our Christian theism should affect our view of the world. As Thomas Morris has pointed out, for some time now there has been an attitude of theological anti-realism among many theologians. They believe that it is intellectually futile to bring their Christian theism to bear on questions of the nature, origin, investigation, and development of the world.⁶

In science, this theological anti-realism has manifested itself in the view that science and theology are non-interacting, non-competing disciplines. They are perceived as either being complementary to each other, and focusing on different realms of reality,

or else as in being conflict with each other, and asking and answering very different kinds of questions.

This attitude expresses itself in the conviction that creation science is not a science. There are a number of reasons for this conviction, but, as we have seen, chief among them is the idea that broad philosophical and theological issues are outside of the realm of science. Creation science is a mistake, science must adopt methodological naturalism, and the theological concept of a miraculous act of God is not something that should be allowed to enter into the practice of scientific theory formation, explanation, or testing.

The purpose of this article is twofold. First, I want to catalog and illustrate the role that conceptual problems have played and should play in the practice of science. Regardless of the debate about the scientific status of creation science, this discussion is valuable as a corrective to the singular preoccupation with empirical problems that seems to prevail in much current discussion about science. Secondly, and more importantly, I want to make one step in an argument to the effect that creation science *is* a science and not a religion (a second-order issue in the philosophy of science). I will do this by examining the untenable but popular claim cited above, that creation scientists' utilization of theological, ethical, and philosophical concepts are somehow irrelevant and inappropriate to the practice of science. In the process, I hope to show precisely how conceptual problems have entered into the controversy over creation and evolution. We will see that the mere presence of broad philosophical or theological ideas is not sufficient to signal the presence of non-science or pseudo-science.

It is crucial to keep in mind what I am and am not attempting to accomplish in this article. First, I make no first-order scientific claim that any particular creationist model, e.g. young earth creationism, is scientifically adequate. Thus, arguments to the effect that young earth creationism has been fal-



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sified or that creationism taken as a research program has not proven fruitful are beside the point. My concern is whether or not some form of creationism should be regarded as science in the first place, instead of religion masquerading as science.

Second, I am not attempting to defend the scientific status of creationism against every criticism in sight, nor am I trying to build a positive picture of what some fully developed creationist model would look like. Rather, I am trying to show that once we look at how internal and external conceptual problems have properly entered into the practice of science throughout its history, we have a precedent for thinking that when advocates of some version of creationism appeal to theological, philosophical, or ethical concepts as part of their intellectual practices, they have not necessarily stopped doing science and started doing something else. Instead, such utilizations of theological, philosophical, and ethical propositions by creationists fit a clearly defined typology that has been part of science for some time. Only someone out of touch with the nature and importance of conceptual problems for science could think otherwise.

We have a precedent for thinking that when advocates of some version of creationism appeal to theological, philosophical, or ethical concepts as part of their intellectual practices, they have not necessarily stopped doing science and started doing something else.

In my view, this "methodological naturalist" understanding of science and religion is a mistake. One source of this mistake is a preoccupation with the more empirical aspects of science and a concomitant failure to appreciate the role that conceptual problems have played throughout the history of science.

There are two broad strategies we could take regarding the scientific status of creation science. The first is negative. We could argue that there is no adequate line of demarcation between science and nonscience/pseudoscience, no set of necessary and sufficient conditions for something to count as scientific. Therefore, we cannot state principles that rule out creation science. Given the fact that crea-

tionist theories were regarded as scientific by a significant number of scientists and philosophers of science until this century, we could argue that the burden of proof is on anyone who wishes to *change* the way creation science is classified, and this burden of proof has not been met.⁷

Now, I think it is generally acknowledged that no line of demarcation has been, or perhaps, can be, formulated. For this reason, philosophers of science as diverse as realist Ernan McMullin and anti-realist Larry Laudan have agreed that creation science cannot be judged unscientific in this sense.⁸

Creation science's appeals to philosophical or theological ideas can be, and often have been, part of the practice of science itself, and thus are not irrelevant and inappropriate.

Contrary to thinkers like Ruse, I agree with McMullin and Laudan in holding that this negative argument is correct. But the issue need not be left here, for there is a second, more positive line of defense for the claim that creation science is a science. This approach tries to show that creation science's appeals to philosophical or theological ideas can be, and often have been, part of the practice of science itself, and thus are not irrelevant and inappropriate. This strategy will be the focus of the arguments that follow. I will begin by offering a characterization of creation science, and then will examine the nature and role of conceptual problems and how they shed light on the scientific status of creation science.

As a working definition of creation science, let us use the one expressed in the famous creation science trial (McLean v. Arkansas) in Little Rock, Arkansas in December of 1981.

Creation-science means the scientific evidences for creation and inferences from those scientific evidences. Creation-science includes the scientific evidences and related inferences that indicate: (1) Sudden creation of the universe, energy, and life from nothing; (2) The insufficiency of mutation and natural selection in bringing about the development of all living kinds from a single organism; (3) Changes only within fixed limits of originally created kinds of plants and animals; (4) Separate ancestry for man and apes; (5) Explanation of the earth's geology by catastrophism, including the occurrence of a worldwide flood; and (6) A relatively recent inception of the earth and living kinds.⁹

While this characterization of creation science will do for our purposes, one thing should be pointed out. The essence of creation science theories is not located in points (5) and (6) above. Progressive creationists do not think that a universal flood (and catastrophism in general) can adequately explain the earth's geology. Further, progressive creationists favor the generally accepted dating of the Big Bang, the origin of the solar system and earth, and of life on earth.

But progressive creationists still hold to creationist theories because they, like their "young earth" creationist counterparts, deny the adequacy of theistic evolution and hold that a personal agent of great power and intelligence has intervened in the actual history of the cosmos through primary, agent causation (e.g. the origin of the universe, first life, and basic, "kinds" of living things, including man).¹⁰ Further, they believe that this position is rationally defensible.¹¹

It is best to see progressive creationism and/or young earth creation-science as ways of specifying creationism as a research program. Such a research program recognizes the legitimacy of allowing theological propositions to aid us in formulating, testing, and evaluating scientific theories, in explaining scientific data, and solving various problems relevant to science.

The Nature of Conceptual Problems

Larry Laudan has given a great deal of attention to analyzing the nature and role of conceptual problems in the history of science, perhaps more than any other philosopher of science.¹² According to Laudan, science involves analyzing, clarifying, and solving empirical and conceptual problems. Empirical problems are first-order problems about objects in some domain (e.g. chemical phenomena in acid/base reactions) and are, in general, anything about the observable world that strikes us as odd and in need of explanation. They come in three major types: unsolved problems (those not adequately solved by any theory), solved problems (those that rival theories have solved, perhaps in different ways), and anomalous problems (those a particular theory has not solved, but at least one rival has solved).

Conceptual problems are also part of the practice of science. These come in two basic types. First, internal conceptual problems arise when the concepts

within a theory appear to be logically inconsistent, vague and unclear, or circularly defined, when the definition of some phenomenon in a scientific theory is hard to harmonize with an ordinary language or philosophical definition of that phenomenon, or when the concepts in a theory seem to classify some phenomenon in a problematic way. Second, external conceptual problems arise for a scientific theory, *T*, when *T* conflicts with some doctrine of another theory, *T'*, originating in some discipline outside of science, when *T'* and its doctrines are well founded rationally, regardless of what discipline *T'* is associated with. *T* may be logically inconsistent with *T'* or the two may conflict in a lesser way by being jointly implausible (though still logically consistent) — that is, by being merely compatible, but not mutually reinforcing and explanatory.

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No useful generalizations can be made about the epistemic impact of a conceptual problem on a particular scientific theory. In rare cases, the problem may count decisively against the theory. More likely, the problem will simply tend to count against the theory to a greater or lesser degree. Only a case-by-case analysis can we, at least in principle, determine how a particular conceptual problem should be weighed in assessing the rationality of accepting, withholding, or abandoning a particular scientific theory.

There are several different kinds of internal and external conceptual problems. The following discussion is a classification and illustration of some of the different kinds of conceptual problems which, as we shall see later, figure into the creation science controversy. It is important to keep in mind that the illustrations to follow are just that — illustrations. I am not presenting a defense of them as considerations that won the day; in fact, I do not always agree with the point being made by the examples, and I am not offering a full-blown characterization of these cases. My point is merely to illustrate the

types of conceptual problems which have entered into the very fabric of science throughout its history.

Before we examine types of conceptual problems, one final point should be made. It may be the case that solving empirical and conceptual problems constitutes science, regardless of whether problem solving is understood in a realist or anti-realist way. I am inclined to believe that this is so. But this is a strong thesis, and I do not need it to make my case. For it may be that science is a set of practices, goals, values, methods, and so forth that merely bear family resemblances to one another. In this case, if it can be shown that solving internal and external conceptual problems has been and is an appropriate part of scientific practice, then the utilization of such problems by advocates of creation science does not by itself signal something irrelevant and inappropriate.

The taxonomy which follows is an attempt to show that creation scientists have raised certain conceptual problems which they believe to be anomalous for evolutionary theories and not for creationist theories, and that the types of conceptual problems utilized are consistent with those present throughout the history of science. It may be that evolutionary theories solve these problems and it may be that creationist theories do not. That discussion is beyond the scope of this article's present concern. Instead, I will focus on the epistemically prior issue of the legitimacy of such conceptual problems in the first place.

Types of Internal Conceptual Problems

1. *The concepts of a theory appear to be contradictory, circularly defined, vague, or unclear.* An example of this would be the wave/particle nature of electromagnetic radiation and the wave nature of matter. Some have argued that these concepts appear to be self-contradictory or vague, and attempts have been made to clarify them or to show different ways to understand them.

Another example is the discovery of the electron by J. J. Thomson near the end of the nineteenth century. At that time there was a debate between German and British scientists over the nature of electricity, the former favoring an aether wave view and the latter favoring a particle picture. Earlier in the century, Michael Faraday had conducted various electrolysis experiments — experiments in which electric currents are passed through a water solution of decomposable compounds. He had shown that the amount of product liberated by such experiments is proportional to the amount of electricity intro-

duced into solution, and that the same amount of electricity liberates masses of products proportional to chemically equivalent weights. The point here is not merely that these data tended to falsify the aether wave view. (This would be an empirical problem.) Rather, these data raised internal conceptual problems for aether wave theories because those theories had no clear way to picture or represent the causal mechanisms responsible for those data. Faraday and others of his day had no clear way to understand these results because of conceptual problems resulting from tying the results to their metaphysical picture of electricity as a continuous field or wave. Thomson offered conceptual clarity by changing the conceptual apparatus of electron theory from a wave theory to a particle theory.

2. *Internal conceptual problems that arise in attempts to elucidate the relationship between a scientific definition of a term and a philosophical or ordinary language definition of that term create conflicts.* As an example of this type of conceptual problem, consider the use of operational definitions in scientific theories. Once such a definition is formulated, it is not always clear how to take it. Should the ordinary language term be reduced to the operational definition? Should the operational definition be taken as the main test for the presence of what is designated by the ordinary language term? Should the operational definition be seen as the empirical and/or quantifiable content of the ordinary language definition?

Conceptual problems arise in trying to understand precisely what these terms really mean and how they should be related to philosophical or ordinary language counterparts.

For example, when a psychologist defines "depression," "intelligence," or the "normal, functional family," these are often defined in operational terms, perhaps by reference to a standard test of some sort. Conceptual problems arise in trying to understand precisely what these terms really mean and how they should be related to philosophical or ordinary language counterparts.

3. *Internal conceptual problems which arise when assessing the categorical aspects of scientific claims.* Usually, scientific theories treat a particular phenomenon as an example of a certain category of thing. For example, heat used to be treated as an example of

the category of substance. Later, heat was placed in the category of quality, and later still, in the category of quantity. The idea of color has undergone a similar categorical shift. One of the things which is closely related to categorical classification is the nature of identity. Different identity conditions are associated with alternative categorical classifications: "compositional stuff," "functional stuff," a "quality-thing," a "quantity-thing." Thus, philosophical clarity is needed to bring out identity conditions and other metaphysical aspects involved in the categorical classifications explicitly or implicitly involved in scientific theories.

In addition to internal conceptual problems, there are external conceptual problems which arise in conjunction with scientific theories. There are three main types of external conceptual problems.

Types of External Conceptual Problems

1. *External conceptual problems which are logically inconsistent with a particular scientific theory.* Two examples adequately illustrate this type of external conceptual problem. The first involves action at a distance. As is well known, most Newtonians postulated two kinds of forces: the force of impact and gravitational force which operates at a distance. From the time of Descartes to the present, arguments have been raised against the idea of a force defined as action at a distance. They include: (1) reality is a plenum and forces between two bodies are to be understood in terms of efficient, mechanical causes resulting from the impact of particles intervening between the two bodies in question; (2) our best philosophical understanding of causation requires the contiguity of cause and effect in space and time; and (3) a theory with one type of force is simpler than a theory with two types of forces.

A second example comes from the late J. L. Mackie.¹³ Mackie raised philosophical arguments against the special relativity idea that there is no such thing as an absolute reference frame for absolute rest and motion. If Mackie is correct, then there is such a thing as absolute space, contrary to what the special theory of relativity asserts.

2. *External conceptual problems may arise for a scientific theory if that theory is taken to be the whole story about some phenomenon and such a posture undercuts one of the necessary preconditions for a scientific realist construal of that theory.* Roughly, scientific realism is the view that science progresses towards truer and truer theories about the theory-independent world and that science does so in a rationally justifiable

way. A number of philosophers of science have listed what they take to be necessary preconditions for a realist understanding of science, e.g. the existence and knowability of a theory-independent world, the ability of language to refer to that world, the laws of logic, and so forth.

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Now, if a scientific theory undercuts one of the necessary preconditions of science itself, then that theory would be guilty of self-referential inconsistency. For example, Keith Lehrer has argued that certain varieties of physicalism regarding the mind/body problem are self-refuting.¹⁴ Thus, if various physicalist theories of mind are offered in a reductive way as the whole show, as it were, then Lehrer and other have argued that these theories make normative, non-natural rationality impossible. Thus, they make science itself impossible, including physicalist theories of mind.

3. *External conceptual problems may arise when some scientific theory T, while strictly consistent with some theory in a discipline outside science, T', still tends to count against T'.* An example of this could be the use of teleological explanations which treat living organisms as goal-directed systems. It has been widely argued that evolutionary theory tends to count against the use of such explanations and, more otologically, against the presence of entelechies in organisms, even though the two are not mutually incompatible.

Perhaps I have now said enough about the nature of conceptual problems to give an idea of how they have figured into the practice of science. It is important to keep in mind the fact that conceptual problems arise in a field like logic, metaphysics, ethics, theology, and many other branches of study. But here we find that after they have surfaced, they become part of the very fabric of science itself. Why? Because part of scientific practice is the confirmation of scientific laws and theories, and confirmation involves assessing the rationality of accepting a given theory in light of all of the relevant evidence. Part of the relevant evidence is the way the theory solves the internal and external conceptual problems associated with it and its rivals. After all, it is no ac-

cident that philosophers are advancing models of evolutionary ethics and epistemology. These are attempts to work out an evolutionary research program and they illustrate the fact that science is not intellectually isolated from other cognitive concerns.

Conceptual Problems and Creation Science

Creation science cannot be adequately understood without examining it in light of the role conceptual problems play in creationist positions. The following are some illustrations of the kinds of internal and external conceptual problems associated with creation science's criticisms of evolutionary theory, which are claimed to support creationism. Creationists argue that these problems present difficulties for evolutionary theory but are not problems for creationism. Again, the point here is not to develop the illustrations, or even to argue that they are individually or collectively decisive, but simply to show that conceptual problems are problems which creation science and evolutionary theory must solve, and they are aspects of the confirmation of creation science and the disconfirmation of evolutionary theory. Therefore, conceptual problems play the same role in the creation/evolution debate that they have in theory adjudication in other areas of science throughout its history.

Internal Conceptual Problems

Type One. The first type of internal conceptual problem mentioned above has involved problems with a theory's actual concepts. There are several examples of this type of conceptual problem involved in assessing evolutionary theory. First, problems have arisen with certain understandings of the mechanism of evolutionary development which utilize the idea of "survival of the fittest." Some scientists have claimed that evolution promotes the survival of the fittest, but when asked what the "fittest" were, the answer was that the "fittest" were those which survived. But this seems to imply a problem of circularity with at least one aspect within evolutionary theory, and attempts have been made to redefine the goal of evolution (e.g., the selection of those organisms that are reproductively favorable) and the idea of fitness to avoid circularity.

The point here is not that the problem has not been solved or even that it was ever sufficient by itself to justify abandonment of evolutionary theory. Rather, the point is that when an objection of this

type was raised it was not an example of an empirical problem with evolutionary theory (as would be problems with gaps in the fossil record), but rather it was a type of internal conceptual problem.

Michael Denton has argued that in order to justify an evolutionary transition from A to B which involved intermediate forms, one must discover intermediates which bridge that transition or construct plausible hypothetical pathways for that transition.¹⁵ Denton, argues, however, that many of these transitions are so problematic, e.g. that between a reptilian scale and an avian feather, that conceptual problems of vagueness and unclarity arise for any hypothetical pathway. Again, the point is not the first-order issue of whether or not Denton's objection has adequate rejoinders. Rather, the point is that this type of criticism is an example of an internal conceptual problem.

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Roughly this same type of argument has been raised against origin of life experiments. Bradley, Thaxton, and Olsen have claimed that prebiotic soup experiments involve illegitimate investigator interference at crucial times in order to guide natural processes down specific nonrandom pathways.¹⁶ In the absence of such interference, they claim that no conceivable mechanism could have accomplished the right effect.

One final example should suffice here. Creationists claim that the universe had a beginning through the production of the first event by means of agent causation. Stephen Hawking has claimed that many people find the idea of a first event objectionable because it "smacks of divine intervention."¹⁷ Hawking's own view involves the proposal that space and time might form a closed surface without a boundary. William Lane Craig has argued that Hawking's model involves serious internal conceptual problems, e.g. a World Ensemble ontology (our world is a fluctuation of super-space in which all physically possible worlds are embedded), a B series view of time, and the replacement of real time with

imaginary time (the square root of -1 is used as a coordinate of the time dimension).¹⁸

Type Two. This type of internal conceptual problem involves relating a scientific definition to an ordinary language or philosophical definition. The following two examples illustrate how this type of problem has entered into creation/evolution discussions. First, questions have been raised about the use of "information" in DNA and in ordinary language. It has been argued that if information is given a scientific definition, say as specified complexity, configurational entropy, or the number of instructions required to specify the structure in question, then DNA bears a very close analogy to human language. Some claim that since the latter signals the presence of meaning (e.g. propositions, concepts), and since meaning comes from intelligent minds, then information in DNA signals the presence of a Mind behind it.¹⁹

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essentialist regarding
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tend to count against
evolutionary theory.*

Consider a second example. E. Mayr has claimed that evolutionary theory is incompatible with the essentialism of thinkers like Aristotle and Plato (roughly the view that a class of organisms will be constituted by an essence or nature possessed by all and only members of that class).²⁰ Evolutionary definitions of taxonomic concepts, e.g. *Homo sapiens*, regard essences or types as unreal abstractions, and only individual and variable members of populations are real. Philosophers who embrace the existence of essences and real natural kinds could argue as follows. If evolutionary theory in general, and definitions of species in particular, tend to make essentialism unreasonable, then if there are good reasons to be an essentialist regarding living organisms, these reasons tend to count against evolutionary theory. This type of objection is raised by clarifying a scientific definition of a species and relating it to a philosophical essentialist definition.

Type Three. The third type of internal conceptual problem mentioned above involves assessing the categorical aspects of scientific claims. The following example illustrates the tendency in evolutionary theory to classify organisms as property things (structured stuff, or wholes, where the parts are "prior to" their wholes). Richard J. Connell has argued that scientific explanation tends to emphasize efficient and material causes, be physicalistic, reductionistic, and mechanistic in its orientation to macro-objects (e.g. living organisms), and thus, treats them like property-things or aggregates (roughly the view that organisms are structured stuffs with emergent properties, whose parts are prior to those organisms taken as wholes, and for which a machine metaphor is an adequate explanatory model).²¹

Paul Churchland and D. M. Armstrong have argued that evolutionary theory is incompatible with any form of dualism, especially substance dualism.²² If they are right, then organisms are property-things. Now, if someone thinks there are good grounds for classifying organisms as substance-things (deep unities where the wholes are "prior to" their parts), then it would constitute an internal conceptual problem for evolutionary theory, raised by analyzing the categorical classification of organisms most compatible with that theory.²³

External Conceptual Problems

Type One. This type of problem involves an intellectual idea initially raised in a domain outside of science which, if rational or true, would be logically inconsistent with evolutionary theory. Two examples will serve to illustrate this type of problem.

If evolutionary theory is extended, as it often is, to include issues involved in the origin of the universe, then the following issue arises. Philosophical arguments can be given which show that it is reasonable to claim that the universe began a finite time ago as a result of agent causation. Support for the beginning of the universe involves, among other things, presenting philosophical problems with the existence and/or traversability of an actual infinite, both of which would be involved in coming to the present moment from a beginningless universe. Support for the agent causation view involves, among other things, showing state-state causation to be inadequate to generate a first event from a timeless, immutable state of affairs ontologically prior to the first event.²⁴ These arguments have been offered as support of creationist ideas of creation and against certain evolutionary models of the universe.

The second example is very important. Suppose someone held to the following two propositions:

1. The Bible is the Word of God and it teaches the truth on all matters of which it speaks.
2. The Bible, properly interpreted, teaches (among other things) certain truths that run counter to evolutionary theory and which are consistent with creationist theories.

Suppose further that this person had a list of good, rational arguments for these two propositions. In support of (1), he or she lists arguments from prophecy, history, archaeology, and other areas of science for the contention that the Bible is a divinely inspired book and it is rational to trust it when it speaks on any matter, science included. In support of (2), he or she offers detailed arguments from hermeneutical theory, linguistics, comparative ancient Near Eastern studies, and so forth.

In the case just cited, such an individual would have reasons, perhaps good reasons, for believing that the general theory of evolution, in its current or recognizably future forms, is false and that creationism will be vindicated. As Laudan has argued from his studies in the history of science:

Thus, contrary to common belief, it can be rational to raise philosophical and religious objections against a particular theory or research tradition, if the latter runs counter to a well-established part of our general *Weltbild* — even if that *Weltbild* is not “scientific” (in the usual sense of the word).²⁵

Type Two. This type of external conceptual problem focuses on a scientific theory which, if taken as the whole of some phenomenon, undercuts a necessary precondition for science itself (understood in a realist way), and thus, makes the scientific theory self-referentially inconsistent.

Even Darwin mused about why one ought to trust the deliverances of the mind if it were a mere product of a blind process of natural selection and survival...

A prominent example of this kind of external conceptual problem involves focusing on the nature of rationality itself. Even Darwin mused about why one ought to trust the deliverances of the mind if it were a mere product of a blind process of natural selection and survival, and recent thinkers like Stan-

ley L. Jaki have echoed these sentiments.²⁶ A number of arguments have been associated with this type of problem, but they all cite some necessary feature of rationality itself which, it is argued, is incompatible with an evolutionary account of the origin and nature of our faculties.

Suffice it to say that if someone claims to be justified in the belief that evolutionary theory is inconsistent with the existence of rationality, including scientific rationality, then evolutionary theory could be faulted as being self-referentially inconsistent.

Some of these features are as follows: the need for libertarian freedom to make sense out of rational obligation; an epistemological commitment to internalism and normative, nonnatural ideas of rationality; the need for an enduring “I” and absolute identity through change to make sense out of rational inferences; a mental faculty of intuition to be able to “see” the laws of logic; intentionality as an irreducibly mental property in order to have thoughts (beliefs, experiences) about the world; and an agent view of the self to account for episodes of purposeful or intentional action involved in reflection. The point is that these features presuppose (1) substance dualism (2) agent causation (3) faculties designed to be appropriate “truth gatherers” in one’s noetic environment, and not faculties shaped by survival value (in which case, inverted qualia and related problems indicate that systematic delusion is underdetermined *vis a vis* possession of truth so far as survival is concerned).

Again, the details of these and counter-arguments are not of primary importance here. Suffice it to say that if someone claims to be justified in the belief that evolutionary theory is inconsistent with the existence of rationality, including scientific rationality, then evolutionary theory could be faulted as being self-referentially inconsistent.

Type Three. The final type of external conceptual problem listed above is one in which evolutionary theory is logically consistent with some rational doctrine outside science, but the two are not mutually reinforcing, epistemically speaking, and one tends to count against the other.

The main example of this type of external conceptual problem is the existence of what might be called common sense, objectivist morality. Suppose someone believed the following:

- (1) Virtue theory coupled with a de-ontological view of ethical rules is part of an overall analysis of morality.
- (2) Moral statements are objectively true in terms of a correspondence theory of truth which, in turn, implies the existence on nonnatural moral properties.
- (3) Humans have intrinsic worth and dignity *qua* human beings in a way not shared by lower animals, which have lesser value and lesser moral rights.
- (4) Moral intuitionism is true and there must be a faculty of moral intuition for there to be moral knowledge.
- (5) Moral obligation presupposes libertarian freedom which, in turn, makes sense if substance dualism is true.

These comments illustrate the fact that one could claim that the common sense, objectivist moral view is true and rational, and that such a view is hard to square with an evolutionary account of the nature and origin of the cosmos, especially Homo sapiens.

Now, a number of thinkers have argued that this view of morality, while strictly consistent with an evolutionary naturalism, nonetheless is odd and is an unlikely "dangler," given evolutionary naturalism. For example, David Hull makes the following observation:

The implications of moving species from the metaphysical category that can appropriately be characterized in terms of "natures" to a category for which such characterizations are inappropriate are extensive and fundamental. If species evolved in anything like the way that Darwin thought they did, then they cannot possibly have the sort of natures that traditional philosophers claimed they did. If species in general lack natures, then so does *Homo sapiens* as a biological species. If *Homo sapiens* lacks a nature, then no reference to biology can be made to support one's claims about "human nature." Perhaps all people are "persons," share the same "per-

sonhood," etc., but such claims must be explicated and defended with no reference to biology. Because so many moral, ethical, and political theories depend on some notion or other of human nature, Darwin's theory brought into question all these theories. The implications are not entailments. One can always dissociate "*Homo sapiens*" from "human being," but the result is a much less plausible position.²⁷

George Mavrodes has argued that the existence of common sense, objectivist moral properties is queer and unlikely, given a naturalistic account of the world and human beings.²⁸

David Solomon has noted arguments to the effect that virtue theory makes sense against a backdrop of essentialism and a broadly teleological view of nature, especially human nature, and that such a backdrop is unlikely, given a modern scientific view of the nature and development of the cosmos, including man.²⁹ Helga Kuhse and Peter Singer claim that the common sense view of the intrinsic, special dignity of being human is guilty of an indefensible speciesism, and part of their argument is that this view is unreasonable in light of evolutionary theory.³⁰

These comments illustrate the fact that one could claim that the common sense, objectivist moral view is true and rational, and that such a view is hard to square with an evolutionary account of the nature and origin of the cosmos, especially *Homo sapiens*.

In sum, various types of internal and external problems have been part of scientific theory assessment throughout the history of science, and the same can be said for creationist and evolutionary theories. Science is not an airtight set of disciplines completely isolated from other fields, and problems which originate in other disciplines can enter into the very fabric of science itself as part of the assessment of a scientific theory.³¹ To claim this much is to simply observe the fact that other fields interact with science in various and complicated ways, and sometimes they become part of science itself.³² Creation science may fail to be science for some other reason, but not because of its attempt to pose and solve conceptual problems. For as we have seen, raising and solving such problems are parts of the legitimate business of science.

The second-order philosophical claim that versions of creationism, e.g. creation science, are not a science but religion simply because creationist theories utilize broad philosophical and theological concepts cannot be sustained. There is no widely

accepted set of necessary and sufficient conditions which constitute a line of demarcation between science and nonscience/pseudoscience that can be used to place creation science in the latter camp. Further, by focusing on the nature and role of conceptual problems as part of the very practice of scientific explanation and confirmation, we see that creation science is an attempt to respond to those problems thought to be problematic for an evolutionary research program.

It would seem, then, that creationist theories like creation science cannot be labeled non-science or pseudo-science by simply citing the presence of philosophical, ethical, and theological conceptual issues within creationist theories. It may be that creationist theories, while scientific, are not as rationally acceptable as their evolutionary rivals. But that, of course, is a different matter altogether.³³ *

Notes

¹Robert C. Cowen, "Science Is What Can Be Argued, Not What Is Believed," *The Baltimore Sun*, July 8, 1987, Section B, p. 8.

²Michael Ruse, *Darwinism Defended* (Reading, Mass.: Addison-Wesley, 1982), p. 322.

³Michael Ruse, *Darwinism Defended*, p. 322. Cf. David Hull's review of Phillip Johnson's *Darwin on Trial in Nature* 352 (August 8, 1991): pp. 485-86.

⁴John Weister, "Should Public Schools Teach Creation Science," *Christianity Today* 32 (September 18, 1987): p. 50.

⁵Paul de Vries, "Naturalism in the Natural Sciences: A Christian Perspective," *Christian Scholar's Review* 15 (1986): pp. 388-96; Howard J. Van Till, Robert E. Snow, John H. Stek, Davis A. Young, *Portraits of Creation* (Grand Rapids: Eerdmans, 1990); Howard J. Van Till, "When Faith and Reason Cooperate," *Christian Scholar's Review* 21 (September 1991): pp. 33-45.

⁶Thomas V. Morris, ed., *Divine & Human Action: Essays in the Metaphysics of Theism* (Ithaca: Cornell University Press, 1988), pp. 2-5.

⁷As Philip Kitcher noted: "Moreover, variants of creationism were supported by a number of eminent nineteenth-century scientists These creationists trusted that their theories would accord with the Bible, interpreted in what they saw as a correct way. However, that fact does not affect the scientific status of those theories. Even postulating an unobserved Creator need be no more unscientific than postulating unobservable particles. What matters is the character of the proposals and the ways in which they are articulated and defended. The great scientific creationists of the eighteenth and nineteenth centuries offered problem-solving strategies for many of the questions addressed by evolutionary theory." See his *Abusing Science: The Case Against Creationism* (Cambridge, Mass.: MIT Press, 1982), p. 125.

⁸Norman Geisler, *The Creator in the Courtroom* (Milford, MI: Mott Media, 1982), p. 176.

⁹Eman McMullin, "Introduction: Evolution and Creation," in *Evolution and Creation*, ed. Eman McMullin (Notre Dame: University of Notre Dame Press, 1985), p. 46; Larry Laudan, "Commentary: Science at the Bar — Causes for Concern," *Science, Technology, and Human Values* 7 (Fall 1982): pp. 16-19. Cf. Michael Ruse, "Response to the Commentary: Pro Judice," *Science, Technology, and Human Values* 7 (Fall 1982): pp. 19-23; Larry Laudan, "More on Creationism," *Science, Technology, and Human Values* 8 (Winter 1983): pp. 36-38.

¹⁰For a survey of different views of creation and God's causal activity in creation/evolution discussions in the middle of the nineteenth century, see Neal C. Gillespie, *Charles Darwin and the Problem of Creation* (Chicago: University of Chicago Press, 1979), pp. 19-40.

¹¹It is sometimes objected that the idea of a grouping described as "kind" is religious and not scientific. But this is simply false. Just because "kind" occurs in the Bible does not mean that the term is any more religious than other terms that occur in the Bible, e.g. terms for mathematical numbers, cattle, the sun, and so on. A better point would be to claim that "kind" is vague. But this, by itself, does not make "kind" a non-scientific term. Science often uses general, vague terms. Creationists do need to make their use of "kind" more precise, e.g. by giving it operational content, but when they do they will not transform a religious concept to a scientific one, but rather, a vague scientific concept into a more precise one.

¹²Cf. Larry Laudan, *Progress and Its Problems* (Berkeley: University of California Press, 1977). Problem solving is central for Laudan's anti-realist approach to science. According to him, the basic unit of scientific progress and rationality is the solved problem. Scientific rationality is defined in terms of scientific progress, and scientific progress is defined in terms of problem-solving effectiveness. Since I have realist leanings in the philosophy of science, I do not share Laudan's overall approach to the nature and role of problems in science. But my differences with Laudan are not essential to my thesis, because I agree with his contention that conceptual problems have been and ought to be part of science.

¹³J. L. Mackie, "Three Steps Towards Absolutism," in *Space, Time, and Causality*, ed. Richard Swinburne (Dordrecht, Holland: D. Reidel, 1983), pp. 3-22.

¹⁴Keith Lehrer, *Knowledge* (Oxford: Clarendon, 1974), pp. 236-49.

¹⁵Michael Denton, *Evolution: A Theory in Crisis* (London: Burnett Books, 1985), pp. 55-68, 157-232.

¹⁶Charles B. Thaxton, Walter L. Bradley, Roger L. Olsen, *The Mystery of Life's Origin* (New York: Philosophical Library, 1984), pp. 99-112.

¹⁷Stephen Hawking, *A Brief History of Time* (New York: Bantam Books, 1988), p. 46.

¹⁸William Lane Craig, "What Place, Then, For A Creator?: Hawking on God and Creation," *British Journal for the Philosophy of Science*, Vol. 49 (1990): 473-91.

¹⁹Cf. Hubert P. Yockey, "Self Organization Origin of Life Scenarios and Information Theory," *Journal of Theoretical Biology* 91 (1981): pp. 13-16; "A Calculation of the Probability of Spontaneous Biogenesis by Information Theory," *Journal of Theoretical Biology* 67 (1977): pp. 377-98.

²⁰E. Mayr, *Populations, Species, and Evolution* (Cambridge, Mass.: Harvard University Press, 1970), p. 4.

²¹See Richard J. Connell, *Substance and Modern Science* (Notre Dame: University of Notre Dame Press, 1988).

²²See Paul M. Churchland, *Matter and Consciousness* (Cambridge, Mass.: MIT Press, 1984), p. 21; D. M. Armstrong, *A Materialist Theory of Mind* (London: Routledge and Kegan Paul, 1968), p. 30. These statements show how conceptual problems can enter into the scientific evaluation of a theory: one man's *modus ponens* is another's *modus tollens*.

²³Cf. George Bealer, "The Philosophical Limits of Scientific Essentialism," in *Philosophical Perspectives*, Vol. 1: *Metaphysics*, 1987, ed. James E. Tomberlin (Atascadero, Calif.: Ridgeview, 1987), pp. 289-365.

²⁴Cf. J. P. Moreland, *Scaling the Secular City* (Grand Rapids: Baker, 1987), pp. 15-42.

²⁵Larry Laudan, *Progress and Its Problems*, p. 124.

²⁶Stanley L. Jaki, *Angels, Apes, and Men* (La Salle, Ill.: Sherwood Sugden, 1983), pp. 51-72.

²⁷David Hull, *The Metaphysics of Evolution* (Albany, NY: State University of New York, 1989), pp. 74-75.

²⁸George I. Mavrodes, "Religion and the Queerness of Morality," in *Rationality, Religious Belief, & Moral Commitment*, eds. Robert

Audi, William J. Wainwright (Ithaca, N. Y.: Cornell University Press, 1986), pp. 213-226.

²⁹David Solomon, "Internal Objections to Virtue Ethics," in *Midwest Studies in Philosophy XIII: Ethical Theory: Character and Virtue*, eds. Peter A. French, Theodore E. Uehling, Jr., and Howard K. Wettstein (Notre Dame: University of Notre Dame Press, 1988), pp. 430-431.

³⁰Helga Kuhse, Peter Singer, *Should The Baby Live?* (Oxford: Oxford University Press, 1985), pp. 118-139.

³¹It may be thought that I have been guilty of an inconsistency in the following way. I have agreed that there is no line of demarcation between science and non-science and yet I have argued that we can recognize clear cases of science and clear examples where conceptual problems have been appropriate parts of scientific practice. But an inconsistency only follows from these claims if we adopt epistemological methodism, that is, roughly the idea that we cannot know or justifiably believe *p* unless we already have criteria for (1) how it is that we know or justifiably believe *p* in the first place and (2) how it is that we can know or justifiably believe that the case at hand can be classified as an example of *p* and not something

else. However, I do not hold to epistemological methodism. I am a particularist, and I believe clear cases of science and of appropriate utilizations of conceptual problems can be recognized prior to any clear, general criteria. Indeed, it is the cases which serve as a court of appeal for competing criteria, not vice versa.

³²It is beside the point that some people believe that theistic evolution is a way to adjust evolutionary theory so as to accommodate some of these conceptual problems. Other thinkers believe that creationist theories are better alternatives than theistic evolution, all things being considered (e.g. Biblical exegesis, the demand for primary agent causality regarding the origin of the universe, first life, various basic kinds of life, and man). But even if they are wrong, the point here is that these conceptual problems illumine the scientific status of creation-science, not that creation-science is the best scientific theory available, though I believe that to be the case as well.

³³I wish to thank Del Ratzsch and Steve Meyer for their helpful comments on an earlier draft of this paper.

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The Use and Abuse of Philosophy of Science: A Response to Moreland

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J.P. Moreland's "Conceptual Problems and the Scientific Status of Creation Science" argues against the notion that creationist theories are inherently unscientific. He suggests: (1) there are no good reasons to exclude postulations of intelligent design or special creative acts of God from science *a priori* and (2) there is at least one good reason to allow consideration of such postulations in science — namely, that creationist theories attempt to solve conceptual problems which, following Laudan, he regards as a primary function of many scientific theories. Moreland's analysis does not address any of the specific empirical claims that the various creationist theories (old-earth, young earth, theistic macromutationalist, etc.) make, but instead seeks to counter the claim that such theories can not (i.e., in principle) be considered scientific because they invoke special divine action as part of their explanatory framework. Thus, unlike Ruse,¹ Stent,² Gould,³ Grizzle,⁴ Murphy,⁵ and others, Moreland does not regard the possibility of a scientific theory of creation as "self-contradictory nonsense."⁶

While Moreland's conclusions no doubt seem quite radical to many practicing scientists and longtime ASA members, his arguments are, in my opinion, quite sound. Philosophers of science have generally lost patience with attempts to discredit theories as "unscientific" by using philosophical or methodological litmus tests. Such so-called "demarcation criteria" — criteria that purport to distinguish true science from pseudo-science, metaphysics and religion — have inevitably fallen prey to death by a thousand counter examples. Well-established scientific theories often lack some of the allegedly necessary features of true science (e.g. falsifiability, observability, repeatability, use of law-like explanation,

etc.), while many disreputable or "crank" ideas have often manifested some of these same features.⁷

Consider, for example, falsifiability.⁸ As Imre Lakatos has shown, some of the most powerful scientific theories have been constructed by those who stubbornly refused to reject their theories in the face of anomalous data. On the basis of his theory of universal gravitation, Newton, for example, made a number of predictions about the position of planets that did not materialize. Nevertheless, rather than rejecting the notion of universal gravitation, he refined his auxiliary assumptions (e.g. the assumption that planets are perfectly spherical and influenced only by gravitational force) and left his core theory in place. As Lakatos has shown, the explanatory flexibility of Newton's theory in the face of apparently disconfirming evidence turned out to be one of its greatest strengths. Such flexibility was emphatically not a token of "non-scientific status," as the Popperian model would suggest.⁹

Indeed, more careful study in the history of science has shown the falsificationist ideal to be extremely simplistic. Rarely are the core commitments of theories directly falsified via a single failed prediction. Instead, predictions occur when core theoretical commitments are conjoined with auxiliary hypotheses; thus, leaving open the possibility that auxiliary hypotheses, not core commitments, are responsible for deviations from prediction. On the

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other hand, the history of science is littered with the remains of failed theories that have been falsified, not by the air-tight disproof of a single anomaly, but by the judgment of the scientific community concerning the preponderance of data. Are such falsified, and therefore falsifiable, theories (e.g. the flat earth, phlogiston, heliocentrism, etc.) more scientific than successful theories (such as Newton's in, say, 1750) that are capable of wide-ranging explanatory power?

As the philosopher of science Larry Laudan has shown,¹⁰ such contradictions have plagued the demarcation enterprise from its inception. As a result,¹¹ most contemporary philosophers of science regard the question "what distinguishes science from non-science" as both intractable and uninteresting. Instead, philosophers of science have increasingly realized that the real issue is not whether a theory is scientific, but whether a theory is true, or warranted by the evidence. As Laudan puts it, "If we could stand up on the side of reason, we ought to drop terms like 'pseudo-science'... they do only emotive work for us."¹² As Martin Eger has summarized, "demarcation arguments have collapsed. Philosophers of science don't hold them anymore. They may still enjoy acceptance in the popular world, but that's a different world."¹³

Despite having fallen into disrepute with philosophers of science, demarcation arguments remain especially popular with both creationist and evolutionary polemicists (and, alas, many contributors to this journal). Nevertheless, the use of demarcation arguments to distinguish the scientific status of competing programs of origins research is especially problematic. One of the reasons for this is that many origins theories, if true, have obvious metaphysical overtones or implications. Those wishing to separate the scientific from the religious in contemporary cosmogony, for example, may find themselves facing quite a conundrum. On what basis could one assert that the various secular anthropic principles, many-worlds scenarios or quantum-cosmologies are any more or less scientific (or more or less religious) than, for example, recent theistic interpretations of the delicate balance of physical constants or the big bang singularity?

Attempts to distinguish the scientific from the pseudo-scientific in origins research fail for another reason. The demarcationist arguments used in the origins controversy almost inevitably presuppose a positivistic or neo-positivistic conception of science. Among their other deficiencies, such accounts of science fail to take into account the distinctive methodological character and limitations of the historical

sciences.¹⁴ Theories of intelligent design or creation have been alleged to be necessarily unscientific because they: (a) do not explain by reference to natural law,¹⁵ (b) invoke unobservables,¹⁶ (c) are not testable,¹⁷ (d) do not make predictions,¹⁸ (e) are not falsifiable,¹⁹ (f) provide no mechanisms,²⁰ (g) are not tentative,²¹ (h) have no problem solving capability,²² etc. Evolutionary theories have been tarred with many of the same methodological brushes.

As I have argued elsewhere,²³ however, none of these criteria provide grounds for distinguishing the *a priori* scientific status of either program of origins research over the other — unless, that is, the criteria are applied in a tendentious or question-begging way. Indeed, my research has suggested that metaphysically neutral criteria do not exist that can define science narrowly enough to disqualify theories of intelligent design or creation *a priori* without also disqualifying theories of naturalistic descent or evolution on identical grounds.²⁴ Either science will be defined so narrowly as to disqualify both types of theory, or science may be defined more broadly, in accord with appropriate desiderata for historical inquiry, and the initial reasons for excluding opposing theories will evaporate.

Consider the following example. Creationist theories have often been said to be unscientific because they make reference to an unobservable intelligence that can not be studied or tested empirically. Yet, if unobservability precluded testability neither evolutionary nor creationist theories could qualify as scientific. Indeed, Darwinists have long defended the apparently unfalsifiable nature of their theoretical claims by reminding critics that many of the creative processes they invoke occur at rates too slow to observe. Similarly, the core historical commitment of evolutionary theory — namely, that present species are related by common ancestry — has a very similar epistemological character to present theories of intelligent design or creation. The transitional life forms that ostensibly occupy the nodes on Darwin's branching tree of life are unobservable, just as the postulated past activity of a designer is unobservable.²⁵

Origins theories generally must make assertions about what happened in the past to cause present features of the universe (or the universe itself) to arise. They necessarily must attempt to reconstruct unobservable past causal events from present clues or evidences. Methods of testing, therefore, that depend upon direct or repeated observation of cause/effect relationships have minimal relevance to origins theories of whatever type. Those who insist upon observing causal antecedents or verifying the

actual predictions will find nothing scientific in any origins theory. If, however, one accepts the necessity of testing competing historical theories *ex post facto* by comparing their explanatory power, then the original reason for excluding creationist theories from consideration dissolves. My analysis of the other demarcation arguments enumerated above suggests they are similarly incapable of discriminating the *a priori* scientific status of creationist and evolutionary theories.²⁶

Thus, from the standpoint of contemporary philosophy of science and recent work on evolutionary demarcation arguments, Moreland's first assertion seems to me unproblematic. There do not seem to be convincing arguments for disqualifying creationist theories as inherently unscientific. Nevertheless, without further demonstration, many practicing scientists may be forgiven for a certain suspicion of philosophers of science. What after all do philosophers really know about science? Yet as Moreland has pointed out, demarcation arguments do not make claims about nature itself, thus reflecting the domain of scientists; rather, they make second-order assertions about the nature and method of scientific practice, the study of which does directly and legitimately concern philosophers of science. In this case, it is scientists, not philosophers, who assert beyond their authority.

Moreover, given the recent trend within the philosophy of science to integrate philosophical analysis with historical study, there seems, to me at least, to be little reason to doubt the philosopher's conclusions about the failure of demarcation arguments. Too many examples from the history of science itself show these arguments to depend upon oversimplifications and caricatures of scientific practice. Nor is this fact surprising when one considers the history of philosophy. Demarcation, historically, has been the special project of positivist and neo-positivistic philosophers whose claims were judged deficient in part because they misrepresented actual scientific practice — as Michael Polanyi, a scientist turned philosopher, so convincingly demonstrated.²⁷

Thus, the first part of Moreland's argument seems sound. There do not seem to be good reasons to exclude postulations of intelligent design or special creative acts of God from science *a priori*. Instead, most of the reasons for disqualifying such theories seem to be derived from discredited positivistic accounts of scientific rationality. Yet what about Moreland's second (and main) argument? Are there any good positive (though not positivistic) reasons to consider creationist theories scientific? Do recent non-positivistic accounts of scientific method and ra-

tionality suggest the possibility of a scientific theory of creation? Moreland invokes recent work by Larry Laudan to answer both questions in the affirmative.

And here again, I agree with Moreland's conclusion. His analysis illustrates persuasively to me one way that creationist theories might well conform to a general model of scientific practice. If one takes Laudan's work as a good descriptive account of what scientific theories do, then creationist theories seem to be as scientific as many other theories already regarded as such. Like other theories that already enjoy scientific status, creationist theories attempt to solve both internal and external conceptual problems.

Yet one might want to ask whether or not Laudan's account of the nature of science is accurate or complete. Perhaps true scientific theories do other things besides solve conceptual problems that creationist theories don't do. Perhaps there are other better (non-positivistic) accounts of scientific method and rationality that would not cast so favorable a light on the possibility of a scientific theory of creation as does Laudan's. Moreland, of course, does not address such possibilities, as he carefully limits the scope of his paper to analyzing the implications of Laudan's work for the scientific status of creationism.

Nevertheless, those hoping to find a post-positivist philosophy of science to assist them in defining creationist theories out of existence may have to look long and hard. In my opinion, other recent accounts of scientific rationality offer little hope for a renewed program of demarcation. In fact, quite the reverse is the case. Paul Thagard²⁸ and Peter Lipton's²⁹ work on the use of inference to the best explanation has, for example, suggested an unexpected similarity between scientific reasoning and the reasoning used in religious, historical, philosophical and ordinary discourse. Knowledge simply does not appear to be divided into the neat isolated compartments assumed by many demarcationists and complementarians. Empirical data may have metaphysical implications, while unobservable (even metaphysical) entities may serve to explain observable data or their origins.

Furthermore, as Elliot Sober and I have argued (independently), both the argument for intelligent design and the Darwinian argument for naturalistic descent with modification can be understood as attempts to make retrodictive inferences to the best explanation.³⁰ This logical similarity between the two theories raises an important question: What makes either intelligent design or naturalistic descent

inherently more or less scientific than the other when both theories depend upon similar forms of inference and methods of empirical evaluation?

Recent work on the methods of the historical sciences has suggested that the methodological and logical similarity between creationist and evolutionary theories runs quite deep. Both programs of research attempt to answer characteristically historical questions; both may have metaphysical implications or overtones; both employ characteristically historical forms of inference, explanation and testing; and, finally, both are subject to similar epistemological limitations.³¹ Thus, intelligent design and naturalistic descent appear to be what I term "methodologically equivalent" — that is, both prove equally scientific or equally unscientific provided the same criteria are used to adjudicate their scientific status and provided metaphysically neutral criteria are selected to make such assessments. (Design and descent may not, of course, be equivalent in their ability to explain particular empirical data, but that is a separate issue).

Clearly, I can not demonstrate exhaustively the above arguments in the space available in this response. Nevertheless, I mention my work and other developments in the philosophy of science as a warning against the cavalier use of philosophy to make categorical judgments against ideas we would prefer not to engage. I readily understand the distaste that many ASA friends feel for the sloppy handling of data that has unfortunately characterized the work of some of our more fundamentalist brothers and sisters. I myself reject young-earth flood geology.³² Nevertheless, I do so not because the supposition of a young earth is intrinsically any less scientific than its opposite. Rather, I do so because the empirical data seems to me to support strongly the supposition of great antiquity.

I wonder, however, if in our zeal to disassociate ourselves from our young-earth colleagues, we have too readily embraced an unnecessarily secularized vision of science that serves neither truth nor Christ. With the demarcation arguments that have underwritten methodological naturalism now exposed as yet another vestige of an untenable enlightenment view of rationality, the time seems especially ripe for ASA members to take the lead in probing the extent to which strict materialistic assumptions must govern all branches of science. Nowhere is such a re-evaluation more necessary, for the sake of science itself, than in the area of origins research.

Consider for the moment a radical possibility. It might well be the case that God acted in special

way (i.e., in a way that differs from his ordinary supervenience over nature that we describe with laws).^{*} He might well have acted discretely or specially to create, for example, the universe, the first life, the major taxa and/or human consciousness. It might also be the case that unambiguous traces of his special creative activity remain by which such activity could be convincingly inferred. And, then again, it may not be so. Yet I see no reason,³³ and philosophy of science currently provides no reason, to limit the inferences that scientists may draw in their attempts to explain the origin of the evidence they observe. Artificial limitations upon theory construction only leave open the possibility that the best explanations may not have been considered. Scientia so encumbered is unworthy of the name.

Indeed, the most important reason to question methodological naturalism is not that it undermines the claims of religion; the best reason to question the doctrine is that it limits the prerogatives of science. Methodological naturalism is not so much irreligious as *irrational*. Hyperbole aside, strict naturalism functions (at least within origins research) to close off legitimate lines of inquiry and avenues of potential explanation. It therefore, limits the ability of scientists to pursue the truth wherever, and perhaps, to Whomever, it might lead. Moreland correctly challenges ASA members to reassess this truncated and anti-intellectual view of science. *

Theists who invoke the special assistance or activity of Divine agency to explain an origin event or biblical miracle are not, as is commonly asserted, guilty of semi-deism. It does not follow that those who infer that God has acted in a discrete, special, and perhaps more easily discernable way in one case, deny that he is constantly acting to "uphold the universe by the word of his power," at other times. The medievals resisted this false dichotomy by affirming two powers of God, or two ways by which he interacts with the world. The ordinary power of God they called his "Potentia Ordinana" and the special or fiat power they called his "Potentia Absoluta" (Courtney (1985) 243-269). Many modern theists who affirm the special action of God at a discrete point in history have this type of distinction in mind and are not guilty of denying God's constant providence over nature. To affirm an instance of Potentia Absoluta is not to deny Potentia Ordinana.

Notes

¹Ruse (1982) 322-24.

²Stent (1984) 137.

³Gould (1984) 118.

⁴Grizzle (1993) 33.

⁵Murphy (1993) 33.

⁶Ebert, et. al. (1987) 8-10. Lewontin (1983) xxvi.

⁷Laudan (1988a) 337-350.

⁸Ibid.

⁹Lakatos (1970) 189-195.

¹⁰Laudan (1988a). Laudan (1988b) 354.

¹¹This excessive reliance upon a philosophical definition of science to circumvent the hard work of evaluating specific empirical claims ironically credits philosophy of science with more

power than it possesses. That such philosophical considerations are typically raised by positivistic minded scientists who regard appeals to "philosophy" as anathema only compounds the irony of the demarcationist enterprise. If any demarcating is to be done, it ought to be done by the philosophers of science who specialize in such second-order questions about the definition of science. Yet for reasons specified already philosophers of science have increasingly spurned this enterprise.

- ¹²Laudan (1988a) 349.
- ¹³Eger quoted in Buell (1989).
- ¹⁴See, for example, Beady (1989) and Saunders and Ho (1984) on falsifiability, and Meyer, 1994a, 67-112.
- ¹⁵Ruse (1988b) 301. Ruse (1988a) 26. Ruse (1992) 1-6.
- ¹⁶Root-Bernstein (1984) 74. Grinnell (1992).
- ¹⁷Gould (1984) 129-30. Ruse (1988b) 305. Ebert, et. al. (1987) 8-10. Skoog (1989) 1-2.
- ¹⁸Root-Bernstein (1984) 73. Ruse (1988a) 28. Ebert, et. al (1987) 8-10.
- ¹⁹Kline (1983) 42. Gould (1984) 120. Root-Bernstein (1984) 72.
- ²⁰Ruse (1982a) 59, Ruse (1988f) 305. Gould (1984) 121. Root-Bernstein (1984) 74.
- ²¹Kehoe (1985) 173-180. Ruse (1988b) 305. Ruse (1988a) 28. Ebert, et. al. (1987) 8-10.
- ²²Kitcher (1982) 126-27, 176-177.
- ²³Meyer (1994a).
- ²⁴*Ibid.*
- ²⁵Meyer (1990) 120. Darwin, (1859) 398. Hull, (1973) 45.
- ²⁶Sober (1993) 27-46. Meyer (1994a).
- ²⁷Polanyi (1962).
- ²⁸Thagard (1978) 77-92.
- ²⁹Lipton (1991).
- ³⁰Sober (1993) 27-56. Meyer (1994a).
- ³¹Meyer (1994). Meyer (1990) 11-135. Sober (1993) 27-56.
- ³²Yet even so I have to recently acknowledge the emergence of many highly trained and well disciplined young earth scientists. I would mention Kurt Wise as one who is doing very interesting work. Old earth geologists and biologists have much to gain from dialogue with such scientists and certainly should not exclude them from ASA fellowship.
- ³³Laudan (1988a), Laudan (1988b). Quinn (1988a), Quinn (1988b).

References

- Beade, Pedro (1989) "Falsification and Falsifiability in Historical Linguistics." *Philosophy of the Social Sciences*, 19: pp. 173-181.
- Courtenay, W. (1985) "The Dialectic of Omnipotence in the High and Late Middle Ages." *Divine Omniscience and Omnipotence in Medieval Philosophy*, T. Rudovsky (ed), D. Redel Publishing Company, pp. 243-269.
- Darwin, C. (1859) *The Origin of Species by Means of Natural Selection*. London. All quotes taken from version reprinted by Penguin in Harmondsworth, England, 1984.
- Eger, M. as quoted in J. Buell (1989) "Broaden Science Curriculum." *Dallas Morning News*, March 10, 1989. Quoted by Buell from a telephone interview. For a more thorough exposition of Eger's views, see: Eger (1988) "A Tale of Two Controversies: Dissonance in the Theory and Practice of Rationality." *Zygon* 23: pp. 291-326.
- Gould, Stephen Jay (1980) "The Senseless Signs of History." *The Panda's Thumb*. New York: W.W. Norton, pp. 27-34.
- Gould, Stephen Jay (1984) "Evolution as Fact and Theory." *Science and Creationism*, Montagu, Ashley (ed). New York: Oxford University Press, pp. 117-125.
- Grinnell, F. (1992) "Radical Intersubjectivity: Why Naturalism Is An Assumption Necessary for Doing Science." *Darwinism: Scientific Inference or Philosophical Preference*, Buell, J. and V. Hearn, (eds.) Forthcoming.
- Grizzle, R. (1993) "Some Comments on the 'Godless' Nature of Darwinian Evolution, and a Plea to the Philosophers Among Us." *Perspectives on Science and Christian Faith* 44:2, pp. 175-177.
- Hull, David L. (1973) *Darwin and His Critics*. Chicago: The University of Chicago Press.
- Kehoe, A. (1985) "Modern Anti-Evolutionism: The Scientific Creationists." *What Darwin Began*, Godfrey, Laurie R. (ed.). Boston: Allyn and Bacon, Inc, pp. 165-185.
- Kitcher, P. (1982) *Abusing Science*. Cambridge, Mass: The MIT Press.
- Kline, A. David (1983) "Theories, Facts and Gods: Philosophical Aspects of the Creation-Evolution Controversy." *Did the Devil Make Darwin Do It?* Wilson, David B. (ed). Ames, Iowa: The Iowa State University Press, pp. 37-44.
- Lakatos, Imre (1970) "Falsification and the Methodology of Scientific Research Programmes." *Criticism and the Growth of Knowledge*, Lakatos and Musgrave (eds.). Cambridge: Cambridge University Press, pp. 91-195.
- Laudan, L. (1988a) "The Demise of the Demarcation Problem." *But Is It Science?* Ruse, Michael (ed). Buffalo: Prometheus Books, pp. 337-350.
- Laudan, L. (1988b) "Science At the Bar — Causes for Concern." *But Is It Science?* Ruse, Michael (ed). Buffalo: Prometheus Books, pp. 351-355.
- Lewontin, R. (1983) "Introduction." *Scientists Confront Creationism*, Godfrey, L. (ed.) p. xxvi. New York: W.W. Norton.
- Lipton, P. (1991) *Inference To the Best Explanation*. London: Routledge.
- Meyer, S.C. (1990) *Of Clues and Causes: A Methodological Interpretation of Origin of Life Studies*. Cambridge University Ph.D. Thesis.
- Meyer, S.C. (1994a). "The Methodological Equivalence of Design and Descent." *The Creation Hypothesis*, Moreland, J.P., (ed.) Downers Grove: InterVarsity Press, pp. 67-112.
- Meyer, S.C. (1994b) "Laws, Causes and Facts: A Response to Professor Ruse." *Darwinism: Scientific Inference or Philosophical Preference*. W. Dembski and V. Hearn (eds) The Foundation for Thought and Ethics: Dallas.
- Murphy, Nancey (1993) "Phillip Johnson on Trial: A Critique of His Critique of Darwin." *Perspectives on Science and Christian Faith* 45:1, p. 26-36.
- Quinn, Philip L. (1988a) "The Philosopher of Science as an Expert Witness." *But Is It Science?* Ruse, Michael (ed). Buffalo: Prometheus Books, pp. 367-385.
- Quinn, Philip L. (1988b) "Creationism Methodology and politics." *But Is It Science?* Ruse, Michael (ed). Buffalo: Prometheus Books, pp. 395-400.
- Root-Bernstein, Robert (1984) "On Defining a Scientific Theory: Creationism Considered." *Science and Creationism*, Montagu, Ashley (ed). New York: Oxford University Press, pp. 64-94.
- Ruse, M. (1982a) *Darwinism Defended: A Guide to the Evolution Controversies*. London: Addison-Wesley.
- Ruse, M. (1988a) "A Philosopher's Day in Court." *But Is It Science?*, Ruse, Michael (ed). Buffalo: Prometheus Books, pp. 13-38.
- Ruse, M. (1988b) "Witness Testimony Sheet: McLean v. Arkansas." *But Is It Science?*, Ruse, Michael (ed). Buffalo: Prometheus Books, pp. 287-306.
- Ruse, M. (1992) "Darwinism: Philosophical Preference, Scientific Inference, and Good Strategy." *Darwinism: Scientific Inference or Philosophical Preference*, Buell, J. and Hearn V. (eds). Forthcoming.
- Polanyi, M. (1962) *Personal Knowledge*. Chicago: University of Chicago Press.
- Saunders, P.T. and M.W. Ho, (1982) "Is Neo-Darwinism Falsifiable — and Does It Matter?" *Nature and System* 4: pp. 179-196.
- Skoog, Gerald (1989) "A View From the Past." *Bookwatch Reviews*, 2 p. 1-2
- Sober, E. (1988) *Reconstructing the Past*, Cambridge, Mass.: MIT Press.
- Sober, E. (1993) *Philosophy of Biology*, San Francisco: Westview Press.
- Stent, Gunther S. (1984) "Scientific Creationism: Nemesis of Sociobiology." *Science and Creationism*, Montagu, Ashley (ed). New York: Oxford University Press, pp. 136-141.
- Thagard, P. (1978) "The Best Explanation: Criteria for Theory Choice," *Journal of Philosophy*, 75, p. 77-92.

Is Creation Science An Oxymoron?

A Response to Moreland

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J.P. Moreland's paper, "Conceptual Problems and the Scientific Status of Creation Science" starts with the issue of whether or not the description "creation science" is an oxymoron. It concludes that the argument cannot be sustained that creation science is not a science but a religion because it utilizes broad philosophical and theological concepts, or that creation science cannot be faulted by simply citing the presence of philosophical, ethical, and theological conceptual issues within creationist theories.

Part of the argument is to point to various other areas of science where participating scientists have indeed used philosophical, ethical, or religious conceptual issues as part of their theory formation. Such an approach has two shortcomings.

(1) The question needs to be settled whether practicing scientists have been consistent in using philosophical, ethical, or religious conceptual issues as part of their theory formation. It is quite possible that other scientists have also violated the structure of authentic science for their own particular philosophical or religious reasons. The appropriate response in such a case would be to recognize that these scientists have been involved in an inappropriate activity that we ought not to imitate, not adopt their practice as normalizing for others. Believers in atheism who allow their atheistic convictions to dictate their involvement in the theory of evolution are no more capable of doing authentic science than are theists who allow their theistic convictions to cause them to reject any theory of origins involving natural processes.

(2) A distinction must be drawn between the role of philosophical or religious concepts in forming a theory, and the injection of these concepts as part of the mechanisms of the theory. It may be that scientists carrying out authentic science may be in-

fluenced in the choice of a theory by philosophical or religious convictions. The first thing that they then need to do, however, is to set forth experimental tests of this theory as a scientific theory, quite independent of those philosophical or religious concepts. If the theory cannot be tested, either directly or indirectly, with a description in natural categories, then it is concluded that a scientific description cannot currently be given. Such uncertainties may give rise to a long period of time in which the appropriate theory must remain open because no adequate test can be constructed. If, however, the effect of the philosophical or religious convictions on theory formation is to propose that an essential mechanism of the theory is a supernatural act, which by definition cannot be tested scientifically, then such a theory cannot be considered to be a scientific theory.

Such extended semantic discourse, however, does not really deal in a straightforward way with the original issue. The reasons for regarding creation science as an oxymoron are far simpler and far easier to cite.

First of all, consider a basic simple definition of what constitutes authentic science. Authentic science is a particular way of knowing, based on descriptions of the world obtained through the human interpretation in natural categories, of publicly observable and reproducible sense data, obtained by sense in-

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teraction with the natural world. The descriptions of science must be obtained through human interpretation of data, and human interpretation of data may be influenced by a variety of philosophical, metaphysical, religious and cultural inputs. But the crucial consideration here is that to be part of authentic science, such descriptions must be given in natural categories. This choice is not made because anti-religious scientists are committed to "methodological naturalism" in order to advance their philosophical agenda, but simply to define and delimit the range of descriptions that can reasonably claim the support and validity of authentic science.

The limitation to descriptions in natural categories is inimical to Christian theology only if one adopts the mistaken attitude of scientism, i.e., that science is the only source of assured knowledge and truth. Clearly if one believes that only science can provide meaningful knowledge and information, then this is tantamount to asserting that all meaningful knowledge and information must be in natural categories. But if scientism is recognized as an unjustified extrapolation from science into metaphysics, philosophy, false religion, or world view, then other possibilities become evident. If there exists in the world a phenomenon that cannot be adequately described in natural categories, then the net result will be that it will not be possible to obtain a defensible scientific description. Other kinds of description, other ways of knowing must be brought to bear. Here again it is important to recognize that to say that a phenomenon can be adequately described in natural categories scientifically does not mean that it can be exhaustively so described, or that such a description rules out the possibility or the importance of recognizing beyond the scientific description the activity of God.

People are, of course, free to disagree and attempt to change this definition, but a high degree of caution is advisable. This definition is the working format for authentic science by people who are actually engaged in doing authentic science. There is furthermore a close relationship between the defense of authentic science and the defense of authentic Christian theology. Efforts to impose theological ideas on science, and efforts to impose scientific ideas on theology are both destructive of the validity which we would like to be able to associate with authentic science and authentic theology.

A scientist may be led by his religious convictions to propose the theory that the earth came into being 10,000 years ago. This could be in principle a scientific theory. To validate such a theory he must then involve himself in extensive testing of the ap-

parent age of the earth. He cannot do authentic science by starting with the assumption that he knows that the earth is 10,000 years old, and then try to find evidence that supports such an assumption; such an activity would be pseudoscience. But if a scientist were led by his religious convictions to propose the theory that the earth came into being 10,000 years ago with all of the evidences of being 5 billion years old, then this could never be classified as a scientific theory, because no conceivable test could ever be made of its validity. The conclusion that it cannot be classified as a scientific theory does not demand that it not be true, only that it cannot be described in a way consistent with that limited discipline known as authentic science.

In a sense the issues raised in Moreland's paper constitute a kind of "straw man." They miss the main points of contention. Let us return to the basic question, "Why is creation science an oxymoron?" Three basic reasons can be cited.

(1) As a matter of fact, "creation science" must necessarily be "anti-evolution science." Since the assumption of the reality of divine creation rules out (for the advocate of creation science) the possibility of any description in natural categories, the only place to attack is against the proposal that there are such descriptions, namely those encompassed in some theory of biological evolution.

Now the anti-Christian aspects of evolution do not arise from the biological theory of evolution itself, which has been frequently integrated into a totally biblical perspective. The anti-Christian aspects of evolution arise from the development of what we may call evolutionism, an inherently anti-Christian world view which views evolution within the framework of scientism. The place for a Christian to attack, therefore, is the claim that evolutionism is really based on the theory of biological evolution. The failure to do this constitutes a major tactical error of so-called creation science.

(2) Neither "creation science" nor "anti-evolution science" can be accepted as authentic science for a very simple reason. Both of these assume that science can be done for the purpose of establishing a previously accepted model. But the strength of properly functioning authentic science is that any attempt to direct scientific activity because of any previously accepted model dictated by philosophical, metaphysical, or religious concerns is rejected. This is no more unique as a critique of "creation science" than it would be as a critique of a proposed "evolution science." Attempts to establish evolution by doing science are no more valid than are attempts

to establish creation by doing science. Investigators who shape their scientific inquiry, descriptions and conclusions because of their belief in the validity of evolution are doing at best bad science, and at worst pseudoscience. Investigators who shape their scientific inquiry, descriptions and conclusions because of their belief in the validity of creation are again doing at best bad science, and at worst pseudoscience. Authentic science must be directed toward the open question of how to describe what is in natural categories, in the best way possible, unless it is found not to be possible.

(3) It is not possible to scientifically provide evidence for "creation," if by creation is meant, as is usually the case, supernatural activity by a divine intelligence outside the possibilities of scientific description. Science can in principle provide the framework for deciding that we cannot describe origins scientifically, that certain events happened in history in a way that we cannot describe scientifically. Science can in principle also provide us with evidence that would be consistent or inconsistent with insight

into God's creative activity. But if God were to have created living creatures instantaneously by fiat, then the only scientific description for the event is "spontaneous generation," not "creation." The choice to identify such acts with God's creation is a choice made out of a faith context of a life committed to God, not one that can be provided by science. This is why, for example, one might defend the possibility of offering instantaneous vs. process descriptions for origins in education in science, or of offering creation as a religious interpretation of the scientific evidence in education in human thought and history, but one cannot defend the inclusion of creation as a scientific mechanism in a science curriculum.

Unfortunately, this paper does not deal with any of these objections to the phrase and concept of "creation science." Until the proper distinctions are made, the proper inferences understood, and the proper applications put into common use, this subject will remain one of confusion for many Christians not trained in science. *

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Response to Meyer and Bube

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I want to thank professors Meyer and Bube for their thoughtful comments on my article. Meyer is in basic agreement with what I argue and he extends my position with further arguments that I find convincing. Due to space considerations, and since Meyer and I are in such agreement about these matters, I will devote the majority of what I say here to Bube's response.

I have appreciated Bube's writings over the years, and I agree with a number of the points he makes in his response to my article. However, we do have deep differences and I will bring those to center stage, first, by commenting on three relatively minor points and, second, by looking at what I take to be the major issue in Bube's paper.

First, Bube claims that the issues raised in my article are a kind of "straw man," that the real culprit is not the theory of biological evolution *per se* but, rather, evolutionism taken as a version of scientism. In my view, this claim represents a simplistic caricature of what is going on. It is one thing to assert, quite correctly, that scientism is wrong and ought to be resisted. It is another thing altogether to simply reduce the complexities of the theology/science interaction, say as exemplified in the creation/evolution discussion, to nothing more than illicit extrapolations or territory encroachments from one side to the other.

Many advocates of creation science (and I make it clear that I use this term to cover various progressive creationist models as well as young earth paradigms) simply think that:

- (1) Science and theology can directly interact at the same level of description in epistemically positive and negative ways and nothing about the nature of science or theology rules this out.
- (2) Natural theology is a legitimate enterprise and, while theology does not in general need the support of science to be rational, nevertheless,

some theological claims and arguments in natural theology (e.g. the universe had a beginning, there is a designer, humans arose in the mideast, life originated by a primary causal act of God) can tend to be supported by or at odds with scientific discoveries.

- (3) The most rationally defensible ways of exegeting scripture are at odds with the general theory of evolution in its various forms.

Since a number of bright and informed believers hold these views, three different but related issues are generated:

- (i) Does the very nature of science rule out creation science as a religion and not a science?
- (ii) Is creationism, taken as a research program, empirically fruitful in solving problems? and how does the epistemic virtue of empirical fruitfulness figure into evaluating research programs in general and creationism in particular?
- (iii) How do current models of creation science compare to evolutionary rivals in light of empirical discoveries?

The point of my article was to address the first and, to a lesser extent, the second of these questions in a limited way. In light of the complexity of the issues involved here, it is simplistic to simply announce that the real issue is evolutionism. Such an announcement is Procrustean.

This leads to a second minor point. Bube offers a definition of science as the main foundation of his response. I will look at some details of that definition later. But for now, something very important needs to be said about the simple fact that he would offer such a definition and place so much weight on it. The task of defining science is not primarily one for scientists. Thus, it is cognitively irrelevant that the majority of practicing scientists hold to a certain definition. They are simply not trained as experts in this area for a simple reason. Defining

science is a second-order philosophical question, not a first-order scientific one, and the history and philosophy of science should be the fields that handle this task. When a scientist offers a definition of science, he or she does so by taking a meta-scientific, that is, a philosophical standpoint, not a scientific one.

The plain fact is that historians and philosophers are almost universally agreed that there is no adequate definition of science (including Bube's), no line of demarcation between science and non-science or pseudo-science, no set of necessary or sufficient conditions for stating what science is or is not. We can recognize paradigm cases of science without such a definition and we can state a general characterization of science that will *often* and *for the most part* be useful. But that is about all we can do. Thus, arguments that rest on such definitions are on thin ice indeed.

Recently, Larry Laudan has shown that attempts to define science are rooted in polemical battles which try to show that some cognitive practice is not really science by identifying beliefs that are "'sound' and 'unsound,' 'respectable' and 'cranky,' or 'reasonable' and 'unreasonable'."¹ As Meyer has reminded us, Laudan goes on to say that,

If we would stand up and be counted on the side of reason, we ought to drop terms like 'pseudo-science' and 'unscientific' from our vocabulary; they are just hollow phrases which do only emotive work for us. As such, they are more suited to the rhetoric of politicians and Scottish sociologists of knowledge than of empirical researchers."²

If scientists are going to discuss these matters, they owe it to themselves to become familiar with the vast literature in the history and philosophy of science on this topic. I suspect that such familiarity would temper the temptation to claim, as does Bube, that if current definitions by practicing scientists are at odds with the history of science, the conclusion to draw is, quite possibly, that history violates "the structure of authentic science."

The third point is this. Bube's paper claims that creation science cannot be authentic science because it is done to establish a previously existing model, presumably because the model is not tentatively and openly, but rather dogmatically, embraced ahead of time. However, several things are wrong with Bube's employment of this argument. First, even if tentativeness is an epistemic virtue in science, it is a characteristic of scientists themselves, not of their theories. Theories are not conscious beings. Thus, all that follows from this is that creation scientists

should loosen up, not that creation science models themselves are pseudo-science. Perhaps Gish, Morris, Walter Bradley and others just need therapy to make them more tentative. If that happened, would Bube agree that creation science models are models of science (a different question than asking if they are empirically adequate)? The fact is that some creationists are quite tentative about their models, in whole or in part, and creation science paradigms could be taught, researched, and explored by those who don't even accept them. Thus, the tentativeness of a scientist has nothing to do with the scientific or pseudo-scientific status of his or her theory. Moreover, a number of other theories are considered scientific even though their practitioners are not tentative. Does anyone today doubt the circulation theory of blood? Does this lack of tentativeness make any difference? It is one thing to say that a lack of tentativeness can tend to make a scientist distort data. This point, while often true, counts equally against evolutionists as well, and in any case, it is ultimately beside the point because the acceptability of a paradigm is a matter of several factors, including how it fares in light of several epistemic virtues (e.g. simplicity, empirical accuracy, fruitfulness in guiding new research, effectiveness in solving internal and external conceptual problems) and how it compares to its rivals. So even though tentativeness is in general a virtue for scientists themselves, it is only one of many important factors and, as I have said, its absence among practitioners of a paradigm does not mean that the paradigm itself is not a scientific paradigm.

I come now to a critique of what I take to be the central issue of Bube's paper: the details of his definition of science, of which two shall be mentioned. First, Bube's definition of science includes methodological naturalism as part of that definition. I have criticized methodological naturalism elsewhere,³ and will only offer some brief remarks here.

To begin with, I have already pointed out that demarcationist strategies, methodological naturalist ones included, have been failures. We should learn from this fact. Second, even if we grant that scientific *explanation* requires descriptions of mechanisms in natural categories, it only follows that creation science — or perhaps a better term would be "theistic science" — is not science if we go on to grant the erroneous assumption that science is exhausted by explanation. But this is not the case. Theistic science is rooted in the idea that Christians ought to consult all they know or have warrant to believe in forming and testing scientific hypotheses, in explaining things in science, and in evaluating the plausibility of various scientific hypotheses, and among the

things they should consult are propositions of theology (and philosophy).

This understanding of theistic science allows us to spell out a number of ways that theological (and philosophical) beliefs can enter into the very fabric of science apart from explanation proper. Two of them are as follows: (1) Theology can provide and solve internal and external conceptual problems. (This was the main point of my article.) (2) Theology can provide a picture of what was and was not going on in the formation of some entity (e.g. the first event, first life, the basic kinds of life, man, and for some, the geological column) and what some entity is (e.g. living things have souls that constitute their nature and ground the search for more species-specific principles of classification). These pictures can serve as guides for new research (e.g. by postulating that a purpose will be found for vestigial organs), they can yield predictions that certain theories will be falsified (e.g. those entailing a beginningless universe) and that certain discoveries will be made (e.g. that evidence of human origins will be found in the mid-east).

Thus, even if theological ideas cannot be used in scientific explanation, theistic science could still be legitimate science by utilizing theological beliefs in these other ways. Bube appears to acknowledge this in a few places, but his definition of science is inconsistent with this acknowledgement. This is all creationists need to justify the claim that theistic science is science and not religion.

Second, it is false that theological propositions like the flood of Noah or a direct, primary causal act of God cannot be used to explain things in science. Scientific explanation is not limited to a covering law model of explanation using only natural laws nor to a realist causal model that only posits natural, material entities as causes. This is especially true in the historical sciences, though the point is not limited there. Scientists regularly explain things by citing causal entities, processes, actions, or events in their explanations. For example, the Big Bang is cited as a single causal event in certain scientific explanations. Now, some branches of science, e.g. SETI, archeology, forensic science, psychology or sociology, use personal agency and various inner states of agents (desires, willings, intentions, awarenesses, thoughts, feelings) as part of their description of those causal entities. For example, Richard DeCharms claims that "a scientific concept of the self that does not encompass personal causation is inadequate."⁴ There is nothing non-scientific about appealing to personal agency and the like in a sci-

entific explanation, and it is this insight that theistic scientists capture and that Bube leaves out.

It may be objected that such appeals are permissible in the human sciences and not the so-called natural sciences. But this response is question-begging in that it rules out personal explanation in natural science by definition instead of merely defining those sciences ostensibly. Moreover, such question-begging legislations have hurt science in other areas, e.g. cognitive psychology and artificial intelligence models of consciousness. In this regard, John Searle says:

How is it that so many philosophers and cognitive scientists can say so many things that, to me at least, seem obviously false? I believe one of the unstated assumptions behind the current batch of views is that they represent the only scientifically acceptable alternatives to the antisocialism that went with traditional dualism, the belief in the immortality of the soul, spiritualism, and so on. Acceptance of the current views is motivated not so much by an independent conviction of their truth as by a terror of what are apparently the only alternatives. That is, the choice we are tacitly presented with is between a "scientific" approach, as represented by one or another of the current versions of "materialism," and an "unscientific" approach, as represented by Cartesianism or some other traditional religious conception of the mind.⁵

In my view, it is this methodological naturalist straightjacket that would deny to, say, biology, paleontology, and the study of origins, the same freedom of movement. The claim that if we allow such freedom then there would be no way to stop it is a red herring. Theistic scientists do not believe in a capricious God nor do they appeal to a direct act of God willy nilly in an explanation, but only if there are good theological, philosophical, and/or scientific reasons for doing so.

This leads to the second detail of Bube's characterization of science. He claims that if God created living creatures instantaneously by *fiat*, then the only scientific description for the event is spontaneous generation, not creation. But why is this the case? I can only think of two reasons. First, God is not a natural physical entity or process. But as we have seen, science does not limit its explanatory entities to such natural mechanisms.

Second, it may be that Bube thinks the two explanations "spontaneous generation" and "creation" are each consistent with empirical data in that the data entails neither. But this is irrelevant. Theories are always underdetermined by data and scientists regularly make inferences to the best explanation

even though other explanations are logically possible, or even if the two rivals are, strictly speaking, empirically equivalent. Note that in creationist employments of a primary causal act of God regarding the origin of the universe, first life, and human beings, the notion of creation is not merely a *description*, but an inductive *inference* to the best explanation. If such an explanation is in fact the best one, whether based on probability considerations or analogy with human artifacts and the known properties of matter, and if such an inference solves external and internal conceptual problems better than the "spontaneous generation" alternative, then what is unscientific about such an inference? That it is not entailed by the data is irrelevant; scientific inferences to the best explanations never are. The idea that the scientist must notice the data and the analogy to artifacts, notice that a causal act of God solves this as well as various conceptual problems, but nevertheless must take off his or her scientist's cap and put on another one before he or she makes the inference is, in my view, picking at nits.

In closing, I have a plea. Years ago, Thomas Kuhn pointed out that when science is dominated by a major paradigm, scientists who do not accept that paradigm are treated poorly by their colleagues who adopt the dominant view: they are called pseudo-scientists, they have trouble getting published, and in general, sociological pressure is brought to bear on them to conform. If this is true (and who can doubt it in light of the sociology of much of the

American Scientific Affiliation in the last several years), then scientists may well be the last people to ask about what counts as science because they are too close to the issue to have the objectivity and perspective needed to make such a judgment. When we couple this insight with the fact that definitions of science are philosophical and historical and not primarily scientific matters, then Bube's own word of caution, with a slight but important twist, actually has an opposite effect from the one he intended:

Until the *appropriate* distinctions are made, the *appropriate* inferences understood, and the *appropriate* applications put into common use, this subject will remain one of confusion for many Christians not trained in the *history and philosophy of science*. *

Notes

¹Larry Laudan, "The Demise of the Demarcation Problem," in *Physics, Philosophy, and Psychoanalysis*, ed. by R. S. Cohen, L. Laudan (Dordrecht, Holland: D. Reidel, 1983), p. 119.

²*Ibid.*, p. 125.

³See J. P. Moreland, "Creation Science and Methodological Naturalism?" in *Man and Creation: Perspectives on Science and Religion*, ed. by Michael Bauman (Hillsdale, MI: Hillsdale College Press, 1993); "Theistic Science and Methodological Naturalism," in *The Creation Hypothesis: Scientific Evidence for a Designer*, ed. by J. P. Moreland (Downers Grove, Ill: InterVarsity Press, forthcoming, 1994), Chapter 1.

⁴Richard DeCharms, "Personal Causation, Agency, and the Self," in *The Book of the Self: Person, Pretext, and Process*, ed. by Polly Young-Eisendrath and James Hill (N. Y.: New York University Press, 1987), p. 18.

⁵John Searle, *The Rediscovery of the Mind* (Cambridge, Mass.: MIT Press, 1992), pp. 3-4.

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)

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R. Clifford & P. Johnson, *Shooting for the Stars: Astrology, Clairvoyance, Reincarnation, Near-Death Experiences*, Albatross

Norman Cohn, *Cosmos, Chaos, and the World to Come: The Ancient Roots of Apocalyptic Faith*, Yale University Press

Ronald L. Ecker, *The Evolutionary Tales*, Northbridge, 1993

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Lonni Erickson, *Creation vs. Evolution: A Comparison*, 1993 edition.

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H. Morris, *Biblical Creationism*, Baker

Roger G. Newton, *What Makes Nature Tick?*, Harvard University Press, 1993

Dennis Overbye, *Lonely Heart of the Cosmos: The Story of the Scientific Quest for the Secret of the Universe*, Harper Collins

Wolfhart Pannenberg, *Toward a Theology of Nature: Essays on Science and Faith*, WJ/JKP, 1993

Walter James Remine, *The Biotic Message: Evolution Versus Message Theory*, St. Paul Science

Al-Ghazali Against Aristotle: An Unforeseen Overture to Science In Eleventh-Century Baghdad

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The year was A.D. 1091, the city was Baghdad, and a thirty-three year-old scholar, whose reputation for Greek learning and religious piety had preceded him, was arriving by caravan from the east. His name was Abu Hamid Muhammad ibn Muhammad al Tusi al-Ghazali. He was born in Persia. He wrote and spoke Arabic. His religion was Islam.¹ And what he wrote during the next four years played a definite, though unforeseen role in the origin of modern science.

One Basic Idea

It would seem far-fetched that our everyday life of computers and DNA and research and all the rest would have anything imaginable to do with one particular person with a strange-sounding name, a name that few non-Muslims today have ever heard of, a person who lived nine centuries ago and in a society completely unlike our own. Ask an average computer specialist today what good the Middle Ages have done for us. After his or her eyes glaze over, the answer probably will be "nothing." In one sense, this is correct. But there is another perspective.

So great is the gulf fixed between the medieval and the modern that we are not even aware that a transformation in thought has occurred, a transformation more revolutionary even than the coming of computers and DNA. What one, basic idea about the natural world most distinguishes our modern age from the medieval? Unless we have taken the time to look into the matter, we would be hard put either to say what this would be — or why knowing would be of interest to anyone. Yet we conduct our everyday lives as though we knew.

The concepts, the ideas that produced modern comforts and inventions, and the tools of thought needed to think about the natural world are all dif-

ferent from those used in the Middle Ages. We do not think about nature the way people did then. The very intellectual furniture of our minds has been changed. Can we say therefore that a connection really exists between the Arab culture of the Middle Ages and the rise of science in the Western Renaissance? Between the vanished culture of eleventh-century Baghdad and the scientific culture of our day?

Of course, we can be sure that thirty-three year-old *Abu Hamid al-Ghazali*, riding his camel down the western slopes of the Zagros Mountains and approaching the Tigris River for the first time, had no such exalted thoughts in his head. He had concerns of his own, and personal objectives that were specific to his own time. Still, if we could have joined *Abu Hamid's* caravan arriving from Persia and followed him through the next four years we could have discovered an outlook on life and habits of thought to which many readers of this journal might respond. There's a certain parallel between his life and ours.

For one thing, he came to Baghdad to take up a teaching job, and apparently he was popular and

This paper was originally delivered in abbreviated form at the Annual convention of the American Scientific Affiliation at Wheaton College in July of 1991. It is an abbreviated version of one chapter of a three-chapter work on the reactions to Aristotle in the Middle Ages of Al-Ghazali, Averroes, and Maimonides.

**Al-Ghazali Against Aristotle:
An Unforeseen Overture to Science in 11th Century Bagdad**

successful, for it is said that he had some three hundred students every year. For another, he was ambitious, and set about to make a name for himself by writing scholarly books. Most important for the purpose of this paper, he did not hesitate to ruffle academic feathers; his Islamic faith prompted him to dispute what the learned were saying about nature, and in so doing he challenged Aristotle, who was the great authority figure of the Middle Ages.

In those days the learned spent a good deal of energy pondering a pair of weighty alternatives: is the world eternal, or did it have a beginning? The people of the Middle Ages had a way of stating a problem with the utmost clarity. This eternity and creation couplet represented the central controversy in which al-Ghazali took part. The main subject was Aristotelian thought, which was the orthodoxy of the day. Against this orthodoxy, with its claim that the world was eternal, was arrayed the monotheism of Judaism, Christianity, and Islam, which proclaimed that the world was created.

For several centuries, learned Jews, Christians, and Muslims followed Aristotelian philosophy, and they also followed biblical and qur'anic precepts. As a consequence of their monotheism they wrestled with the two alternatives, eternity and creation. Al-Ghazali was a lively participant in this debate during the last decade of the eleventh century. The aim of the learned of all three faiths was to get at the real Aristotle and to maintain their respective theological orthodoxies. As a result, a lively ferment of ideas nurtured the rise of western civilization. Moreover, the unforeseen outcome of this debate determined the possibility of science as we know it. Whether the world was regarded as eternal or created determined whether one day we could access computers and DNA.

In other words, if the world is eternal, as Aristotle had declared, then everything we observe in nature is logical and "fixed," and determined from all eternity to be as it is observed to be, nothing new can

ever occur in nature, and in consequence, science as we know it could never have been possible. On the other hand, if the world had a beginning, as revealed in both the Bible and the Qur'an, then something new might occur, and therefore we cannot be sure of what nature is like unless we go out and investigate. Centuries were required for the learned to get it into their heads that the world was not eternal, but had a beginning, and the process of working though the implications of the concept of creation resulted in a transformation of thought that gave rise to modern science.²

This creation and eternity couplet has reminded me of the present-day couplet of "scientific creationism" versus evolution. But any supposed parallel quickly breaks down. People are no longer worried about whether the world is eternal, I take it, and the other member of the medieval couplet is stated today with rather less clarity, I sometimes think, in that "scientific creationism" is more often than not confused with "creation." I should make my own position clear straightaway: "scientific creationism," that we hear so much about these days and which is sometimes called "creation science," "special creation," or simply "creationism," has descended from the biological concept of "special creation" that was invented in the eighteenth century. "Scientific creationism" can only be confrontational, divisive within churches, and an obstacle to science education; it is not scientific, and, most important, it has nothing whatever to do with the Judeo-Christian-Islamic doctrine of creation. What interests me here is the basic idea that made science possible, and that was the theological concept of "creation."³

Purpose

All of the above is by way of coming to the point of this essay. I wish to bring out al-Ghazali's Islamic view of creation (*khalqun*), and examine how he opposed Aristotelian eternity (*abadi*); hence my title,



The author, a historian of science, was given his start among cows and chickens on a Michigan farm. His B.S. is from Wheaton College, his M.S. from the University of Minnesota, and his doctorate in the history of science and medicine from Yale University. He has twice sojourned abroad, in the Middle East and with UNESCO in West Africa, and visited the cities and lands referred to here, as a prologue to voyaging on the seas of thought. As an educator he has promoted the Biological Sciences Curriculum Study and opposed the introduction into the public schools of "scientific creationism" as inimical to theological orthodoxy and sound science. He has supported the teaching of evolutionary theory as an extension of the doctrine of creation. He has helped to organize symposia on Lake Michigan ecology, on AIDS, and, to mark the Darwin centenary, on creationism in American culture. He has published numerous articles on the history of science, though he is now in want of publishers for two finished volumes on the Voyages of James Cook and an edited volume on Evolution, Religion and Society. He has been cited in Who's Who in the Midwest in 1974 and 1994. He credits a generous providence for an ideal past and a vigorous, though harried present.

"Al-Ghazali Against Aristotle." Al-Ghazali was not concerned with the foundations of science, as some of us are today, although he certainly was interested in the logical foundations of knowledge (*'ilm*, or *falsafa*) in general. The word "science" was unknown; it did not come into its present-day use until about the mid-nineteenth century.⁴ His intention was to interpret Aristotle correctly and to strengthen Islamic faith among his contemporaries. But the unforeseen result was to help modify and weaken Aristotelian thought; hence my subtitle "An Unforeseen Overture to Science..." It was the overthrow of Aristotelian eternity and the establishment of the concept that the world had a beginning that made modern science possible. He played a leading role in that transformation of thought.

Now, it cannot be expected that among readers of this journal "al-Ghazali" would be a household name as well known, for instance, as the name "Darwin." On the other hand, we might expect his name to enjoy more familiarity among the almost one billion of the Earth's inhabitants who are Muslim.⁵ It seems to be more the case, at any rate, along Kedzie Avenue in Chicago, where you will find shopkeepers who have settled there from Cairo and Ramallah and Nineveh. In a recent informal poll conducted by a regular customer, the transplanted shopkeepers did recognize al-Ghazali's name, although they were not exactly sure why he is sometimes called "the proof of Islam" (*hujjat al-Islam*).⁶ There was one question the poll-taker did not venture to ask, however. He wondered how, in their opinion, did al-Ghazali contribute to the coming of computers and DNA, but decided against the query, suspecting that they would have had no more idea of that sequence than our average computer specialist had of any benefits we have received from the Middle ages.

In Al-Ghazali's Baghdad

So let us return to that caravan coming from the Persian desert, and follow the thoughts of one person. He was learned and deeply religious, and was coming to take up a teaching job during the last decade of the eleventh century in medieval Baghdad. He promptly entered the controversy over whether the world is eternal or created. Let us observe this particular Muslim scholar and find out what kind of a place he was going to and see what he had to say.

An academic sinecure awaited Abu Hamid al-Ghazali. His learning and piety had already come to the notice of the powerful *Nizam al-Mulk*, who was the vizier, or minister of state, of the reigning

Seljuk Turks. This Seljuk vizier was an enlightened public figure in Persian society and a patron of learning; he wrote a treatise on good government, established academies of advanced education, instigated calendar reform, and lavished public funds on teachers and poets. He had hired al-Ghazali to teach theology and uphold Sunni orthodoxy at a handsome new seminary he had established, in the city of Baghdad. It was the most influential of all his academies.⁷ The seminary, called the Nizamiyyah College and named after himself, had a considerable endowment that provided room, board, and tuition for the students and salaries for the teachers. It is well that he made these provisions, inasmuch as he was assassinated the year after al-Ghazali's arrival. The Nizam had established this particular seminary on the east bank of the Tigris River in about the year 1067; it antedated by almost a century the earliest university in Europe.⁸

There at the Nizamiyyah al-Ghazali made his mark. At ease in Arabic and Persian, he was a prolific writer and most probably an effective teacher. Before long he outshone his colleagues and grew popular far outside his classroom. A letter arrived one day from the Berber monarch in distant Morocco, one *Yusuf ibn Tashfin*, soliciting the legal expertise of the famous Persian newcomer in Baghdad. It is clear, however, that if he were in higher education today he would not get far. For one thing, he believed that education should not only advance knowledge but also strengthen moral character. For another, he believed that theological precepts have a proper role in the organization of knowledge. Moreover, it was his robust theism that prompted him to mount a vigorous critique of Aristotelian thought. What he had to say is worth noticing whenever we examine the origins of modern science.

In order to understand why this bilingual Persian could master Aristotle in Arabic, apparently even before his arrival in Baghdad, and why his writings can now be seen to have a place in the origins of modern science, it is well to understand that he was entering a cultural setting that was very old. Baghdad had already waxed and waned as a center of commerce, government, and learning for some four centuries when he came to town. A rich cultural heritage was the background and support for his achievement.

Al-Ghazali's Baghdad was a city of some one million souls and the capital of the long-lived 'Abbasid Caliphate. This government was founded in A.D. 749 by *Abu-al-'Abbas*, who was descended from an uncle of the Prophet Muhammad, and who took the title of "Caliph" (*khalifa*), meaning representative of God (*Allah*) on Earth. The Caliphate brought high

civilization to wide-ranging lands and peoples and lasted until A.D. 1258 when the Mongols sacked Bagdad. But in the late eleventh century the 'Abasids were at the perigee of Muslim influence.⁹ Although the Arabs had long since securely planted Islam all the way to the Atlantic and as far east as the Himalayas, the once-glittering empire had been splitting into sundry dynasties and schisms. Strong medicine was needed. This was being administered by the invading Seljuk Turks, who had been in control of Bagdad for some thirty-six years when al-Ghazali arrived.

They were a vigorous lot, the Seljuks. Their forebears were tough nomads on the steppes of Central Asia, in Turkestan. Appearing in the eleventh century, they had swarmed in on horseback. They planted their feet on the necks of the Sunni Arabs, whose religion and urban ways they quickly absorbed, they gained prominence under the illustrious Nizam al-Mulk, and already they were aiming themselves at Constantinople.¹⁰ With the Seljuks and al-Ghazali, who himself was a product of Seljuk education, religious Islam gained ascendancy and for a brief interval brought rejuvenation to the distracted realm.

The Golden Age of Islam

As with many Arabs today, it was to the past that al-Ghazali gazed with pride. Three centuries before his time, the 'Abbasid Caliph *Harun al-Rashid*, who was the contemporary of the Emperor Charlemagne and who is celebrated in the *Thousand and One Nights*, first recognized the value of translating Greek manuscripts into Arabic. Harun al-Rashid opened the way for the establishment and expansion of Arab learning.

Al-Ghazali could look back with particular pride to the reign of Rashid's son and successor, the Caliph *al-Ma'mun*, under whose administration Greek science and mathematics were embraced. When Aristotle appeared to al-Ma'mun in a dream with the assurance that reason and religion were closely related, al-Ma'mun knew what that meant: Allah wanted him to make Greek learning available in Arabic, and to be quick about it. The enlightened al-Ma'mun therefore threw himself heart and soul into the project.¹¹

Al-Ma'mun dispatched his agents near and far to collect manuscripts, from monasteries in Mesopotamia and Asia Minor, from private collections in Constantinople. In A.D. 830 he established a translation center in Bagdad. This "House of Wisdom,"

as it was called, also included a library and possibly an astronomical observatory. A number of fine libraries, in fact, graced Bagdad during the 'Abassid age, and the many who came to learn undoubtedly turned them into busy places.¹²

An especially talented learner and teacher during those uncommon years was the brilliant mathematician named *Muhammad ibn-Musa al-Khwarizmi*. He was probably about age thirty when he had the good fortune to fall under the notice of the Caliph al-Ma'mun, who put him on the public payroll at the House of Wisdom. Al-Khwarizmi, for his part, was careful to dedicate several of his books to the Caliph. He wrote treatises in astronomy and mathematics, on the astrolabe, the Jewish calendar, and geography, but he is regarded chiefly as one of the founders of algebra. The term itself is derived from the title of his book, *Al-jabr wa'l-muqabala*, which I translate simply as "study of equations" instead of the more literal "restoration and balancing." He developed it in part from Babylonian, Hindu, and Greek sources. Its Latin translation, the *Liber algebrae et almucabala*, helped to introduce algebra into Europe.¹³ At any rate, the not-old and ambitious al-Khwarizmi would repair to the House of Wisdom library of an afternoon, and there, with a comfortable living assured from the 'Abbasid treasury, he could read in peace and work on his astronomical tables and his second-degree quadratic equations, which, incidentally, he wrote without using any symbols.

The Nestorians

The Caliph al-Ma'mun also hired talented Nestorian Christians who were fluent in Arabic, Greek, and Syriac and installed them in his House of Wisdom.¹⁴ They waxed rich by translating for him. Nestorian Christians of the ninth century became the bridge between Islam and Hellenism, and because of their expertise Greek science reached the West. Under Nestorian Christian hands, the works of Aristotle, including the *Categories*, *Generation and Corruption*, the *Heavens*, the *Physics*, *History of Animals*, the *Metaphysics*; and in addition, the works of Euclid, Galen, Hippocrates, and Ptolemy all were rendered into Arabic at the behest of the Muslim government.¹⁵

A leading administrator of the translating enterprise was named *Hunain ibn Ishaq*, a Nestorian Christian. He did much of the translating work himself from Greek to Arabic, with Syriac as a probable intermediate step. He also supervised the other translators, who included Jews, Muslims, and Sabians, and his expertise earned him much wealth and prestige among the Arabs. Detailed records of the

time describe how the work was done, where the translators came from, their recruitment, salaries, and high standing in the Muslim government.¹⁶ All of this transpired two hundred years *before* al-Ghazali came to Baghdad.

As a consequence of al-Ma'mun's policy, the accomplishments of the Greeks were made available to the learned of the Arab world. By the last quarter of the ninth century, the translating was essentially complete, most of it done in Baghdad, the opulent capital of the 'Abassid Caliphate in the East. At a time when Charlemagne was only beginning to learn how to write his own name, al-Rashid, al-Ma'mun and the learned of the Arab world were exploring and promoting Greek philosophy and science.

The Caliph al-Ma'mun was very interested in astronomy as a means of solving practical problems in Islamic life, say, for determining the correct time for prayer. He hired the best astronomers of the day, and set them to checking the results obtained by Ptolemy, the great astronomer-mathematician of antiquity. They rechecked his calculations concerning the length of the solar year, obliquity of the ecliptic, precession of the equinoxes, and the like. About the year A.D. 822 al-Ma'mun's wide-ranging interests prompted him to send his astronomers to a site, said to have been at Tudmor, which is now Palmyra, in Syria, to determine the length of one degree along the north-south meridian. Since it has been common knowledge since antiquity that the Earth is round, they planned to use this measurement to calculate the circumference of the Earth.¹⁷

This was the "Golden Age" of the Arabs, which lasted approximately from the middle of the ninth century to the time of 'Umar al-Khayyam at the end of the eleventh. During this period, the translations became the foundation not only for Arabic originality in mathematics, medicine, and science, but also for the flowering of Islamic theology.¹⁸ Muslim philosophers and theologians were dazzled by Aristotle. But they quickly noticed that their Arabic translations of Aristotle seemed to contradict the Qur'an, and this brings me to the reason for al-Ghazali's annoyance with the opinions of the learned elite.

Aristotelianism and Monotheism

Two schools of thought contended for supremacy in accommodating Islam to Aristotelian thought. That is, two different groups of Muslim theologians and philosophers developed contrasting qur'anic interpretations of Aristotle. The first heralded reason in the Greek tradition, holding that Aristotle and Muhammad were both right.¹⁹ Avicenna, who was

celebrated in the Latin West as a philosopher and physician, held this view. In the second school of thought, and also as a reaction to the first, Aristotelianism was respected but was subordinated to orthodox Islamic theology.²⁰ The most important exponent of this position was al-Ghazali.

What had happened was this. In not many decades after Muhammad's death in A.D. 632, the tongue of the Arabian desert had become the idiom of the learned. Now, the questions that concerned the philosophers and theologians of that time — especially in the language they used in treating the nature of God and the world — are often thought today to be obsolete, and it may be of some surprise that anyone who spoke Arabic would have been concerned at all. At any rate, from the Atlantic seaboard east to the Nile and the Euphrates and Tigris, and well beyond to the flood plains of the Oxus and the Indus, the learned among Jews, Christians, and Muslims alike found themselves bound together by their common monotheism and by what they regarded as their common allegiance to their Greek masters.²¹

The Incoherence of the Philosophers

What worried al-Ghazali, however, was that far too many people were falling under the spell of philosophers who were putting out altogether wrong ideas about Aristotle. They had all left the faith of their fathers and were following false doctrines. While upholding Greek doctrine, he blamed the philosophers, who were misleading the faithful by elevating human reason. In his opinion, human reason when unaided by revelation only led to unbelief.

In choosing the title for his book — *The Incoherence of the Philosophers* (*Al-Tahafut al-Falasifa*) — he lost no time in declaring what he thought of the prevailing champions of Greek thought.²² This book is not light reading. Al-Ghazali expounded his views in tightly-reasoned prose that displays his mastery of Aristotelian logic and his facility with the technical vocabulary of philosophy and theology. The translation from the Arabic by the orientalist Simon van den Bergh is a splendid contribution to the literature of the Middle Ages and prompts a new appreciation of how deep are the wellsprings of our western heritage. And we can easily surmise from the *Incoherence of the Philosophers* that al-Ghazali found in the Arabic language a supple and versatile instrument for expressing complex and highly abstract ideas.

The chief culprit among those who were incoherent was *Abu-'Ali al-Husayn ibn Sina*, or Avicenna,

as he came to be known in the West. A native of a village near the city of Bukhara in what is now Turkestan, ibn Sina was the great tenth and early eleventh century Persian physician and philosopher, whose encyclopedic *Canon of Medicine* influenced the practice of medicine both in the Middle East and in Europe for many centuries.²³ Al-Ghazali was never timid in singling out his great predecessor, who he claimed was misleading the faithful by means of an altogether undue reliance on Aristotle.

Throughout his *Incoherence of the Philosophers*, in fact, al-Ghazali defended faith in Allah, but simultaneously he revered Aristotle, and cited with admiration four of his works, the *Generation and Corruption*, the *Heavens*, the *History of Animals*, and the *Physics*. He ratified his admiration of these works by invoking the Qur'an: "The Holy Law does not ask one to contest and refute them."²⁴ Like almost all the learned of the Middle Ages, he remained securely within the embrace of Aristotle. But time and again we find him becoming obliged by his Islamic faith to seek release from some of Aristotelian thought.

In al-Ghazali's opinion, ibn Sina was incoherent because he failed to recognize the numerous contradictions and inconsistencies between Aristotelianism and Islam. Pious and learned Muslims who followed ibn Sina into false teaching, he felt, therefore encountered these troublesome obstacles to faith, especially to their belief in creation. I analyze his views concerning creation according to the following overlapping topics: (a) divine creation, (b) divine essence, and (c) the divine will, as follows.

Divine Creation

First of all, the learned knew perfectly well that Aristotle had declared the world to be eternal; they had read this often enough in the *Physics*, the *Heavens*, and also in the *Metaphysics*. Aristotle in fact had based his argument for the existence of the Unmoved Mover, or God, on the premise of the eternality of celestial motion.²⁵

Christians, Jews, and Muslims, gazing at the night sky, could not fail to be impressed by this Aristotelian argument. The wheeling both of the stars and also of the wandering stars, as the planets were called, seemed indeed to bear out Aristotle's unequivocal declaration, in the *Heavens*, that "the heaven as a whole neither came into being nor admits of destruction, but is one and eternal, with no end or beginning of its duration."²⁶ But as monotheists, they shared a common faith in creation.

And so it was that many of the learned grew skeptical, and joined reason with faith to argue instead from the premise of the temporality of the world; life was fleeting and earthly goods finite and transitory. With al-Ghazali, what is important to keep in mind is that theological arguments drawn from Islamic monotheism called into question the core of Aristotelian thought.

The Muslim philosophers, who followed ibn Sina in embracing Aristotelian eternality, also believed, with al-Ghazali, that the world (*al-samw wa-l-'ard*, or *l-konun*) was created by Allah. Now, if the world were eternal, he wanted to know, how could it have been created? In their zeal to embrace Aristotelian thought, he complained, ibn Sina and his Muslim admirers had not really proved that the world was eternal.

They say that the world is caused, and that its cause is without beginning or end, and that this applies both to the effect and to the cause, and that, if the cause does not change, the effect cannot change either; upon this they build their proof of the impossibility of its beginning.²⁷

He asked repeatedly whether there could be any causal *nexus* at all between an eternal unchangeable God and an eternal changing world. His answer was no; his main theme in fact was the logical contradiction he saw in the concept of eternal creation.

For two centuries after Muhammad, creation meant, generally speaking, "out of nothing." Then, with the advent of the Arabic translations of Greek manuscripts, those who read the Qur'an began to see that creation might also mean not only from nothing, but also from a preexistent something. But if that were the case, was that preexistent something a pre-world matter? If so, this view would be consonant with what Aristotle had said.

Moreover, the Neoplatonists had developed a complete and influential view of reality. The cosmos was an array of spheres of being that issued continuously from God, who was often expressed metaphysically as the "Necessary Existent" or the "First Principle," and the spheres descended hierarchically to the sublunar level. Did the world therefore issue eternally from the eternal and inexhaustible essence (*mahiyyah*) of Allah, as the Neoplatonists were fond of saying?²⁸

On most pages al-Ghazali wrote as though he meant creation from nothing, although he did not use that formula.²⁹ But now and again, when pondering *how* the composite Earth of animals, minerals and vegetables could result from the exertions of the First Principle — that is, when pondering *how*

Allah had created the world — he would resort to the language of Neoplatonic emanations, with heavenly spheres and souls and intellects filling the celestial spaces.

Infinity

In any case, belief in creation meant a problem with Aristotle: either accommodation or opposition.³⁰ It was plain to al-Ghazali that the reasons for creation were far better than for eternity. In his opinion, ordinary observations of the night sky provided a splendid argument for creation. He argued that the continuous revolutions of the planets and stars, far from demonstrating eternal motion, as Aristotle maintained, actually called into question Aristotle's own concept of infinity, which was basic to Aristotle's teaching that the world had no beginning.³¹

In discussing infinity, he put forward an ingenious argument concerning the rotation of the celestial spheres, displaying as he did so his grasp of Aristotelian cosmology and also of Ptolemaic and Arab astronomy.³² One year was required for the Sun to revolve around the Earth, he reminded his readers, twelve years were required for Jupiter, thirty for Saturn, and the firmament itself performed a complete rotation in 36,000 years.³³ He had consulted the Arabic edition of the *Almagest*, Book 7, in which the mathematician Ptolemy had adopted the calculations of Hipparchus, who was the great astronomical observer of antiquity.³⁴

Because the planetary and stellar periods were all different, al-Ghazali reasoned, they must have had a beginning. If Aristotle's assertion were correct that these celestial bodies were eternal, then the infinite number of revolutions of Saturn ought to be equal to the infinite number of revolutions of the fixed stars, when in fact Saturn required thirty years for one revolution and the outer sphere of the fixed stars required 36,000 years.

Now if that were so, reasoned al-Ghazali, Aristotle would have meant that, not only could an infinite number be counted, but one infinite could be larger than another; that is, the infinite revolutions of Saturn would be a thousand times more than the infinite revolutions of the fixed stars.³⁵ But Aristotle had maintained that the infinite could not be counted. Therefore, reasoned al-Ghazali, the world could not be eternal but must have been created. So, here we have the leading theologian of Baghdad and of the eleventh century, this acute student of Aristotle, deploying the declarations of Aristotle himself against Aristotelian eternity and on behalf of an assured theism.³⁶

Actually, this ingenious argument was first put forward by the sixth century Christian thinker, John Philoponus, in his book entitled *Eternity of the World*, which al-Ghazali might have read in Arabic translation.³⁷ In fact, a dozen or so other Muslim theologians thought up variations of this argument in order to oppose Aristotle.³⁸

Time And Space

Al-Ghazali also did not have any hesitation in departing from Aristotle when declaring that time itself was created, and that the will of Allah was responsible. The desert sage was unequivocal:

Time is generated and created, and before it there was no time at all. The meaning of our words that God is prior to the world and to time is: He existed without the world and without time, then He existed and with Him there was the world and there was time.³⁹

Such cool assurance, however, only raised new questions. How was it that we could imagine a "time" preceding the creation of time? How could there have been a "before" when time did not exist? Ordinarily such an intuition would have been an argument for the eternity (*qadam*) of time. He, however, saw no problem at all, and, in the light of his own devout Islamic faith, gave an intriguing example of what he meant:

If we say, for instance, that God existed without Jesus, and then He existed with Jesus, these words contain nothing but, first, the existence of an essence and the non-existence of an essence, then, the existence of two essences, and there is no need to assume here a third essence, namely, time.⁴⁰

Was this devout Muslim referring here to the pre-existence of Jesus? If so, it would only be in keeping with the high place he accorded to Jesus, and indeed with the veneration of Jesus by Islam as a whole.

But what is time? He could not be sure, but agreed with Aristotle in twice saying that time is somehow a measure of motion.⁴¹ Whatever time is, it is relative, he believed, and its subjective character is a consequence of our inability to "imagine the beginning of a thing without something preceding it." Our imagination refuses to believe in the absence of a "real anterior" to the creation. We simply cannot transcend the limits of our finite being. God (*Allah*) alone transcends time.⁴²

Just as a time anterior to the world is an illusion, claimed al-Ghazali, a void space outside the world was also an illusion. Thoughts about time were leading him to thoughts about space. In a sense, the

two categories were commensurable, and in his opinion were related to the human perspective.

There is no difference between temporal extension, which is apprehended as divided through the relation of before and after, and spatial extension, which is apprehended as divided through the relation of high and low.⁴³

What he meant was this: It is entirely possible for us to admit the existence of a beginning with no preceding time, even though, humanly speaking, we cannot visualize such a thing. Likewise, one could also admit, but not visualize, a "highest" point, or boundary, beyond which there was absolutely nothing. In other words, he explained, we cannot imagine the boundary of the world at the outer sphere without imagining something "beyond" it. But when we say there is no "beyond," we do not know what this means, for "it belongs to the illusion of imagination." He had been mulling over what Aristotle had said in the *Physics*, *Heavens*, and the *Categories* about space and the "void."⁴⁴

Having agreed with Aristotle that time is an attribute of motion, he also agreed with Aristotle that extension, or dimension, is an attribute of an object occupying space, and that space itself without extension is unintelligible. Just as the world has no "above" and "below" — in saying this he was departing from Aristotle's teaching again — so it was that "outside" the world is neither occupied nor is it empty space — in this returning to Aristotle's thought.⁴⁵ Al-Ghazali was nothing if not an independent thinker.

Divine Essence

Next, he turned to what both Aristotle and Muhammad had to say about the nature of God — that is, the meaning of the divine essence, and how this was expressed in the divine acts. In other words, was Aristotle's Prime Mover the same as Allah? This was a difficult question for both Christians and Jews. Was Aristotle's Prime Mover the same as the Jehovah of Abraham, Isaac, and Jacob? If so, then the nature of God, to whom one prayed, was of some consequence. And if so, then it followed that nature, that is, the world itself, would be found to have certain characteristics. For the devout among the Muslim learned, the most prominent expression of the divine essence was in the act of creation.

Act of the Agent — Creation and the Creator

The act of creating the world occurred because Allah willed it so, al-Ghazali insisted, and will was

the faculty of differentiating one thing from another. For example, while creating the celestial spheres, God could have chosen any two opposite points on the sphere for the location of the celestial poles; say, on the eighth sphere, which contains the fixed stars; instead of the locations now observed. Any two opposite points would have done as well, he maintained, and "especially the highest sphere, the ninth, which possesses no stars at all," could also revolve on any two other, opposite poles that God could have chosen at the creation.⁴⁶

We should pause for a look at those two spheres that al-Ghazali picked out in order to emphasize the will of God. When he referred to the sphere of the fixed stars and to the ninth sphere, he was reflecting his own considerable knowledge of eleventh-century cosmology. The shape of the celestial orbits was the Aristotelian circle, and the number of the spheres themselves embodied the development of astronomy since antiquity. Arab astronomers of the day had to account for *two* observed motions of the stars, the diurnal and the precessional, and they assumed that the Aristotelian circle, as said, was the path of each of those celestial revolutions. Indeed, the Aristotelian circle was assumed to be the shape of the orbits of the Sun, Moon, and the planets, which they called the wandering stars, the Earth being at the center of the cosmos.

According to this scheme, the revolution of the eighth sphere would explain why the stars are seen nightly to sweep in a circle around the pole star (Polaris), as they certainly do, in this way executing their diurnal motion. And a slow revolution of the ninth sphere, its motion somehow being communicated to the sphere of the fixed stars, which is the eighth sphere, would explain the observed, slow longitudinal drift westward of the stars, that is, the precession of the equinoxes.⁴⁷ This longitudinal drift westward has been calculated to be once in about 36,000 years, and has been known since the time of Hipparchus.

What is important here is neither the Aristotelian influence on al-Ghazali, for he did not dispute the validity of the Aristotelian circle, nor his astronomical misconceptions; those spheres do not exist, and the celestial orbits are not Aristotelian circles. Rather, it is the way his Islamic faith in the will of God shaped his view of the cosmos. Here, in declaring that the world could have been other than it is, he was plainly disagreeing with Aristotelian cosmology, which in the Middle Ages declared that the world could *not* be other than it is. The world was the result of divine choice, not Aristotelian necessity.

Deep in the eleventh century, the Islamic faith of this Aristotelian never wavered:

The world exists, in the way it exists, in its time, with its qualities, and in its space, by the Divine Will, and will is a quality which has the faculty of differentiating one thing from another.⁴⁸

All the same, Aristotle did remain a pervasive influence on his thought. For instance, he marveled at how the "Divine Wisdom" could readily be discerned in the "obliquity of the ecliptic," which, after all, determined the "qualities of things" on Earth. When he wrote those words, he probably had been consulting his Arabic edition of the *Heavens* and also the *Generation and Corruption*, in both of which Aristotle had declared that the annual movement of the Sun along the ecliptic was the cause of all change and becoming on Earth. Nor, indeed, could he have had any reason to depart from Ptolemaic astronomy when he went on to credit the wisdom of Allah for the "wise contrivance of the apogee and the eccentric sphere," both of which he could have read about only in an Arabic edition of the *Almagest*.⁴⁹

Act of the Agent — Did God Have Any Say in the Creation?

The Muslim philosophers — those renegades in Islam, al-Ghazali called them — claimed that the world was the eternal act (*fi'lun*) of Allah (God), who was the agent (*fa'ilun*) in the creation. But in thus casting their lot with Aristotle, they had to admit that Allah was not endowed with either will or choice. They believed that creation flowed from Allah, not by choice, but by necessity; and that agent and act were simultaneous. Al-Ghazali leveled another censure at the ibn Sina faction:

You say that what proceeds from God proceeds in the way of necessity and nature, and that He has no power not to do it, and this too resembles a kind of bondage, and indicates that He is as it were, under necessity as to that which proceeds from Him.⁵⁰

Ibn Sina and the other renegades were devout Muslims, of course, and believed, as did al-Ghazali, that the world stood in relationship to God as effect to cause. But as earnest Aristotelians they conceived that relationship as a necessary connection, one that could not be severed. Ibn Sina, Neoplatonist that he was, had argued that cause and effect were simultaneous with existence.⁵¹ The Earth, moon, sun and planets were emanating eternally from the inexhaustible essence of God. The world being everlasting, the moment therefore never came when God

was not its agent.⁵² It was rather like a shadow and a person, or light and the sun.

Not so, said al-Ghazali. Light and a shadow are only metaphors for effects. Only an act made by choice can be called an act; an agent is a cause that acts by an exercise of the will; and an act implies a will. He was adamant in his opposition to ibn Sina and the other philosophers:

Declare therefore openly that God has no act, so that it becomes clear that your belief is in opposition to the religion of Islam, and do not deceive by saying that God is the maker of the world and that the world is His work, for you use the words, but reject their real sense!⁵³

The word "act" seemed indeed to represent the paper war al-Ghazali was waging against his enemies; it represented the major difference between the Aristotelian and monotheistic views of the world.

What Creation Means

For ibn Sina, act is an eternal process; this means that existence is joined with the agent in a continuous connection. Agent and act are simultaneous. This was the basis for the belief that, since the world is everlasting, the moment never comes when God is not its agent.

For al-Ghazali, representing monotheism's opposition to Aristotelianism, the connection between agent and object meant, on the other hand, a coming into being, and this connection ceased at the transition from non-existence to existence. The act of creation itself produced existence, which meant that the object became separate from the agent; the world, having a temporal existence, was separate from the creator. With this concept of creation came the concept of divine choice: God chose among alternatives — the unforeseen consequence of which was the possibility of science. God's act was a temporal process. For al-Ghazali, the question remained: How therefore could ibn Sina say that an eternal world was God's act?⁵⁴

Lest there be any misunderstanding, the above paragraph cannot be construed as a statement of "creationism," as that term is known today; neither is it anything like a scientific statement. It is a theological affirmation representing the position of Abu Hamid al-Ghazali. As such, it can be regarded as an *assumption* that entered unforeseen and ineluctably into the foundations of modern science during the European Renaissance. Al-Ghazali was *not* an eleventh-century "creationist."

"Oneness" of the Agent — Does God "Know" Everything?

Muslims as well as Christians and Jews, moreover, believed that God is one in eternal essence, and without parts.⁵⁵ This belief implied a distinction between divine and human cognition.

For the learned of the Middle ages, the "oneness" of God promptly raised the question of God's self-knowledge and how God's knowledge of his creation differed from how humans "know" something. For the curious of the twentieth-century, versed in the ways of psychology, this question, while certainly abstruse, is not entirely impractical, for it has a bearing on understanding how the mind constructs knowledge of the external environment. For instance, human cognition has two modes: recognizing an object using the senses, and possessing an idea representing that object. But divine cognition in this respect cannot be assumed to be analogous.

Ibn Sina had developed a position that was consistent with an Aristotelian view of God to deal with the question of how God "knew" something. Wishing to avoid plurality in the essence of God and seeking accommodation with Aristotle, he seemed to say that the First Principle had knowledge only of itself.⁵⁶ Quite possibly Ibn Sina had been pondering Book XII of the *Metaphysics*, in which Aristotle declared that the thoughts of the Unmoved Mover were only of itself, because, in God, "thought and object of thought are the same."⁵⁷ According to Ibn Sina, therefore, God knew himself and the created world in the sense of being conscious of what emanated by necessity from his own essence. What Avicenna might have meant, I think, and what al-Ghazali rejected, is that it was appropriate for an omniscient being to know only general and abstract principles; it was not fitting for the deity to be concerned with the humdrum events in our daily lives. Such an Avicennian view might be consistent with that strange Aristotelian principle found in *Metaphysics* XII.7 of thought thinking itself, that is, of God knowing only his own essence.

Al-Ghazali at once realized that, according to Ibn Sina, Allah could not know anything about the very important people and events described in the Qur'an, such as Moses and Aaron, Joseph in Egypt, and David; it would hardly be fitting for Allah not to be aware of the attempted seduction of Joseph in Egypt (Qur'an, surah 12). He restated Ibn Sina's position. According to it, if God had knowledge of an object in the creation, say, a knowledge of Zaid, this could only mean a duality — that is, knowledge of himself and also knowledge of Zaid — and a duality would compromise the oneness of God.

Al-Ghazali's rejoinder was, "nonsense." He dismissed the notion. At that rate, if "God does not know the individual," he snapped, "he cannot know that Zaid becomes a heretic or a true believer."⁵⁸ Not for him a Prime Mover who could do nothing but contemplate itself; he worshipped a Creator who knew the cares of Zaid and Abdul and Khalid, and even of Fatima. He continued:

Indeed they (the philosophers) make Him lower than any of His creatures, who know themselves and know Him, and he who knows Him and knows himself is of a nobler rank than He is, since He knows none but Himself. Their profound thoughts about God's glory end therefore in a denial of everything that is understood by His greatness, and assimilate the state of God to that of a dead body which has no notion of what happens in the world, with the sole exception that God possesses self-knowledge.⁵⁹

He argued that it should be plain to any decent Muslim that Allah knew not only himself but certainly knew particulars in his own creation.⁶⁰ Is the self-knowledge of God identical with the divine essence? He argued rather that plurality, as it involves God, at any rate, is actually "in the expression used to describe the essence, not in the essence itself."⁶¹

In any case, he insisted, these arguments about plurality in the essence of God are groundless, inasmuch as the heavens themselves displayed abundant evidence that plurality issues from the oneness of God. Why, one needs only to go out and have another look at the night sky to see that this is so. Of course, the sky over eleventh-century Baghdad did not have light pollution; in calling for a look at the stars, he was asking his readers to do something that no twentieth-century city dweller can simply do.

Out of the First Intellect emanated the sphere of the fixed stars, with some thousand and twenty stars. (He was consulting the *Almagest* again.⁶²) The stars came in all shapes and sizes, with other differences in magnitude, position, color, and in different figures, such as a ram, a bull, a lion, and even a man, which al-Ghazali said are strung along the celestial equator.⁶³ He was mistaken when he said equator; he was referring to the zodiac, which is strung along the ecliptic. And he was two stars off when he looked in the *Almagest*, which lists 1,022 stars, not 1,020, as he said. At any rate, a plurality proceeding from the First Intellect could be assumed.

Exactly how all this plurality came from Allah he could not tell. To say that the plurality of 1,020 stars was in the First Intellect certainly was to abandon the oneness of God. On the whole, he had no

wish to give final answers, only to disturb the claims of the philosophers. "Think about God's creation," he exclaimed, "but do not think about God's essence."⁶⁴

Divine Will

Having brought to light contradictions between Aristotelianism and Islam in the Muslim belief in divine creation and the divine nature, al-Ghazali then mounted a critique of Aristotelian causality. Among all of his seventeen discussions, this critique quite possibly has the most direct bearing on understanding the origins of modern science. As usual, his reasoning displays a sophisticated grasp of Aristotelian thought. And as usual throughout his *Tahafut al-Falasifa*, it was his Islamic conception of the divine will that prompted yet another of his analyses of Aristotle's view of the world, resulting this time in a critique of causal relationships in nature.

He realized that if God's will were manifested in acts that were eternal productions of the divine essence, as Aristotle seemed to say, then those acts, including the world itself, could not be voluntary.⁶⁵ That is, the world would be an inevitable consequence of the divine essence. And this would actually mean that, if Aristotle were correct, God actually had no will. Now, if there was one thing that Muslims did *not* believe, it was that Allah had no will.

When al-Ghazali took up this question of causality, it is not altogether clear just what he meant. But it is clear what he said:

The connection between what is usually believed to be a cause and what is believed to be an effect is not a necessary connection; each of two things has its own individuality and is not the other.⁶⁶

That is, he denied that any necessary and logical connection exists between cause and effect.

Eternality and necessity — he knew that, according to Aristotle, the one requires the other. For instance, knowledge of nature therefore "could not be other than it is," according to Aristotle in his *Posterior Analytics*; "the truth obtained by demonstrative knowledge will be necessary." Aristotle is even more outspoken in the *Nicomachean Ethics*:

We all suppose that what we know is not even capable of being otherwise; of things capable of being otherwise we do not know, when they have passed outside our observation, whether they exist or not. Therefore the object of knowledge is of necessity. Therefore it is eternal; for things that are of necessity in the unqualified sense are all eternal.⁶⁷

What this passage means is that in the Aristotelian world all observed events had been established from eternity, so that one event logically followed the other. God exerted no choice — indeed, God could not have.

Ibn Sina and other Muslim philosophers who sided with Aristotle in this matter had argued that causal connections in nature were both logical and necessary.⁶⁸ In other words, ibn Sina's world, like Aristotle's, was fixed; its events were made necessary by the eternal and unchanging essence of God, and its events could not be otherwise than they were observed to be. Anything entirely new in either the celestial or the sublunar world was impossible, since it would thereby intrude upon the immutability, perfection and self-contemplation of the Necessary Being.

But al-Ghazali had his doubts. He wholeheartedly disputed the assertion of the philosophers that,

[the] connection between causes and effects is of logical necessity, and that the existence of the cause without the effect or the effect without the cause is not within the realm of the contingent and possible.⁶⁹

The reason why he took so categorical a stand against this Aristotelian position is primarily because he wished to safeguard the possibility of divine miracles without calling into question the omnipotence of Allah. He felt that Aristotelian necessity would deny the very possibility of divine miracles, of which he cited examples, such as the changing of Moses's rod into a serpent, and the resurrection of the dead. These miracles represented his belief that Allah could impart life to an inanimate object and his belief in the future judgment, beliefs familiar to all Muslims.

Philosophers who considered "the ordinary course of nature a logical necessity," would claim that such miracles were impossible. If Aristotle and ibn Sina were correct, miracles could not occur because they would "interrupt the usual course of nature," and God's free will would be proscribed.⁷⁰

Why Cotton Burns

Al-Ghazali argued instead that each of two apparently related events has its own individuality, and that neither could be a cause or effect of the other. Take the burning of cotton. Why was it, he wanted to know, that philosophers were always insistent that fire caused burning, when the only reason they could give was that the two events always occurred together. No, God was the only agent. God

created the burning, God created the ashes. In fact, God created the knowledge of the burning in the mind of the observer. He explained:

The agent of the burning is God, through His creating the black in the cotton and the disconnection of its parts, and it is God who made the cotton burn and made it ashes either through the intermediary of angels or without intermediation. For fire is a dead body which has no action, and what is the proof that it is an agent? Indeed, the philosophers have no other proof than the observation of the occurrence of the burning, when there is contact with fire, but observation proves only a simultaneity, not a causation, and, in reality, there is no other cause but God.⁷¹

For him, it was not incongruous to reject Aristotelian logical necessity and with the same breath explain himself by means of the Aristotelian four causes, as he does in the above passage. Here we can identify the material cause — the cotton itself; the formal cause — the essence of the flame; the efficient cause — the act of thrusting the cotton into the flame; and the final cause — the entelechy or purpose served by burning the cotton to produce ashes. Besides, the invocation of ministering angels is another reminder that al-Ghazali was no strict empiricist; in the Middle Ages, angels were incorporeal intermediaries which the learned sometimes called "intellects," and which functioned in the *nexus* of the divine and the natural.

The same interpretation al-Ghazali gave to the burning cotton, he maintained, could be applied to all sequential events; the same for all "empirical connections in medicine, astronomy, the sciences, and the crafts"; the same for all cause-effect couplets such as thirst and drinking, sunrise and light, or medicine and health. After all, drinking did not imply the quenching of thirst. The inscrutable will of Allah was the cause of each event; all so-called causes and effects were separate and divinely executed acts of God.

For the connections in these things is based on a prior power of God to create them in a successive order, though not because this connection is necessary in itself and cannot be disjointed.⁷²

Whatever did al-Ghazali mean? By invoking the deity did he deny causality?⁷³ He certainly knew that cotton, when thrust into a flame, would really catch fire. Was he saying that God kept on creating every atom, every instant of time, and even every particle of memory? Or was he saying only that God had created the natural order in which events were observed to follow in sequence? Was his critique of causality a theological barrier inadvertently

erected by Islam to the rise of science?⁷⁴ Or do we find here a pioneering step toward the Western Renaissance?

Al-Ghazali's criticisms against ibn Sina and other like-minded philosophers were unrelenting. It was even impossible for them to prove the existence of God.⁷⁵ Not only that, declared their critic, but their position even led to atheism. If all temporal events inevitably terminated in an eternal, circular movement of causes and effects, then the world required no cause. This is how he summarized the matter:

It is therefore clear that for the man who does not believe in the temporal creation of bodies, there is no foundation for believing in a creator at all.⁷⁶

Epilogue

Having finished his book and after four years of success at the prestigious Nizamiyah College, al-Ghazali quit his job. He gave up the emoluments and perquisites and privileges that, in his day, as in ours, come with academic life. Some say he had a nervous breakdown, others that he experienced an inner, spiritual transformation as thorough as that experienced by Saul of Tarsus on the way to Damascus.⁷⁷ In any event, he did go to Damascus.

About the time that Pope Urban II was exhorting the motley hordes that became the first crusade, al-Ghazali left behind the bookstalls, the palaces, the learned discussions, and the aristocracy of merchants, scholars, and poets, together with the sycophants and assassins to be found in the Baghdad of his day, and, having arranged for the care of his wife and daughters, set his face to the western desert. For a time he sojourned in Damascus, where every day he would enter the Umayyad Mosque to worship.⁷⁸

Medieval Muslims regarded the Umayyad Mosque with its splendid dome and soaring minarets as one of the wonders of the world, and so it must have seemed.⁷⁹ The Arabs deemed a simplicity of line and detail to be fitting and proper for the incorporeal and transcendent Being they worshipped. Indeed, the language of the vaulted space they achieved speaks of eternity that so gripped the medieval mind, and evokes the mystery of God's ways to humankind.

The Umayyad Mosque remains today one of the noblest places of worship to be found anywhere in the world. A western traveler can enter the serene space, kneel in Christian prayer, and with unshod feet walk among the pillars where in the eleventh century al-Ghazali came to pray. Beneath the richly-

carpeted floor is the location of a sacred enclosure where in the first century pagan worshipers entered a temple of Jupiter, which in the fourth century was transformed into the Church of St. John the Baptist, and which in the eighth century made way for the present mosque.⁸⁰ A few remnants of the church have survived. Over the lintel of the south entrance can be seen an inscription in Greek from the Psalms and Hebrews: "Thy kingdom, oh Christ, is an everlasting kingdom, and thy dominion endureth for all generations."⁸¹

Here we are reminded of our debt to the past: the foundation laid by the Greeks, who were our first teachers; the ancient Hebrews, who gave the world monotheism and invented the idea of *creatio ex nihilo*; the cosmopolitan Arabs, who assimilated and transmitted ancient learning; the Christians of the European Middle Ages and Renaissance, who learned from their Greek masters and from their Jewish and Muslim forebears.

After departing Damascus, al-Ghazali visited Hebron, a place of pilgrimage for Muslims, where he paid his respects at the tomb of Abraham and Sarah, which is sacred also to Jews and Christians. He visited Jerusalem, soon to fall into crusader hands, and made the Hajj to Mecca. After some years, he returned to Nishapur, in his native Persia, for more writing and reflection on the timeless issues of faith and reason. It is likely that his route led him past the tomb of ibn Sina, which can be seen today in the city of Hamadan in southwest Iran.

The first sixteen discussions of Al-Ghazali's book, *The Incoherence of the Philosophers*, were translated into Latin in A.D. 1328, in France, as part of the work entitled *Destructio Destructionum*.⁸² Gradually al-Ghazali's views made their mark in the Latin West, although their exact impact in the later Middle Ages and Renaissance is unknown. Thomas Aquinas, who died in A.D. 1274, did not see the *Destructio Destructionum*, although he was introduced to Islamic thought as a teen-age student in Naples, where he had access to Arabic sources.⁸³ An edition of the *Destructio Destructionum* was printed in 1497 in Venice, and was reprinted three times in the sixteenth century in Lyons. A Latin translation, made from a previous Hebrew translation, was printed in Vienna in 1532.⁸⁴ Various Arabic editions were published during subsequent centuries. At last in 1954 there appeared the splendid English translation by the Dutch orientalist, Simon van den Bergh, the edition on which this study was based.⁸⁵ The Nizamiyah College remained in service until the beginning of the sixteenth century, and a surviving portion of a minaret was identified as such in 1939.⁸⁶

It is pertinent here to notice the flexibility of Islam with respect to the doctrine of creation. Thus we have the striking contrast of al-Ghazali and ibn Sina, both of whom considered themselves to represent the correct interpretation of both the Qur'an and Aristotelian thought. In addition, both were considered by their peers to be good Muslims, which, of course, they were.

Al-Ghazali and the Origins of Science

Among the blessings that come from living in the West may be included the fact that the tides of history surged west, from Baghdad and Cairo, to Salerno, to Toledo, to the cathedral schools of France. Indeed, the question remains whether the Renaissance might have been delayed or even aborted had not the western mind been quickened by contact with the Muslim Middle East.

Biological evolution, that is, the origin of diversity from simpler forms, was utterly inconceivable in the Aristotelian world; as inconceivable as it would have been for an eleventh century astronomer to reject the Aristotelian circle in describing the revolutions of the celestial bodies. Changes could occur, yes, but only as an actualization of an already existing potentiality; that is, by a bringing forth of what was already there. But novelty, something entirely new, such as a brand-new species or phylum, was not conceivable. The theory of biological evolution emerged at last in the eighteenth century; it required chance, contingency, linear time, and non-repeatable change, all provided by a created world, all, in varying degree, to be found within the conceptual orientation provided by the three monotheistic religions.⁸⁷

The place of al-Ghazali in the rise of modern science is distinct and of consequence. It lies in his opposition to major portions of Aristotelian thought by means of his theistic affirmation of creation. For him, creation meant a coming into being; the creation was an expression of the divine will. For him, coming into being meant that the creation was separate from the Creator. By his affirmation of creation and rejection of eternity he helped to lodge an ineluctable doubt at the heart of Aristotelian thought.

This affirmation, invented by the Maccabees in about 63 B. C., was taken up by Islam from Judaism and Christianity and was applied against Aristotle. Thus transformed, this affirmation of faith was bequeathed by Islam to Christianity in the later Middle Ages, to become integral to the rise of science during

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the Renaissance.⁸⁸ Thus we see that in al-Ghazali, the Islamic opposition to Aristotle in effect preceded the opposition mounted by Christian theology.⁸⁹

When the shadows began to lengthen, Abu Hamid al-Ghazali set out once again across the desert, not far this time, to his childhood home in northeastern Persia, whence his pilgrimage began. In A.D. 1111, in his native village of Ghazaleh, near the city of Meshed, with his brother and a few students at his side, he died, and was buried near the grave of the Persian poet Firdausi and not far from the tomb of the 'Abassid Caliph, Harun al-Rashid.

In the influence of his philosophy on Islamic theology, he completed the structure of Sunni orthodoxy that has prevailed throughout much of the Muslim world to this day.⁹⁰ In the influence of his religious experience on his readers he has been compared with Augustine. Al-Ghazali became an appealing figure in the West; his much admired spiritual pilgrimage from erudition to mysticism mirrored a painful choice between reason and faith.⁹¹ Whether in the last decade of the eleventh century or the last decade of the twentieth, al-Ghazali's life resonates with the tension that divides the obedience of faith from the logic of secularism.

The greatest theologian of Islam, the Muslim closest to being a Christian — such are the accolades that thoughtful students of Arab history are wont to heap on this remarkable and intense figure.⁹² He was an Aristotelian. But he was possessed of the conviction that even though he was not *from* eternity, that his *destiny* was eternal. Above all, he was a Muslim, one who strives and submits; a follower of Islam, the religion of submission. For him, the god of the philosophers was not the God of the Qur'an.

Throughout his life he strove to express the meaning of the Muslim confession: "*La Ilaha illa Allah — There is no God but God.*" Perhaps we might agree with Kenneth Cragg, Arabist and Christian friend of Islam, who allowed that, in the end, al-Ghazali might have achieved the cry of the one who was called the Friend of God: "Whom have I in heaven save thee?"⁹³

Who of us can say this Muslim seeker did not succeed? *

Acknowledgments

I was introduced to Islam and to the riches of the Arabic science and culture of the Middle Ages by Edwin and Eleanor Calverley, long-time Presbyterian mission-

aries in Kuwait. Dr. Edwin E. Calverley was a Arabist, clergyman, and student and translator of al-Ghazali. Mrs. Eleanor Calverley, M.D., was a specialist in ophthalmology.⁹⁴ In September of 1954 I had come to teach biology at the American University in Cairo. We were sitting at the Astra Cafe, across the street from the University, when the scales commenced to fall from my eyes as they cheerfully traced out for me on a paper napkin the Arabic letters for Astra that I noticed in a nearby neon sign, and where from them I first heard utterance of al-Ghazali. Cherished friends in the years that followed and indulgent observers of my Arabic studies, they were a link for me with the days of two once-celebrated Arabists in Cairo, the historian of medicine, Max Meyerhof, and the Christian missionary, Samuel Zwemer, and with the former Emir of Kuwait, a link indeed with the household of Islam of the past.

I am also grateful to Don and Tex Swanjard, long-time friends, Arabists and sojourners in Kuwait City and Baghdad, who are for me a link with the present-day *dar al-Islam*. Because of them, I need only make a long distance call to be brought up-to-date on a puzzling point in Arab history or get help running to ground a needed citation. In addition, James R. Moore has often given me valuable insights and comments concerning this project. Marjorie Behringer has also provided encouragement on numerous occasions. I am also grateful to Atiah Althobaity; David J. Barlow; Keith Lencho; Frank E. Miller; Ali Reza, MD; and Amir Sanati, MD, and Sister Mary Stephenette for their comments on matters both syntactical and Islamic.

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From first to last I should have been nowhere without the splendid translation by the orientalist Simon van den Bergh of Averroes' *Tahafut al-Tahafut*, which contains major sections of al-Ghazali's *Incoherence of the Philosophers* and also extensive footnotes, and which provided many contented hours during the last ten years or so, making this study possible.

Notes

¹For the background of al-Ghazali's life and thought I have consulted Cragg, 1956; Diyab, in Young, 1990; Faris, 1985; Hitti, 1971 (1968); MacDonald, 1899; Marmura, 1992; Rosenthal, 1962; Watt, 1963; 1985 (1962); and Zwemer, 1920. I follow Hitti and the *Encyclopaedia of Islam* for the spelling of his name, and for transliterations throughout. See also MacDonald, 1902.

²It would appear that the human head has resisted the notion that the world had a beginning even until relatively recent years, at least within the scientific community. In the year

1931 the astrophysicist Sir Arthur Eddington confessed: "Philosophically, the notion of a beginning of the present order of Nature is repugnant to me. I am simply stating the dilemma to which our present fundamental conception of physical law leads us. I see no way around it; but whether future developments of science will find an escape I cannot predict." From an address reprinted by Shapley, 1950, p. 361. The "Big Bang" offered no escape from Eddington's dilemma.³ See Aulie, 1972; 1974-75; 1982; 1983.

⁴*Oxford English Dictionary*, 1933, Vol. 9, p. 222; in 1857 and 1867. The term "natural philosophy" was used in the 17th and 18th centuries.

⁵The number of Muslims worldwide: 950,726,000; *World Almanac*, 1993, p. 718.

⁶Marmura, 1992, p. 206.

⁷Much is known about the Nizamiyah College. The definitive study seems to be Talas, 1939. See also Dodge, 1963; Makdisi, 1961; Le Strange, 1900; and note 83 below. The "Sunni" (meaning model or path) is the larger of the two population divisions of Islam, and recognizes the first four *caliphs* (successors) — Abu-Bakr, 'Umar, 'Uthman, and 'Ali — as the legitimate successors of Muhammad. The other, the "Shi'ah" (meaning "party of 'Ali"), repudiated the first three caliphs, and instead recognized 'Ali, Muhammad's son-in-law, as the sole legitimate caliph after Muhammad's death, and, as did Sunni Islam, developed its own legal and religious doctrines.

⁸Students at Balogna were first granted special rights in A.D. 1158.

⁹In the Qur'an David has the title of *khalifa*; see 38.27. Baghdad was founded as the so-called "Round City" in A.D. 762 by the Caliph Al-Mansur, after the fall of the Umayyad dynasty in A.D. 749 (see note 78 below). On the 'Abassid Caliphate, see Hitti, 1956, *passim*; Hourani, 1990, *passim*; Saliba, 1988; and Sourdel, 1970. Much is known about the city during the heyday of the 'Abbasids — its founding, dimensions, population, neighborhoods, and the like; and early maps have survived. The name Baghdad is pre-Islamic and Iranian, and means "given by God, the gift of God." See Duri, 1960, which contains an extensive bibliography; Le Strange, 1900, 1900a; Lassner, 1970; and the rather good Wiet, 1971. For a splendid 18th-century description and with a city map, see Niebuhr, 1776-1780.

¹⁰The Seljuks entered Baghdad in A.D. 1055; Leiser, 1988, p. 42. For a summary of the Seljuks, see also Hitti, 1956 (1937), p. 473-479; and Spuler, 1970, I, p. 143-171.

¹¹The dream story has a reputable lineage in the Arabic literature Hitti, 1956 (1937), p. 310; Elgood, 1951, p. 103; and Nicholson, 1956, p. 359. A fine interpretation of this remarkable leader is "Al-Ma'mun: Radical Caliph and Intellectual Awakener of Islam," in Hitti, 1971 (1968), p. 76-94.

¹²Mackenson, 1932; Makdisi, 1961.

¹³Bosworth, 1963; Rosen, 1986; Karpinski, 1915; Hitti 1956 (1937), p. 379-380; Gandz, 1926; Toomer, 1973; and for a lucid analysis of the *al-jabr*, see Boyer, 1985 (1968), p. 251-258. The full title of his algebra is *Al-Kitab al-Mukhtasar fi hisab al jabr wa'l-muqabala* (*The Compendious Book on Calculation by Completion and Balancing*). Astrolabe: an astronomical instrument once used to determine altitudes of celestial bodies.

¹⁴For the Nestorian Christians, see Wolfson, 1970 (1956), p. 451-463; Griffith, in Elwell, 1984; and Vine, 1937.

¹⁵See Anawati and Iskandar, 1978; Meyerhof, 1936; and Saliba, 1989.

¹⁶Hunain ibn Ishaq wrote the first textbook of ophthalmology; see Meyerhof, 1928. See also; Fakhry, Majid, 1983 (1970), p. 10, 12; Elgood, 1951, p. 70, 75, 89, 100, 267-269; Hitti, 1956 (1937), p. 313-364; Meyerhof, 1944, and O'Leary, 1957 (1949).

¹⁷Al-Ma'mun might have said to himself, "After all, Eratosthenes had calculated the circumference of the Earth a thousand years before," so why shouldn't he? Two important astronomical instruments were available to him — the quadrant and the astrolabe. A member of his staff, 'Ali al-Asturlabi, wrote a

treatise on the astrolabe (see Hartner, 1960). About that time, the astronomer Muhammad ibn-Jabir al-Battani found the inclination of the plane of the ecliptic to the celestial equator to be 23°33'; the obliquity, which is undergoing slight change, is taken today to be 23°27', so the Arab calculations were not too bad. See Sarton, 1927, I, p. 558, Asturlabi p. 566. O'Leary, 1957 (1949), in a discussion of al-Ma'mun, says the observations occurred near Mosul and also near Damascus; p. 163. See also Dreyer, 1953 (1905), p. 249, 250, 278; Hitti, 1956 (1937), p. 374-375; and Saliba, 1982.

¹⁸Since Islamic theology is my primary emphasis in this study, Arab mathematics, medicine, and science must remain beyond the scope of this short paper, except for my brief digressions on algebra and astronomy. In this context, I use "Arab" generically to mean those who spoke and wrote Arabic, who lived under Muslim rule, and who included Arabs, Persians, Muslims, Jews, Christians, Sabians, Zoroastrians, and assorted Moon-worshippers. Sometimes "Muslim" is also used in this generic sense. For a survey of the sciences, see Goldstein, 1988, Chapter 4, "The Gift of Islam." Hitti, 1956 (1937), Chapter 27, "Scientific and Literary Progress"; the Hitti remains an invaluable source of detailed information. The recent Hourani, 1990, is a masterful complement to, but does not supersede, the Hitti 1956 (1937). Also reliable are Max Meyerhof, "Science and Medicine," in Arnold and Guillaume, editors, 1960 (1931); Browne, 1985 (1962, 1921); Jurji, in Faris, 1985 (1944), and Elgood, 1951; the title, *A Medical History of Persia*, means the strong Persian influence, though primarily under the government of the 'Abbasid Caliphate in Baghdad (ca. A.D. 750-1258). For mathematics Boyer, 1985 (1968), Chapter 13, "The Arabic Hegemony"; Hill, 1915; and Karpinski, 1915. To find out who was who among Jews in Arabic mathematics, medicine, and science, one might start with George Sarton, 1927, I, p. 543-788, 587-588, *passim*. Eban, 1984 (1968), Chapter 11, "The Age of Islam"; in this period, "the Jews not only retained their ancestral creed but gained new strength in the lands of the Moslem conquest"; p. 132. Two views on why modern science did not begin among the Arabs see Sarton, 1927, I, p. 746-748; and Jaki, 1974, Chapter 9, "Delay in Detour."

¹⁹In this sentence I refer to the "Mu'tazilites," who were among the first Arab thinkers to embrace Hellenism and Aristotelianism. Their school of thought began in the city of Basra, in what is now southern Iraq, in the early decades of the eighth century A.D. How then, one might ask, did they learn about Aristotle a full century before the first Greek manuscript was translated into Arabic? I don't know. One of their leaders, a certain Wasil ibn 'Ata, withdrew from participating in a theological dispute to form a group of his own, hence the name of the creed, "al-Mu'tazilah," meaning withdrawal. The dispute concerned the question of whether a Muslim who was an especially heinous sinner could still be a Muslim. The Mu'tazilites emphasized the oneness of Allah, denied that God had attributes and that the Qur'an was eternal, and developed strong views about divine justice and free will. A hundred years later, the 'Abbasid caliph al-Ma'mun raised this creed to a state religion (a period, in approximately A.D. 833-850, sometimes called the 'inquisition') and proclaimed that the Qur'an was created; the effect was to draw more political power to those who could properly interpret the Qur'an, namely himself and the 'ulema, or religious leaders, who were under his control. If the Qur'an were represented as uncreated, and hence eternal, I suppose it would have been thought to be less open to interpretation, whereupon al-Ma'mun's political adversaries might invoke the eternal Qur'an to weaken his power. See Fakhry, 1983 (1970), *passim*; Watt, 1973, *Mu'tazilism* p. 178, 209-250.; Watt, 1985 (1962), Chapter 8: "The Mu'tazilites." As 'Abbasid influence waned so did Mu'tazilism, to survive in certain aspects of Shi'ism today. All the same, Mu'tazilite insistence on the absolute otherness and oneness of God led Muslims to a useful system of negations in describing God, such as "...he is not a body, has no colour, no

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- limit...," a system useful to Christians as well; Watt, 1973, p. 246-247.
- ²⁰I refer here to the followers of the theologian *abu'l-Hasan 'Ali ibn 'Ismail al-Ash'ari* (ca. A.D. 873-950), also of Basra, whose teachings led more directly to orthodox theological scholasticism (sometimes called the Kalam). Al-Ash'ari reduced the emphasis on Aristotelianism, and affirmed that God has attributes and that the Qur'an is eternal. Al-Ghazali, in emphasizing the divine will, opposed Mu'tazilism, and favored Ash'arism, which became incorporated into Sunni orthodoxy, as it is known today. See Fakhry, 1983 (1970), *passim*; Watt, 1985 (1962), Chapter 12: "The Progress of Ash'arite Theology."
- ²¹For an appreciation of how Islam, Judaism, and Christianity during the Middle Ages transformed the Aristotelian concept of God into the commonalities in our respective understandings of God, I suggest Burrell, 1986. On the theology of Islam, including Ash'arism and Mu'tazilism, see Rahman, 1987. For a Christian interpretation of Islam, see the aforementioned Cragg, 1956, and his subsequent books, such as, 1959; 1973; 1978; 1984; 1985. Also noteworthy in the voluminous literature is Woodberry, 1989.
- ²²Van den Bergh, 1978 (1969, 1954), translator and editor, *Averroës' Tahafut l'Tahafut (The Incoherence of the Incoherence)*. This book contains large sections of al-Ghazali's, *Tahafut al-Falasifa (The Incoherence of the Philosophers)*, to which the Averroës work, in about A.D. 1244, was a reply. This splendid edition was reviewed by Zedler, 1956. See also Macdonald, 1928, for a review of an Arabic edition (by Maurice Bouyges).
- ²³Gruner, 1930; Elgood, 1951, Chapter 7, "Avicenna and Rhazes." Translations of ibn Sina's works on philosophy and theology are in short supply. I have employed the following: Afnan, 1980 (1958); Morewedge, 1973; and Arberry, 1979, with translations, such as "On the Nature of God." I cannot improve on Arberry's assessment; *ibid.*, p. 6-7: "To read Avicenna on theology is to be aware of standing in the presence of one of the profoundest and most courageous thinkers in history. He was a Muslim, and the crown of his achievement as a speculative philosopher was to extend Aristotelian metaphysics, as interpreted by the Hellenistic commentators, so as to embrace the fundamental doctrines and practices of the religion he professed. His arguments required but little elaboration to adapt them to an equally powerful defense of basic Christianity and Judaism."
- ²⁴Van den Bergh, 1978 (1969, 1954), p. xiii, 311.
- ²⁵For my Aristotle, I use the elegant edition, Barnes, 1984; and when I have not the elegant Barnes, I fall back on the steadfast McKeown, 1941. Aristotle gets down to business on the eternity of the world and celestial motion in the 8th book of the *Physics*, in which he argues that celestial motion is circular and eternal and therefore required an eternal, unmoved mover; typically: VIII, 6 258b, 10-12: "Since there must always be motion without intermission, there must necessarily be something eternal, whether one or many, that first imparts motion, and this first mover must be unmoved"; VIII 6 259a 7-8: "Motion, then, being eternal, the first mover, if there is but one, will be eternal also." Also in the *Metaphysics*, e.g., XII 7, 1072a, 24-26; and 8, 1073a, 27-28: "eternal movement must be produced by something eternal." Apparently Aristotle wanted to be on the safe side, because before he finished Book 8 of the *Physics* he saw fit to reverse this argument. VIII 6, 259b, 32-33: "if there is always something of this nature, a mover that is itself unmoved and eternal, then that which is first moved by it must also be eternal."
- ²⁶At times Aristotle could use plain language; this, from the *Heavens*, II 1 283b 22-23; similarly: I, 3, 270b, 14-16.
- ²⁷In Van den Bergh, 1978 (1969, 1954), quote, p. 69. Al-Ghazali examined four different so-called proofs (p 1, 37-56, 57, 58-59), derived from Aristotle, for the eternity of the world, and found them all wanting. (A) A created world would have required a decision to create, which would have meant a change, or cause, in the unchanging mind of God, and for this cause required a prior cause, in fact, an infinite series of causes, which is impossible. I can't find this argument expressly in Aristotle, unless it is in the *Physics* VIII Chapter 6, *passim*. Van den Bergh (notes p. 1) says it does come from Avicenna, who, of course, leaned on Aristotle; but I can't find it in the translations of Avicenna by Arberry (1979) and Morewedge (1973) either. (B) If the world were created, "how can there be any before and after without the existence of time?"; *Physics*, Book VIII 1, 251b, 10-11; and also the *Metaphysics* XII 6, 107, 1b, 8-9. This involves Aristotle's concepts of priority and posteriority. (C) Since nothing can be eternally possible, declared Aristotle, in the *Metaphysics* IX, 8, 1050b, 7-8, whatever is possible in eternity is actual; possibility and existence coincide in eternity, and therefore the world, being possible in eternity, is actual and eternal. And anyway, (D) an absolute becoming is impossible, since anything that becomes, comes from something; e.g., 1069b, 35, *passim*.
- ²⁸In learning to cope with reconciling Greek learning with the Qur'an, Muslim scholars first had to know their metaphysics. For instance, even as early as A.D. 830, when al-Ma'mun founded his translation center in Baghdad, they began to wrestle with such fraught concepts as "not from something," which in Arabic is *la min shay*; and "from the non-existent," or *min al-ma'dum* (the two are not the same). They had to decide on a proper Qur'anic interpretation; that is, whether one or the other of these concepts could mean coming from nothing, or whether Allah had acted on a Platonic antemundane matter. Most likely they discussed their fancy new ideas with Syrian Christians, who were Arab Christian living in Syria and who in turn were certainly charmed by Greek learning. How Syrian Christians and Arab and Persian Muslims learned to cope is discussed fully in Wolfson, 1976, p. 354-372.
- ²⁹Al-Ghazali possibly did mean "out of nothing," although, as far as I can see, he did not use those words. This formula was expressed as *de nihilo* first by the Christian apologist, Tertullian, in A.D. 207; see Wolfson, 1976, p. 356. Similar expressions were used by other church leaders of antiquity, who insisted that God created matter out of nothing. Douglas V. McNeel, of San Antonio, Texas has observed recently that Basil also cherished this view. I am grateful for the opportunity I had to read his manuscript: "The Scientist As the Priest of Creation: Saint Basil's Fourth Century Vision of the Relationship Between Theology and Science." Where our formula, *creatio ex nihilo*, came from, I have no idea, although the concept is clearly of Hebrew origin (see notes 77, 78 *infra*); nor do I know whether it was even known *per se* by Muslim theologians. Naturally I consulted Wolfson, but he didn't say (1979 (1973), I, p. 207-211: "The Meaning of *Ex Nihilo* in the Church Fathers, Arabic and Hebrew Philosophy, and St. Thomas.") But Wolfson makes the sensible point that, whatever the interpretation of *creatio*, whether with Neoplatonic emanations or without, the doctrine of creation meant opposition to Aristotle.
- ³⁰The passages in the Qur'an that vexed the Aristotelian Muslims by dealing with creation are Surahs 2.118, 165; 10.4, 7; 11.8; 13.17; 39.6; 41.10-13; 52.36; and 55.11. Wolfson summarized the interpretations of these passages in "Creation of the World," in 1976.
- ³¹In Van den Bergh, 1978 (1969, 1954), p. 8-9, 17, 18, and 49, al-Ghazali takes up the question of infinite numbers. More than likely he was thoroughly familiar with the Arabic editions of the *Metaphysics*, Book XIII especially chapters 8-10; the *Physics*, Book III chapters 4-7; and also *Heavens*, I.2; in which Aristotle undertakes to help us with finite numbers, infinity, and infinite numbers.
- ³²When al-Ghazali wrote his *Tahafut (Incoherence)*, several Arabic translations of Ptolemy's *Almagest* were available to him. "Al-magest" is the English rendering of the Arabic rendering, *al-Majisti*, of a Greek word meaning the greatest. Hitti, 1956 (1937), p. 310-312, 373; O'Leary, 1957 (1949), p. 158; and Sartori, 1927, I, p. 562, 565.

- ³³Van den Bergh, 1978 (1969, 1954), p. 9, for planetary revolutions.
- ³⁴In the 2nd century B.C., Hipparchus, the astronomical observer, estimated the change in longitude of the fixed stars to be about 1° per century, or 36" annually, hence the figure of 36,000 years that al-Ghazali used for a complete rotation around the Earth. This phenomenon is the precession of the equinoxes, or the apparent circle traced by the Earth's axis. The Earth is rather like a spinning top, with its axis presently tilted toward the North Star, or Polaris (Ursae Minoris). It will eventually point toward Vega. As a result, the constellations appear to drift westward along the ecliptic, which is the apparent path of the Earth around the Sun, so that each year, as the Earth comes around, the equinoxes *precede* their positions in earlier epochs. That means that, long after we're all departed, there'll be another North Star, and the coming of spring will not be on March 21. In A.D. 127-151, Ptolemy, the great astronomer and mathematician of antiquity, adopted Hipparchus' figure of 36" annually when he described the geocentric system, in his *Mathematical Composition*, known today as the *Almagest*, with which al-Ghazali was quite familiar in its Arabic translation; see Book 7, p. 227, 230, 233 in Ptolemy (1984). Arab astronomers obtained increasingly more accurate figures. Here I assume the Julian Calendar, and my calculations, though not exempt from error, point out the prowess of the Arab astronomers. The renowned Baghdad astronomer, *Muhammad al-Battani* (died A.D. 929), obtained a calculation of 1° in 66 years, or 54.55" per annum, or 23,841 years for a complete rotation. *Ibn Yunus* (died A.D. 1009) obtained the still more accurate figure of 1° in 70 years, or 51.43" per annum, for a rotation in 25,175 years. This compares favorably with the present-day figure of about 50.27" per annum, or about 25,787 years for a complete rotation. It is curious that al-Ghazali relied on Ptolemy when he had up-to-date figures at hand for his example; the Arab astronomers of his day had really made Ptolemy's computation in this case rather out-of-date. But then, 36" made for easy arithmetic in al-Ghazali's example, and he correctly derived his revolutions. From the *Almagest*, VII, 1-2. For a passage from Ptolemy on the precession, see Cohen and Drabkin, 1958, p. 115-117, and 115 footnote; Bowditch, 1977, I, p. 24-25, 362; and Dreyer, 1953 (1905), p. 276-279.
- ³⁵Van den Bergh, 1978 (1969, 1954), p. 9.
- ³⁶Among Aristotle's numerous asseverations on the infinite, see *Metaphysics*, XIII, 8, 1084a, 2-3: "infinite number is neither odd nor even"; in *Physics*, III, 5, 204a, 25-26: "a part of the infinite would be infinite" — by which he meant that if an infinite were cut in two, each "half" would still be infinite; and similarly, in *Physics*, VIII, 8, 263a, 7: "it is impossible to traverse distances infinite in number," meaning that an infinite number cannot be counted. And, in the *Heavens*, I 5 272a 3: "the infinite cannot be traversed."
- ³⁷John Philoponus of Alexandria, in about A.D. 530, may have initiated the first confrontation between Christianity and Aristotelian cosmology. See Wildberg, 1987 and Sorabji, 1987. The brilliant Philoponus argued against the Aristotelian 5th element (the aether: *Heavens*, I, 3, 270b, 22-25), and the eternity of the world; and argued instead that motion was caused by an "impetus" that God implanted in moving bodies, that heavenly bodies were composed of the same materials as the Earth, and that the world was created. See the excellent analysis by Sambursky, 1987 (1962), p. 154-165: "John Philoponus and his Conception of the Universe." It can be inferred that al-Ghazali read Philoponus in Arabic translation from the fact that Maimonides, in the 12th century, said that John the Grammarian, meaning Philoponus, had been translated into Arabic; Maimonides, 1956 (1881, ca. A.D. 1185), *Guide for the Perplexed*, 1956 (Dover edition), p. 109. Also see Davidson, 1969, p. 89, 357-392, and Macierowski and Hessing, 1988.
- ³⁸Wolfson, 1976, p. 416-434. One can scarcely make headway in studies of this sort without the splendid Wolfson books, which explain all, his distressing syntax notwithstanding.
- ³⁹Van den Bergh, 1978 (1969, 1954), p. 38. For the Islamic view of time see Whitrow, 1989, p. 77-80. The Muslim calendar began in A.D. 622, the year of Muhammad's flight to Medina. Muhammad ibn-Ahmad al-Biruni (AD 973-1048), the Muslim scholar of eleventh-century Afghanistan, in his *The Chronology of Ancient Nations*, C. Edward Sachau, translator and editor, 1879, p. 33-36, explains why. Omar Khayyam decided that the exact date of the Prophet's birth (ca AD 570) was too fraught with uncertainty to be employed as the start of the Muslim epoch, and so instead he chose the Hijrah in AD 622 as the year 1.
- ⁴⁰Van den Bergh, 1978 (1969, 1954), p. 39; also p. 38. Samuel Zwemer listed some forty respectful references that al-Ghazali made to Jesus, in a chapter entitled, "Jesus Christ in al-Ghazali"; 1920, *passim*. For an Islamic view of the Trinity, see "Trinity and Incarnation," in Wolfson, 1976, p. 304-309.
- ⁴¹Van den Bergh, 1978 (1969, 1954), p. 42. The ancients had much to say about time. In his elaborate discussion in the *Physics*, Book IV, Chapters 10-14, typically in 12, 221b, 7, Aristotle said: "Time is the measure of motion"; and in 14, 223a, 18-19, that time "is an attribute, or state, of movement." Augustine thought so, too; *Confessions*, XI.23: "It is by time that we measure the movement of bodies"; although we don't know whether Augustine read Aristotle. In the end, Aristotle gave up and said it was all in the mind. *Physics* 223a, 22-23: "Whether if soul did not exist time would exist or not, is a question that may fairly be asked." Augustine apparently was of the same mind. *Confessions*, XI 27: "It is in my own mind, then, that I measure time." See Ormsby, in Burrell and McGinn, 1990. For two views of time, the Aristotelian and independence of motion, see Capek, 1987.
- ⁴²Van den Bergh, 1978 (1969, 1954), p. 41.
- ⁴³*Ibid.*, p. 42.
- ⁴⁴*Ibid.*, p. 46-48, 51. *Physics*, IV, 4, 212a, 20-21: "the innermost motionless boundary of what contains is place" (*sic*). *Heavens*, I 9 279a 12-13 18: "There is also no place or void or time outside the heaven"; IV, 1, 308a, 18, 23-24: "that there is no up and no down in the heaven, is absurd...since the universe has an extremity and a centre, it must clearly have an up and down." Also *Categories*, 6a, 11-18.
- ⁴⁵*Loc. cit.* For a fascinating analysis of how Aristotle's view of "space" was modified through the centuries by the Judeo-Christian view of space, which is derived from biblical passages, see Jammer, 1953. Aristotle's "place" — the space within a containing body, becomes space that is an attribute of God, a reality separate from matter; e.g., Deut. 4.39; 33.27; Ps. 90.1.
- ⁴⁶Van den Bergh, 1978 (1969, 1954), p. 24.
- ⁴⁷George Sarton claimed that the ninth sphere was invented by *Thabit ibn Qurra*, a brilliant Sabian astronomer from Haran, who was employed in Baghdad; 1927, I, p. 599-600. But I can find no reference to this in Qurra's own impressive book; see the excellent translation, Morelon, 1987. Dreyer refers to a work by Qurra, "On the motion of the 8th Sphere," which has never been published; 1953 (1905), p. 276. Likely the ninth sphere was surmised by the time of Hipparchus, but I don't know. Dreyer also reported that the Arabs proposed a tenth sphere to account for a perturbation in the precession, but I think we might let that go; *ibid.*, p. 278-279.
- ⁴⁸Van den Bergh, 1978 (1969, 1954), p. 19. Did Abu Hamid believe that ours is the best of all possible worlds? See Ormsby, 1984.
- ⁴⁹*ibid.*, p. 24. *Generation and Corruption*, II, 10, 336a, 33-34, "it is not the primary motion that causes coming-to-be and passing away, but the motion along the inclined plane"; and 336b, 17-18: "coming to be occurs as the sun approaches and decays as it retreats." And *Heavens*, II 3, 286b, 5-6: "the reason why there is more than one circular body is the necessity of generation."
- ⁵⁰Quote from van den Bergh, 1978 (1969, 1954), p. 283; also 263-264. For Avicenna's ruminations on emanations, see Afnan, 1980 (1958), Chapter 4, "Problems of Metaphysics"; and Morewedge, 1973, p. 76-78, and 103-106, "Finding the manner in which

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things emanate (*padid*) from the Necessary Existent." Emanations and Neoplatonism are not found in Aristotle, of course, but were invented by the Hellenized Egyptian philosopher, Plotinus, in the 3rd century. See MacKenna, 1969. Wolfson has discussed the subsequent attempts in Christianity, Islam, and Judaism to equate *creatio ex nihilo* with emanations. E.g., around A.D. 450, a certain Dionysius the Areopagite (not the friend of Paul in Acts 17.34), said that *ex nihilo* meant *ex essentia Dei*, adding that God "produces substances by an outgoing of essence"; quoted by Wolfson, 1979 (1973), I p. 209. See also Feldman, 1980. On Dionysius, see "Denis the Areopagite" in Gilson, 1955, p. 81-85, 597-598, passim. [Al-Ghazali would have been surprised to read what Gilson, in a moment of inattention, said of him: "Algazel was a Christian"; *ibid.*, p. 265.] On how these ancient emanations affected later Christian thought, gnosticism, Swedenborg, theosophy, and what not, see Strong, 1945 (1907), p. 383-386.

⁵¹On how cause can coincide with its effect, according to ibn Sina, see Morewedge, 1973, p. 41-44, "Finding the Condition of Cause and Effect"; and p. 50-53, "Finding the Nature of Contingent Being." Also, in the Arberry translation (1979), p. 36, ibn Sina, in commenting on Qur'an 33.62 and 35.41: "...all things having being emanated from him according to a known order and known media: that which came later cannot be earlier, and that which came earlier cannot be later, for it is He Who causes things to be earlier and later."

⁵²The beauty of Neoplatonism is that you can believe in Genesis 1.1 and Aristotle's Prime Mover at the same time. If the Nicene Creed had not been enunciated, if indeed the Council of Nicaea, in A.D. 325, had not made a clear distinction between the world as coming from nothing and the Word as "begotten not made" from the divine essence, and if in consequence history had assuredly taken a different path, I suppose we might be interpreting Genesis 1.1 today in a context of Neoplatonism. In that case, on Sunday mornings we would be applying the Plotinian scheme to the Nicene Creed, "emanation" would come to our lips rather than "creation from nothing," and we would be agreeing with ibn Sina rather than with al-Ghazali. Augustine seemed to think Plotinus was worth reading, judging from the seven positive references he made to that pleasant pagan in the *City of God*, in Books 8, 9, and 10 and calling him "the great Platonist" (X.3). I doubt that emanations were taken literally; they were certainly a metaphor, in order to provide the pious with a pattern of behavior and for understanding one's place in God's creation. Muslim theologians, enamored of Neoplatonism, would not suggest that the world actually flowed, or oozed, from the bowels of Allah, just as we cannot conceive of how the world could suddenly appear in a vacuum, even if we could assume a prior existence of a vacuum (a vacuum is not "nothing"), modern physics notwithstanding. Still, the concept of emanations, like creation from nothing, is difficult for the 20th-century mind to grasp. Emanations did not flow like a river, nor were they intermittent; nor did they occur in time, for they were eternal; yet they were a continuous *nexus* between the unchanging divine and the changing natural. Much food for thought on these matters can be found in the aforementioned Burrell and McGuinn, 1990, particularly the three essays, Burrell, "Creation or Emanation: Two Paradigms of Reason"; Rahman, "Ibn Sina's Theory of the God-World Relationship"; Goodman, "Three Meanings of the Idea of Creation"; and also, of course, Wolfson, passim.

⁵³Van den Bergh, 1978 (1969, 1954), quote from p. 96; p. 89, 92, 95, 96.

⁵⁴*Loc. cit.*, p. 96.

⁵⁵When the learned among Jews, Christians, and Muslims sought language to express what they meant when they said they worshiped "one God"; and inasmuch as the declaration that God is "one" is stated only rarely in both the Bible (e.g., Mark 12.29, 32; John 10.30) and the Qur'an (e.g., Surahs 4.172; 5.74; 6.20); likely at one time or another they would have

consulted what Aristotle had to say concerning the unity and incorporeality of God; e.g., *Physics*, VIII 6, 259a, 14-15: "the first mover must be something that is one and eternal"; and 10, 266a, 10-11: "the first mover must be without parts and without magnitude." Early on, the learned would have pondered Aristotle's statement in *Metaphysics* XII 8, 1074a, 33-34: "all things that are many in number have matter," and they would have profited from the effort. Here I suggest another Wolfson book — 1962 (1934), *The Philosophy of Spinoza*, I Chapter 4: "Unity of Substance," and Chapter 5, "Simplicity of Substance." On incorporeality, Wolfson, observing that neither the Bible nor the Qur'an expressly describe God as "incorporeal," traced this attribute to the first century Jewish philosopher, Philo Judaeus, in 1947: *Philo, Foundations of Religious Philosophy in Judaism, Christianity, and Islam*, vol. 2, p. 94-101, 149-164. Further to plurality in the essence of God, Wolfson, 1979 (1973), p. 112-132, developed the argument that the Muslim doctrine of divine attributes was derived from the Christian doctrine of the trinity. In discussions with Arabic-speaking Christians, the three distinct though immaterial "hypostases" (but one "ousia"), meaning Father, Son, and Holy Spirit, were deemed to correspond with the triad — existence, wisdom, and power — that Muslims recognize as divine attributes of Allah. Said Tertulian, the second century Christian priest of Carthage: "unity of substance not singularity of number"; quoted by Wolfson, 1979 (1973), p. 327.

⁵⁶Van den Bergh, 1978 (1969, 1954), p. 124; also 175, 300, 259-260. Avicenna: "The Necessary Existent cannot contain a multiplicity as though it were composed of many elements, as a man's body consists of many parts"; "The Necessary Existent is a knower of its own essence"; "...there can be a knower of many things without admitting multiplicity in this knower"; Morewedge, 1973, p. 53, 61, 62. Avicenna also said: "God has knowledge of His Essence. He knows all things by virtue of one knowledge"; passim; Arberry, p. 33. Avicenna: "God knows everything, only in a universal way; still no single thing, not even the weight of an atom, is hidden from Him (according to the Koran 34.3; 10.62). This is something very wonderful, the understanding of which needs great intellectual subtlety"; and one is inclined to agree with Avicenna. Quoted by van den Bergh, 1978 (1969, 1954), p. 150, notes.

⁵⁷From the *Metaphysics*, XII 7, 1072b, 20-21, 22: "thought thinks itself because it shares the nature of the object of thought." But then, in chapter 9 Aristotle had to acknowledge that his view of God was not altogether attractive; 1074b, 15: "The nature of the divine thought involves certain problems." Ibn Sina maintained that the "Necessary Existent," or God, knew many things, albeit in a universal way, whatever that meant, without being changed; see Morewedge, 1973, p. 59-62, and also Marmura, 1962. Said Augustine, in *Trinity*, XV, 22: "We see the things which you have made, because they exist. But they only exist because you see them," and Aquinas, in *Summa Theologica*, I, Q.14, art.8: "The knowledge of God is the cause of things." See also MacKenna, 1969, *Enneads*, V.9.5. Aristotle was onto something, I should think.

⁵⁸Van den Bergh, 1978 (1969, 1954), concerning Zaid, p. 276-277. God knows individuals besides universals, also p. 121-124. For several centuries Zaid flourished as Mr. Everyman, always on call whenever a writer needed him to emphasize something. Writers noticed him in each other's manuscripts on creation and used him to disagree. Thus Ibn Sina called on Zaid in the late 10th century; al-Ghazali noticed, and used Zaid to take a different view. Ibn Rushd, way off in Morocco in the 12th century, naturally read their manuscripts, and, sure enough, there's Zaid again, emphasizing ibn Rushd's displeasure with his famous predecessors. Not one to be outdone, Maimonides, also discussing whether the world was eternal or created, summoned Zaid later in the 12th century. The venerable and obedient Zaid was a generic Joe Six-pack for the learned of the Middle Ages. Khalid and Amr also show up in one century or another, but I did not notice a Fatima.

- ⁵⁹*Ibid.*, p. 124. On whether al-Ghazali believed that God is knowable, see Shehadi, 1964.
- ⁶⁰In attempting to solve the problem of divine knowledge, Averroes, in his reply to al-Ghazali in his *Incoherence of the Incoherence*, and Maimonides, in his *Guide for the Perplexed*, argued instead that God's knowledge is totally unlike human knowledge.
- ⁶¹Van den Bergh, 1978 (1969, 1954), p. 121.
- ⁶²*Ibid.*, p. 149. Ptolemy, stars, p. 259; the star catalogue on p. 234-259.
- ⁶³*Ibid.*, p. 149. Al-Ghazali must have been thinking of the zodiac and its constellations; for a ram, bull, a lion, and a man he probably meant the constellations Aries, Taurus, Leo; and possibly Orion, Bootes, or Perseus. But these groups of stars are on the plane of the ecliptic.
- ⁶⁴*Ibid.*, p. 151-152; quote from p. 152.
- ⁶⁵*Ibid.*, p. 263-268. Here al-Ghazali again defended the proposition that God's acts are voluntary; in effect he disagreed with Plotinus.
- ⁶⁶*Ibid.*, p. 316.
- ⁶⁷*Posterior Analytics*, I 4, 73a, 21; *Nicomachean Ethics*, VI 3, 1139b, 23-24.
- ⁶⁸Van den Bergh, 1978 (1969, 1954), *op. cit.* (note 13 above), p. 312-314. I believe this is implicit in ibn Sina; e.g., in the Morewedge translation, *op. cit.* p. 41: "...when one imagines the cause as an existent in the world, it becomes necessary for the effect to exist also..." *passim*.
- ⁶⁹Van den Bergh, 1978 (1969, 1954), p. 312.
- ⁷⁰*Ibid.*, p. 313.
- ⁷¹*Ibid.*, p. 316-317.
- ⁷²*Ibid.*, p. 316.
- ⁷³The ambitious reader might decide for himself after consulting the extensive analysis by Goodman, 1978. Also useful is his detailed exposition, 1971.
- ⁷⁴The nineteenth-century Arabist, Ernst Renan, seemed to think so, in 1861, in his pivotal *Averroès et l'Averroïsme*. Discussing al-Ghazali's critique of causality, he thought the result was plain, p. 97. "C'était, on le voit, la négation de toute science" — that is, laws of nature no longer existed, he declared. He wrote, with some satisfaction, one thinks, "Hume n'a rien dit de plus" — that is, even David Hume, the English skeptic, did not say it better. I agree with Sarton, 1927, I, p. 747: "Al-Ghazali was too noble and broad an intellect to be accused of obscurantism."
- ⁷⁵Van den Bergh, 1978 (1969, 1954), p. 156-169, "The Fourth Discussion."
- ⁷⁶*Ibid.*, p. 253.
- ⁷⁷Most writers, such as in note 1 above, go in for the spiritual transformation. Others, though, rather like a "psychosomatic illness," "a nervous breakdown," or possibly "he even went mad"; referred to by Ormsby, p. 255, in "Creation in Time in Islamic Thought with Special Reference to al-Ghazali," in Burrell and McGinn, editors, 1990.
- ⁷⁸For the materials in this section I rest on the sources cited in note 1 above, and for the facts and dates of nine centuries ago I choose those that seem reasonable and supportable.
- ⁷⁹The Umayyad mosque was built in A.D. 706-714 by the Umayyad Caliph 'Abdul al-Malik I, and is described in much detail — its history, with excellent diagrams and photographs — by Creswell, 1958, Chapter 3, "Works of Al-Walid"; and Doag, 1977 (1975), Chapter 2, "Umayyad Architecture," especially p. 22-27. 'Abd-al-Malik also helped to establish, in A.D. 691, the magnificent Dome of the Rock in Jerusalem. The Umayyads are named for Mu'awiyah who founded in Damascus the line of thirteen caliphs that formed the first dynasty in Islam, in A.D. 661-750. The split between Shi'ah and Sunni Islam (see note 3 above) occurred during this time.
- ⁸⁰My metaphor would have been precise had my pagan temple been Greek, instead of Roman. All the same, my point, made in the next paragraph, I believe stands.
- ⁸¹I have not seen the inscription, not knowing a Umayyad from an 'Abbasid at the time of my visit. But Creswell, 1958, a lifelong student of Muslim architecture, said it is there, p. 50; and so did Hitti, 1956 (1937), p. 222; and I take their word for it.
- ⁸²Grant, 1981, p. 325.
- ⁸³See Hitti, 1971 (1968), p. 164. Aquinas, having died in 1274, probably could not have seen any Latin translation of the *Tahafut*, as Burrell claimed; 1986, p. 89. It is not improbable that an Arabic copy was available, but whether Aquinas had access to one, I do not know. Two other routes of the views that al-Ghazali espoused were possible; one by way of Maimonides, who took account of them in his *Guide for the Perplexed*, 1956 (1881, ca. A.D. 1185) e.g., in Part II; the other by way of the Latin translation of al-Ghazali's *Metaphysics*; Muckle, 1933. See also Beaurecueil, 1947; and Zedler, 1961, "Introduction," p. 18-31.
- ⁸⁴See Grant, 1981, p. 325, with details of these editions.
- ⁸⁵The *Catalogue of the British Museum* (pre-1955, vol. 166) lists forty entries under his name. Van den Bergh, 1978 (1969, 1954), see note 22 above. Also Kamili, 1958.
- ⁸⁶Talas, 1939, p. 31-32. The Nizamiyah College was located east of the Tigris, not far from the river. For map of location, see "Baghdad," 1960, *Encyclopedia of Islam*, facing p. 908. Hitti, 1956 (1937), p. 310, said that the madrasa was absorbed centuries ago by the nearby Mustansariyya Madrasa (al-Mustansariyya University), which was restored recently by the Iraqi government.
- ⁸⁷Thus can be seen the irony when well-meaning church people today accept "creation science." Inevitably their efforts have much in common, not with a biblical faith and world-life view, which they seek, but with an Aristotelian view of nature, which is pre-Christian in origin and which one would think they would wish to eschew.
- ⁸⁸2 Maccabees 7:28: "look at the sky and the earth; see all that is in them and realize that God made them out of nothing." Written about 63 B.C., from the New English Bible with the Apocrypha (1970), the Vulgate of this apt passage would be *ex nihilo fecit illa Deus*. "Out of nothing," I take it, might not be the only possible translation. Some people today suggest that the "Big Bang" proves *creatio ex nihilo*; William E. Carroll suggests caution; (1988).
- ⁸⁹The proposition that the Judeo-Christian-Islamic doctrine of creation contributed to the rise of science during the Renaissance dates primarily from the publication of the seminal paper by Michael B. Foster in 1934; and reprinted in Russell, 1979 (1973), p. 294-315. Creation means the de-divinization of nature: nature is entirely material, and every natural event must be described as having a local and material antecedent. Thus, creation means that science is possible. The Foster paper, however, is comfortably oblivious of Islam; one leaps blithely from antiquity to the Renaissance. A precursor is the much-quoted passage by Alfred North Whitehead, 1959 (1967, 1925), p. 19: "faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivative from medieval theology." But Whitehead, too, forgot the Arabs. Of course, the *Incoherence* was not yet available. In any case, whoever takes the question seriously should contend with the Foster paper.
- ⁹⁰For Sunni and Shi'ah Islam, see note 7 above. For a fuller discussion, see Rahman, 1987. Also Cragg, 1956, p. 98, 131-134, *passim*.
- ⁹¹A tidy al-Ghazali industry is now in operation, one that would have surprised and warmed the heart of the Nizam al-Mulk, who hired him. For a list of al-Ghazali's works and English editions, see Marmura, 1992. New studies also appear: e.g., Littlejohn, 1988. See also, Bello, 1989; Farah, 1984; Field, 1991, on the theory and practice of Sufism; Lazarus-Yafeh, 1975; Qayyum, 1976; Quesem, 1982; Quesem, 1983 (1977).
- ⁹²For instance, by Fakhry, 1983 (1970), p. 147; Hitti, 1956 (1937); and Sarton, 1927, I, p. 739; and Zwemer, 1920.

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⁹³Cragg, Kenneth, 1956, p. 63.

⁹⁴Calverley, Eleanor, 1968. Calverley, Edwin Elliot, 1958; 1977 (1957, 1925).

References

- Afnan, Soleil Muhsin, 1980 (1958), *Avicenna, His Life and Works*.
Al-Biruni, Muhammad ibn-Ahmad, 1879 (A.D. 973-1048), *The Chronology of Ancient Nations* (Schau, translator).
Anawati, G. C., and Albert Z. Iskandar, 1978, "Hunain ibn al-Ibadi, abu Zayd," *Dictionary of Scientific Biography*, vol. XV, Supplement, 1 p. 230-249.
Arberry, Arthur J., 1979, *Avicenna on Theology*.
Arnold, Thomas and Alfred Guillaume, editors, 1960 (1931), *The Legacy of Islam*.
Augustine, *City of God; Confessions*.
Aulie, Richard P., 1972, "The Doctrine of Special Creation," *American Biology Teacher*, April, May.
Aulie, Richard P., 1974-1975, "The Origin of the Idea of the Mammal-Like Reptile," *American Biology Teacher*, November, December, January.
Aulie, Richard P., 1982, "'The Post-Darwinian Controversies,' — An Extended Book Review Essay," *Journal of the American Scientific Affiliation*, March, June, September, December.
Aulie, Richard P., 1983, "Evolution and Special Creation: Historical Aspects of the Controversy," *Proceedings of the American Philosophical Society*, December.
Barnes, Jonathan, editor, 1984, *The Complete Works of Aristotle*, 2 vols.
Beaurecueil, S. de, 1947, "Ghazzali et saint Thomas d'aquin," *Bulletin de l'Institut français d'archéologie orientale du Caire*, vol. 46, p. 199-238.
Bello, Iysa A., 1989, *The Medieval Islamic Controversy Between al-Ghazali and ibn Rushd*.
Bosworth, C. E., 1963, "A Pioneer Arabic Encyclopedia of the Sciences: al-Khwarizmi's Keys of the Sciences," *Isis*, 54: p. 97-111.
Bowditch, Nathaniel, 1977, *American Practical Navigator*.
Boyer, Carl B., 1985 (1968), *A History of Mathematics*, Chapter 13, "The Arabic Hegemony."
Browne, Edward G., 1985 (1962, 1921), *Arabian Medicine*.
Burrell, David B., 1986, *Knowing the Unknowable God: Ibn-Sina, Maimonides, Aquinas*.
Burrell, David B., and Bernard McGinn, editors, 1990, *God and Creation: An Ecumenical Symposium*.
Calverley, Edwin Elliot, 1958, *An Introduction to Islam*.
Calverley, Edwin Elliot, 1977 (1957, 1925), *Worship in Islam, being a translation, with commentary and introduction, of al-Ghazzali's Book of the Ihya' on Worship*.
Calverley, Eleanor, 1968, *My Arabian Days and Nights: A Medical Missionary in Old Kuwait*.
Capek, Milic, 1987, "The Conflict Between the Absolutist and the Relational Theories of Time Before Newton," *Journal of the History of Ideas*, October-December, p. 595-608.
Carroll, William E., 1988, "Big Bang Cosmology, Quantum Tunneling From Nothing, and Creation," *Laval théologique et philosophique*, 44: 1 (fevrier), p. 59-75.
Cohen, Morris R., and I. E. Drabkin, editors, 1958, *A Source Book in Greek Science*.
Cragg, Kenneth L., 1956, *The Call of the Minaret*.
Cragg, Kenneth L., 1959, *Sandals at the Mosque: Christian Presence Amid Islam*.
Cragg, Kenneth L., 1973, *The Mind of the Qur'an*.
Cragg, Kenneth L., 1978, *The House of Islam*.
Cragg, Kenneth L., 1984, *Muhammad and the Christian*.
Cragg, Kenneth L., 1985, *Jesus and the Muslim*.
Creswell, Keppel Archibald Cameron, 1958, *A Short Account of Early Muslim Architecture*.
Davidson, H. A., 1969, "John Philoponus as a Source of Medieval Islamic and Jewish Proofs of Creation," *Journal of the American Oriental Society*, 89: p. 357-391.
Diyab, Adib Nayif, 1990, "Al-Ghazali," p. 424-445 in Young, M. J.L., J. D. Latham, and R. B. Serjeant, 1990, *Religion, Learning and Science in the 'Abbasid Period*.
Doag, John D., 1977 (1975), *Islamic Architecture*.
Dodge, Bayard, 1963, *Muslim Education in Medieval Times*.
Dreyer, John Louis Emil, 1953 (1905), *A History of Astronomy From Thales to Kepler*.
Duri, A. A., 1960, "Baghdad," *Encyclopaedia of Islam*, 1 p. 894-908.
Eban, Abba Solomon, 1984 (1968), *My People: The Story of the Jews*.
Elgood, Cyril, 1951, *A Medical History of Persia and the Eastern Caliphate*.
Elwell, Walter A., editor, 1984, *Evangelical Dictionary of Theology*.
Fakhry, Majid, 1983 (1970), *A History of Islamic Philosophy*.
Farah, Madelain, 1984, *Marriage and Sexuality in Islam: A Translation of al-Ghazali's Book on the Etiquette of Marriage from the Ihya'*.
Faris, "Al-Ghazzali," p. 142-158, in Faris, 1985 (1944).
Faris, Nabikh A., 1985 (1944), editor, *The Arab Heritage*.
Feldman, Seymour, 1980, "The Theory of Eternal Creation in Hasdai Crescas and Some of His Predecessors," *Viator*, vol. 11, p. 289-320.
Field, Claude, translator, 1991, *The Alchemy of Happiness*, by al-Ghazali, revised and annotated by Elton Daniel; on the theory and practice of Sufism.
Foster, Michael B., 1934, "The Christian Doctrine of Creation and the Rise of Modern Natural Science," *Mind*, vol 2, 34: p. 446-468. Reprinted in Russell, 1979, p. 294-315.
Gandz, Solomon, 1926, "The Origin of the Term, 'Algebra'," *American Mathematical Monthly*, 33, p. 437-440.
Gilson, Etienne, 1955, *History of Christian Philosophy in the Middle Ages*.
Goitein, S. D., 1964 (1955), *Jews and Arabs*.
Goldstein, Thomas, 1988, *Dawn of Modern Science*.
Goodman, Lenn E., 1978, "Did al-Ghazali Deny Causality?," *Studia Islamica*, 2, 47, p. 83-118.
Goodman, Lenn E., 1971, "Ghazali's Argument from Creation," *International Journal of Middle Eastern Studies*, vol. 2, p. 67-85, 168-188.
Grant, Edward, 1981, *Much Ado About Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution*.
Griffith, H., 1984, "Nestorius, Nestorianism," in Elwell, 1984.
Gruner, Oskar Cameron, 1930, *A Treatise on the Canon of Medicine*.
Hartner, W., 1960, "Astrolabe," *Encyclopaedia of Islam*, 1 p. 722-728.
Hill, George Francis, 1915, *Development of Arabic Numerals in Europe*.
Hitti, Philip K., 1956 (1937), *History of the Arabs*.
Hitti, Philip K., 1971a (1968), "Al-Ma'mun: Radical Caliph and Intellectual Awakener of Islam," p. 76-94 in Hitti 1971b.
Hitti, Philip K., 1971b (1968), *Makers of Arab History*, "Al-Ghazali: Greatest Theologian of Islam."
Hourani, Albert, 1990, *A History of the Arab Peoples*.
Jaki, Stanley L., 1974, *Science and Creation*, Chapter 9, "Delay in De-tour."
Jammer, Max, 1953, *Concepts of Space: History of Theories of Space in Physics*, foreword by Albert Einstein.
Jurji, Edward J., "The Course of Arab Scientific Thought," in Faris, 1985 (1944).
Kamili, Sabih Ahmad, 1958, *Incoherence of the Philosophers* (Lahore: Pakistan Philosophical Congress).
Karpinski, Louis C., 1915, *Robert of Chester's Latin Translation of the Algebra of al-Khwarizmi*.
Lassner, Jacob, 1970, *The Topography of Baghdad in the Early Middle Ages*.
Lazarus-Yafeh, Hava, 1975, *Studies in al-Ghazzali*.
Le Strange, Guy, 1900, *Baghdad During the Abbasid Caliphate*.
Le Strange, Guy, 1900a, "Description of Mesopotamia and Baghdad, written about the year 900 A.D. by ibn Serapion," *Journal of the Royal Asiatic Society*, p. 255-315.
Leiser, Gary, editor and translator, 1988, *History of the Seljuks: Ibrahim Kafesoglu's Interpretation and the Resulting Controversy*.
Littlejohn, Henry T., 1988, *The Significance of al-Ghazali's Book of Patience and Thankfulness for Cross-cultural Communication Studies with an Annotated Translation of the Book*; doctoral dissertation, Carey International University, Pasadena.

- MacDonald, Duncan B., 1899, "The Life of al-Ghazzali, with especial reference to his religious experiences and opinion," *Journal of the American Oriental Society*, 20, p. 171-191.
- MacDonald, Duncan B., 1902, "The name of al-Ghazzali," *Journal of The Royal Asiatic Society*, p. 18-22.
- MacDonald, Duncan B., 1928, "Tahafot al-falasifat," *Isis*, 10, p. 497-499.
- Macierowski, Edward M., and R. F. Hessing, Spring 1988, "John Philoponus on Aristotle's Definition of Nature: a Translation from the Greek with Notes," *Ancient Philosophy*, 8, p. 73-100.
- MacKenna, Stephen, 1969, *The Enneads*.
- Mackenson, Ruth, 1932, "Four Great Libraries of Medieval Baghdad," *Library Quarterly* 2: p. 279-299.
- Maimonides, 1956 (1881, ca. A.D. 1185), *Guide for the Perplexed* (Dover, Friedlander translation).
- Makdisi, George, 1961, "Muslim Institutions of Learning in Eleventh-Century Baghdad," *Bulletin of the School of Oriental and African Studies*, London 24, p. 1-56.
- Marmura, Michael E., 1962, "Some Aspects of Avicenna's Theory of God's Knowledge of Particulars," *Journal of the American Oriental Society*, 82:3, p. 299-312.
- Marmura, Michael E., 1992, "Al-Ghazali," *Dictionary of Literary Biography*, 115, p. 205-213.
- Marty, Martin and Kenneth Vaux, editors, 1987, *Health and Medicine in the Islamic Tradition* (Park Ridge Center).
- McKeown, Richard, 1941, *Basic Works of Aristotle*.
- McNeel, Douglas V., 1989, *The Scientist as the Priest of Creation: Saint Basil's Fourth Century Vision of the Relationship Between Theology and Science* (unpublished).
- Meyerhof, Max, 1928, translator and editor, *The Book of the Ten Treatises on the Eye Ascribed to Hunain ibn Is-Haq* (Cairo, Government Press).
- Meyerhof, Max, 1936, "New Light on Hunain ibn Ishaq and his Period," *Isis*, 8, p. 685-724.
- Meyerhof, Max, 1944, "The Sources of the History of Arabian Medicine," *Ciba Symposia*, vol. 6, nos. 5 & 6 (Aug.-Sept.), p. 1873-1876.
- Morelon, Regis, translator and editor, 1987, *Thabit ibn Qurra Oeuvres d'Astronomie*.
- Morewedge, Parviz, 1973, *The Metaphysics of Avicenna*.
- Muckel, Joseph Thomas, 1933, editor, *Algazel's Metaphysics: A Medieval Translation*.
- Nasr, Seyyed Hossein, 1976, *Islamic Science: An Illustrated Study* (with color plates; *World of Islam Illustrated Festival*).
- Nicholson, Reynold A., 1956, *A Literary History of the Arabs*.
- Niebuhr, Carsten, 1776-1800, *Voyage en Arabie & en d'autres Pays circonvoisins*, vol. II "Observations faites à Baghdad," p. 239-267.
- O'Leary, De Lacy, 1957 (1949), *How Greek Science Passed to the Arabs*.
- Ormsby, Eric L., 1984, *Theodicy in Islamic Thought: The Dispute Over Al-Ghazali's "Best of All Possible Worlds."*
- Ormsby, Eric L., 1990, "Creation in Time in Islamic Thought with Reference to al-Ghazali," in Burrell and McGinn.
- Ptolemy, *The Almagest*, vol. 6 of *Great Books of the Western World*, 1984, Toomer, G., translator.
- Qayyum, Abdul, 1976, *Letters of al-Ghazzali*.
- Quesem, Muhammad Abdul, 1982, *The Recitation of the Qur'an: al-Ghazali's Theory*.
- Quesem, Muhammad Abdul, 1983 (1977), *Jewels of the Qur'an: al-Ghazali's Theory: a Translation with an Introduction and Annotation*.
- Rahman, Fazhur, 1987, "A Historical Introduction to Islam," in Marty, Martin and Kenneth Vaux.
- Renan, Ernst, 1861, *Averroes et l'averroïsme*.
- Rosen, Frederic, 1886 (1831), *The Algebra of Mohammad ben Musa*.
- Rosenthal, Erwin I. J., 1962, *Political Thought in Medieval Islam*, p. 38-43: "Al-Ghazzali."
- Rosenthal, Franz, 1990, *Science and Medicine in Islam*.
- Russell, Colin A., editor, 1979 (1973), *Science and Religious Belief: A Selection of Recent Historical Studies*.
- Sachau, C. Edward, translator and editor, 1879, *The Chronology of Ancient Nations*, by al-Biruni.
- Saliba, George, 1982, "The Development of Astronomy in Medieval Islamic Society," *Arab Studies Quarterly*, 4, p. 211-225.
- Saliba, George, 1988, *The Crisis of the 'Abbasid Caliphate*.
- Saliba, George, 1989, "Translations and Translators," *Dictionary of the Middle Ages*, 12, p. 127-133.
- Sambursky, Samuel, 1987 (1962), *The Physical World of Late Antiquity*.
- Sarton, George, 1927, *Introduction to the History of Science*, Vol. I: *From Homer to Omar Khayyam*.
- Shapley, Harlow, 1960, *Source Book in Astronomy, 1900-1950*.
- Shehadi, Fadlou, 1964, *Ghazali's Unique Unknowable God: A Philosophical Critical Analysis of Some of the Problems Raised By Ghazali's View of God As Utterly Unique And Unknowable*.
- Sorabji, Richard, editor, 1987, *Philoponus and the Rejection of Aristotelian Science*.
- Sourdel, D., 1970, "The 'Abbasid Caliphate," p. 104-139 in *The Cambridge History of Islam*, vol. I.
- Spuler, Bertold, 1970, "The Disintegration of the Caliphate in the East," *Cambridge History of Islam*, I p. 143-171.
- Strong, Augustus Y., 1945 (1907), *Systematic Theology*.
- Talas, Muhammad As'ad, 1939, *La Madrasa Nizamiyya et son Histoire; L'Enseignement chez les Arabes*.
- Tibawi, A. L., 1954, "Muslim Education in the Golden Age of the Caliphate," *Islamic Culture*, 28, p. 418-438.
- Toomer, G. J., 1973, "Al-Khwarizmi, Abu Ja'far Muhammad ibn Musa," *Dictionary of Scientific Biography*, II p. 358-365.
- Van den Bergh, 1978 (1969, 1954), *Averroës' Tahafut al'Tahafut (The Incoherence of the Incoherence)*.
- Vine, Aubrey R., 1937, *Nestorian Churches*.
- Watt, W. Montgomery, 1963, *Muslim Intellectual: A Study of al-Ghazzali*.
- Watt, M. Montgomery, 1973, *Formative Period of Islamic Thought*.
- Watt, M. Montgomery, 1983, "Al-Ghazali," *Encyclopaedia of Islam*, II p. 1038-1041.
- Watt, W. Montgomery, 1985 (1962), *Islamic Philosophy and Theology*, Chapter 13, "Al-Ghazzali and Later Ash'arites."
- Weisheipl, James A., 1983 (1974), *Friar Thomas D'Aquino: His Life and Works*.
- Whitehead, Alfred North, 1959 (1967, 1925), *Science and the Modern World*.
- Whitrow, G. J., 1989, *Time in History*.
- Wiet, Gaston, 1971, *Baghdad: Metropolis of the Abbasid Caliphate*.
- Wildberg, Christian, 1987, *Philoponus: Against Aristotle, on the Eternity of the World*.
- Wolfson, Harry Austryn, 1947, *Philo, Foundations of Religious Philosophy in Judaism, Christianity, and Islam*.
- Wolfson, Harry Austryn, 1962 (1934), *The Philosophy of Spinoza*.
- Wolfson, Harry Austryn, 1970 (1956), *The Philosophy of the Church Fathers*.
- Wolfson, Harry Austryn, 1976, *Philosophy of the Kalam*.
- Wolfson, Harry Austryn, 1979 (1973), *Studies in the History of Philosophy and Religion*.
- Woodberry, J., Dudley, editor, 1989, *Muslims and Christian on the Emmaus Road*.
- Young, M. J. L., J. D. Latham, and R. B. Serjeant, editors, 1991, *Religion, Learning and Science in the 'Abbasid Period*.
- Zedler, Beatrice H., 1956, "Review of 'Averroës' Tahafut al-Tahafut," *Modern Schoolman*, 33, p. 124-126.
- Zedler, Beatrice, 1961, "Averroës' Destructio Destructionum Philosophiae Algazelis" in the Latin version of Calo Colonymos.
- Zwemer, Samuel M., 1920, *A Moslem Seeker After God: Showing Islam at its Best, Life and Teaching of al-Ghazali, Mystic and Theologian of the Eleventh Century*.

In Search of The Historical Adam: Part 2

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In this article, the second in a series of two, the culture that surrounded the early Adamites in Southern Mesopotamia starting about 5000 to 4000 BC is examined. Early cuneiform writings and inscriptions speak about an historical figure that could have been Adam of Genesis. The Sumerian king lists of early pre-flood rulers begin with "Alulim," the probable equivalent of Adam. Eridu, the oldest city in Southern Mesopotamia, dating to about 4800 BC, is the most likely place to have been Eden, the original home for Adam and his kin. Even the word "Eden" apparently was derived from the Sumerian "edin," meaning "plain," "prairie," or "desert." "Enoch," the city Cain built in the pre-flood period corresponds with "E-anna(k)," a Sumerian and Semite post-flood site. Thus the early passages of Genesis are seen as factually relevant, and an integral part of secular pre-history.

Cuneiform inscribed clay tablets discovered in Mesopotamian excavations have given archaeologists a picture of a civilization almost totally unknown only one hundred years ago.¹ These have given us valuable insights into the history, religion, and racial diversity in the region. And some of these tablets contain references that may appear to pertain to Adam of the Bible.

The Legend of Adapa Related to Adam

Several fragments of the "Legend of Adapa" were taken from the Library of Ashurbanipal (668-626 BC) at Ninevah. One was also found in the Egyptian archives of Amenophis III and IV of the fourteenth century BC.²

The first people largely recognized as Semites (or Adamites)³ were the Accadians, dating to possibly as early as 4000 BC. The early Accadians had a triune God. From the beginning, the Accadian "trinity" consisted of El, the father god; Ea, god of the earth and creator of man; and Enlil, the god of the air. Also dating to about 4000 BC, the polytheistic Sumerians were distinct from the Semitic Accadians and spoke an unrelated language.

As contact developed between these two cultures, things began to rub off. The Accadian father-god

El was corrupted to "Anu" under pressure from the Sumerian "An." Enlil moved into second place, and Ea, known by the Sumerians as Enki, dropped to third.⁴

According to Accadian legend, Adapa was created an exemplary man by Ea, endowed with "superhuman wisdom,"⁵ but not eternal life. A fishing accident angered Adapa, who broke the wing of the south wind, and was summoned to heaven to appear before the god Anu. Adapa was warned by his father, Ea, not to eat a certain food or drink any water that would be offered to him. A cautious Adapa shunned the food and water of life, through which he would have acquired eternal life.⁶

A fragment of one record of the Adapa legend inscribed in Amorite rests in the Pierpont Morgan Library. This is part of the translation:

*In those days, in those years, the sage, the man of Eridu,
Ea, made him like a (riddi) among men;
A sage, whose command no one could oppose;
The mighty one, the Atra-hasis of the Anunaki, is he;
Blameless, clean of hands, anointer, observer of laws.
With the bakers, he does the baking;
With the bakers of Eridu, he does the baking.⁷*

Adam of the Bible and Adapa of Amorite legend were both human sons of God, or a god. According to the legend, Adapa was a sage in Eridu.

Could it be only coincidental that Adam was told "by the sweat of his face" he would eat "bread," and Adapa was a baker by trade; or that Adapa was deprived of eternal life by not eating or drinking the "food or water of life" while Adam was cut off from eating the fruit of the "tree of life?"

Adapa was regarded as a prophet or seer, and had been priest of the temple of Ea at Eridu. Adapa is also described as "blameless," "clean of hands," "anointer and observer of laws." Could that be descriptive of Adam, the first type of Christ? Also, Adam was taken from the ground; in the Hebrew: 'adam from 'adamah. How close phonetically is 'adamah to Adapa?

Did Adam's Fall have an effect on later generations? These two lines are part of one Adapa fragment:

[...] what ill he has brought upon mankind,
[And] the disease that he brought upon the bodies of
men ...

This Jewish tradition of the Fall is also reflected in the fourth (second) book of Esdras (7.118):

O Adam, what have you done
For though it was you who sinned,
the fall was not yours alone,
but ours also who are your descendants.⁹

Westermann concludes that in this text Adam is not understood as a "representative of mankind created by God, but as an historical individual whose 'Fall' was passed on through him to his descendants."¹⁰

Eridu, the Home of Adapa

In 1940-41, the Iraqi government undertook the excavation of Eridu, home of Adapa.

Here at last it was possible to trace a full and uninterrupted sequence of occupations back through the whole duration of the Al 'Ubaid period to an earliest settlement with some features so dis-

tinctive that doubts arose as to whether the name Al 'Ubaid could still appropriately be applied to it.¹¹

Some of the pottery found at the lowest of nineteen levels of occupation was so distinctive that the excavators called it "Eridu ware." It was described as an "extremely fine quality monochrome-painted ware, often with a buff or cream slip."¹² There was also at the lowest level a high percentage of coarse green pottery typical of Ubaid ceramics. Remember, the Ubaidans, dating to between 4500 BC to 3500 BC, were precursors to the Sumerians. Enough similarities were noted between the coarse Ubaid pottery at Eridu with that of the earlier Hassuna and Samarra cultures to denote that at least some of those early settlers had been migrants from the north.

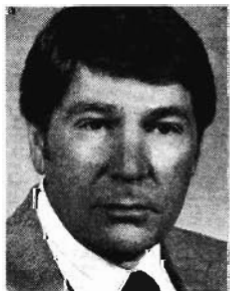
If the two different pottery styles found at the lowest level of the site are indicative of two separate cultures living side by side, one Adamite the other Ubaid, then these pottery shards are of some importance. Quite possibly some of these remnants are from early Adamite populations.

Whatever culture was responsible for Eridu ware, Adamite or otherwise, it was evidently supplanted by Ubaid culture, because only Ubaid pottery could be found at higher levels. And just as the pottery disappeared, so perhaps, did the Adamites, by moving north, probably to Erech, also called by its Sumerian equivalent, "Uruk."

Is Eridu Synonymous with Eden?

It was pointed out in the first part of this article (Part 1, December 1993 *Perspectives*, pp. 241-251) that the Bible implies irrigation for Adam's garden, probably via canal from Eden (Gen. 2:8,10). In 1948-1949, Fuad Safer examined several mounds just outside of Eridu, and reported:

The mounds were found to lie on the banks of the bed of a wide canal which, in ancient times, was undoubtedly connected with the River Euphrates. The recognition of this canal and the



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tracing of its course are now extremely difficult, as it has been filled with sand and soil drifted in from the surrounding plain. The course of the canal crosses the flat depression of Eridu from north-west to south-east and its nearest point to Eridu is about 3 kilometers from the south-west of that site.¹³

In other words, a branch canal from the main canal west of the city to water a garden located east of the city would have flowed through that city, exactly as stated in Genesis 2:8,10.

The Sumerian word, "edin" means "plain," "prairie," or "desert."¹⁴ "Eden" probably was derived from this Sumerian word. Eridu is the earliest known settlement in Southern Mesopotamia, at about 4800 BC.¹⁵ The Sumerians also regarded Eridu as a sacred city. Could Eridu be synonymous with Eden? The time and place are an excellent fit.

Traveling On

Eridu is identified as the home of Adapa. However, he is also called "the Erechian."¹⁶ This, coupled with the disappearance of Eridu ware, may indicate a relocation from Eridu to Erech (Uruk). Eridu is older by some 600 years than Erech, which has been dated to around 4200 BC. Adapa's reason for moving 50 miles north may have been that Eridu was sacked. According to the Sumerian king list, the kingship was overthrown and a new king came to power at Badtabira.

Uruk was first settled around 4200 B. C. by the Ubaid people, and at the lower levels it seems to be a characteristically Ubaid site. But beginning around 3500 B. C., there is evidence of major changes which some archaeologists believe were characteristic of a new culture and others believe represented an indigenous evolution of the "Ubaidans."¹⁷

Erech was clearly established in the pre-flood period according to Sumerian accounts, and re-established after the flood. Erech and the city of Ubaid were located only 30 miles apart, and were contemporary cities situated about 140 miles southeast of Babylon.¹⁸

Alias Adam

In addition to the Bible, possible variations of the name Adam appear elsewhere. On a Sumerian list of ten pre-flood kings ending in Ziusudra (the Sumerian Noah), first on the list is a king named "Alulim."

*When the kingship was lowered from heaven
the kingship was in Eridu.
In Eridu Alulim became king ...*¹⁹

Adapa (created by the god Ea) and Alulim (king by heavenly decree) are both placed at Eridu. If Eridu is Eden, then Adapa, Alulim, and Adam could all be the same man. Conversely, if Adapa, Alulim, and Adam are the same person, Eridu should be Eden, since the Sumerian, Accadian, and Assyrian texts place him at Eridu.

A clay tablet was recovered in excavations at Khorsabad in 1933-34. It contains a list of Assyrian kings beginning with "seventeen kings who lived in tents"²⁰ — probably nomads. "Tudia" tops the list of kings, followed by "Adamu," probably a namesake of his famous forefather. Farther down the list we find the 38th king, "Puzar-Assur." He was one of many Assyrian kings named in honor of a more immediate forefather, Asshur of Genesis 10:11. This same naming pattern is seen in regards to a descendant of Cain in Genesis 4:22 — Tubal-cain.

Another list of pre-flood kings is attributed to the Babylonian priest, Berossus. He lists "Alorus" first on the list of ten pre-flood kings. According to Berossus, Alorus was "appointed by God as Shepherd of men."

The title, "the Son of God," reserved for Sumerian royalty, is also used for "Adamu."²¹ This title is identical to that used of Adam in Luke 3:38, where the genealogy of Christ culminates in "Adam, the son of God."

In Egypt, the pyramids of kings Mer-ne-Re and Nefer-ka-Re were inscribed with a dedication dating to about 2400 BC (many centuries before Moses). The text speaks of a first creation and a deified "Atum" who was on a primeval hill arising "out of the waters of chaos." Among those "whom Atum begot," according to the inscription, is one named "Seth."²²

Could Alorus, Adapa, Alulim, Adamu, Atum, and Adam be all the same person? Perhaps a better question would be, what rationale could be employed to explain away the commonalities? At least some of these secular references must pertain to the first man in biblical history. If these Egyptian, Sumerian, Accadian, Amorite, and Hebrew variations all refer to one man — the most obvious conclusion — then this not only establishes an historical Adam, a.k.a. Adamu, Atum, etc., but the time and the place is also confirmed, and in complete harmony with the Genesis text!

It should come as no surprise that Egyptian inscriptions, Sumerian legends, and Amorite epics would be based upon historical persons and events.

The Sumerians could have learned about Adamic history from two sources; from their own forefathers, who may have lived side by side with Adamites, and from their Semite neighbors, direct descendants of Adam. Many times the Sumerians were subjects of Semitic kings; the great Sargon, for example, began his reign over the entire region in 2371 BC. Adam and his successors also may have ruled over the Ubaidans, who may have been ancestral to the Sumerians.

The Amorites (Gen. 10:16) were descendants of Canaan, Noah's grandson. They must have passed the history of their forefathers down through their generations just as the Israelites did, but distortions and embellishments resulted from centuries of retelling. There was a special purpose in protecting the accuracy of the creation narrative handed down through the line of promise from Shem to Abraham, and through to Moses. Parallel accounts, similar but contorted, can only increase our confidence in the historical value of the Genesis narrative.

Enoch City

If Cain's wife did not come from Adam's line (a question we examined in Part 1), then she must have resided in a nearby settlement of people, probably Ubaidan, whom Cain had originally feared, and for whom Cain was given his mark.

And Cain knew his wife and she conceived, and bare Enoch: and he built a city, and called the name of the city, after the name of his son, Enoch. (Genesis 4:17)

Perhaps partly because Cain was long lived, he was recognized as a special or unique person, as evidenced by his overseeing the building of a city. A city would have been quite inappropriate for only three people, but a city might have been necessary to accommodate a growing community that included his wife's relatives.

Naming the city "Enoch" may seem like Bible trivia, but it is not without significance. According to the Sumerians, kingship resumed at Kish after the flood. Twenty-three kings ruled there until, "Kish was smitten with weapons; its kingship to E-Anna(k) was carried."²³ In *The Makers of Civilization*, Waddell translated E-Anna(k) directly as "Enoch," reckoning it as the Sumerian equivalent for Enoch, the city Cain built.²⁴

Although the flood erased the early inhabitants, the Sumerians re-established Enoch and other pre-flood cities. It was here Mes-kiag-gasher became high priest and king and reigned 324 years.²⁵ His son,

Enmerkar, built or continued building Uruk, the biblical Erech, part of Nimrod's kingdom (Gen. 10:10).

E-Anna(k), "the House of Heaven," is the oldest preserved temple at Uruk, and was supposedly the dwelling place of the goddess Inanna, the Accadian "Ishtar."²⁶

If at the destruction of Eridu, Adam and his kin journeyed to Erech, then this placed the children of Seth at Erech as near to the Cainites at the city of Enoch as Brooklyn is to the Bronx. Driver took note of the remarkable similarity of the names in both lines of descent.²⁷ Compare Sethites: Enosh, Mahalalel, Methuselah, and Lamech with Cainites: Enoch, Mehujael, Methushael, and Lamech. The similarities in names are understandable if they lived in close proximity.

E-Anna(k), now called "Eanna" by archaeologists, has been excavated. A deep sounding was made in the Eanna precinct at Warka in 1931-32. The pottery was identified as Ubaid from level eighteen up to level fourteen. It transitioned to the Uruk period by level ten. Woolley's analysis was that the pottery from the earliest period he found at Ur (which he called "Al 'Ubaid I") was unrepresented at Warka,²⁸ demonstrating that both Ur and Eridu were established before E-Anna(k). And, of course, Adam's Eden would have been older than Enoch, the city Cain built.

The important point is that some of the details omitted from the biblical text are filled in by the Sumerians, confirming not only the existence of the cities of Enoch and Erech, but also pinning down the time and the location.

Pre-Flood Cities Are Also Post-Flood Cities

It is especially noteworthy when we find a city such as Enoch, which the Sumerians clearly identified as existing after the flood, and which the Bible also ties to the pre-flood period. For one thing, it indicates the limited scope and breadth of the flood itself. Conversely, Erech, mentioned by the Bible in the post-flood period, has been excavated to reveal a culture dating to 4200 BC, over a thousand years before the flood. Likewise, Ur, the home of Abraham's youth, had pre-flood beginnings, and was contemporary with Eridu. Furthermore, Asshur built Nineveh after the flood (Gen. 10:11) on an existing city that dates to the pre-flood era, and had been called "Ninua" before the Semites arrived.²⁹

This illustrates that at least four biblical cities that began before the flood were resettled by Sumerians

and Semites after the flood. Thus we have confirmation that the entirety of Genesis 2-11 is confined to the Mesopotamian environs, both the pre-flood and the post-flood periods; and that none of the human history contained in the Bible predates 5000 BC.

Sumerian king lists also demonstrate the longevity of their sovereigns. In the pre-flood period, they reigned for legendary thousands of years.³⁰ After the flood, kings reigned for hundreds of years tapering off to mere mortal proportions in later periods.³¹ The trend jibes with the records in Genesis.

Although the tablets are recorded in Sumerian, some of these kings bear Semetic (Adamic) names. Cain is the only explicit pre-flood example given by the Bible, but he fits the motif of long-lived, non-Sumerian rulers who reigned over Ubaidan and Sumerian subjects. Nimrod and Asshur are biblical post-flood examples.

Of Patriarchs and Kings

When the Sumerian king lists began to surface, there was a rush to show that these were the source of the biblical patriarchs in Genesis 5. The close companion to the Sumerian versions, the Berossus list, was analyzed by the Assyriologist Zimmern, who concluded:

It can hardly be doubted that the Biblical tradition of Gen. 5 (P) concerning the antediluvian patriarchs

is basically identical with the Babylonian tradition about ten antediluvian primeval kings.³²

At the other extreme, G. F. Hasel made a comparative study and found, "a complete lack of agreement and relationship"³³ between Genesis 5 and 11 and the Sumerian kings. As is often the case, the truth may be found somewhere in between. The patriarchs and kings cannot be "basically identical" for reasons we shall see. On the other hand, there is sufficient agreement between the Sumerian kings and the Genesis 5 patriarchs that to say there is "a complete lack of agreement" is equally erroneous.

Deriving a Revised King List

In order to use just one list of kings for comparison purposes, we will revise the king list known as W-B 62 in four steps, taking into account another primary list (W-B 444), and five other lists of pre-flood kings (not shown). Table 1 (below) shows the results.

Step 1. Misplacing names was a common scribal error. Using the other lists as a corrective measure, the fragmented "-kidunnu" is replaced with Enmenluanna, moving him from seventh on the list to third. This squares with WB-444.

Step 2. As a result of step 1, the kings at positions 8 and 9 are moved up one notch to take positions 7 and 8.

Step 3. The fragmented "-alimma" is replaced with Enmengalanna from W-B 444.

Step 4. Suruppak is inserted at position 9 to reflect his status as an intermediate generation. Ubartutu was the reigning king immediately preceding Ziusudra, but Ubartutu was Ziusudra's grandfather, according to Sumerian texts. Ziusudra's father was Suruppak.³⁴

With these four corrective measures, we have a revised king list.

Table 1					
A Revised King List					
W-B 444	W-B 62	Revised King List		City	
1 Alulim	1 Alulim	1 Alulim		1 Alulim	Eridu
2 Alalgar	2 Alalgar	2 Alalgar		2 Alalgar	"
3 Enmenluanna	3 -kidunnu	3 Enmenluanna		3 Enmenluanna	Badtabira
4 Enmengalanna	4 -alimma	4 Enmengalanna		4 Enmengalanna	"
5 Dumuzi	5 Dumuzi	5 Dumuzi		5 Dumuzi	"
6 Ensibzianna	6 Ensipazianna	6 Ensipazianna		6 Ensipazianna	Larak
	7 Enmenluanna				
7 Enmenduranna	8 Enmenduranna	7 Enmenduranna		7 Enmenduranna	Sippar
8 Ubardudu	9 Ubartutu	8 Ubartutu		8 Ubartutu	Shuruppak
		9 Suruppak		9 Suruppak	"
	10 Ziusudra	10 Ziusudra		10 Ziusudra	"

The Flood

Observations

Table 2 is a "spreadsheet" of the pre-flood patriarchs, the revised list of pre-flood kings with the cities in which they reigned, the Berossus list, and two other king lists (for comparison purposes).

One transposition has been performed on the Berossus list. Both Amempsinos and Ensibzianna are identified as king of Larak. Since Larak was "clearly the third city" according to Langdon,³⁵ this suggests the Berossus list has Amempsinos out of order with Edoranchus.

Let us start with some preliminary observations. First, the genealogies in Genesis are just that: the early fathers of the Semites. The Sumerian king lists represent Semite (Adamite) and Sumerian kings, although there is some disagreement among experts as to which is which. At any rate, as the king lists represent rulers, no purely ancestral relationships are implied, even though royal offspring often ascend the throne.

Second, the thousands of years the pre-flood kings reigned looks to be an error in interpretation rather than a recording error. This can be deduced from the post-flood kings at Kish. After "the flood swept thereover," and the kingship was restored, 23 kings reigned a total of 24,510 years—plus, if you can believe it, 3 months and 3½ days! (Archbishop Ussher³⁶ must have had a Sumerologist counterpart.)

Using the archaeological date of 2900 BC for the flood, that would mean the kings of Kish are still ruling today, and have another 19,000 years to go! Where is the error? The years the post-flood Sumerian kings reigned appear to be off by a factor of about 60. The Sumerians used a sexagesimal system of numbers, and that offers a clue as to how astronomical figures may be brought into the realm of believability. Dividing by 60 puts the total years reigned at Kish at a little over 400, a reasonable figure. It can get more complex than that (they may have relied on moon phases rather than sun cycles, etc.), but it's not something we need to dwell on here.

To assert that the Bible genealogies are unrelated to the Sumerian kings because of a discrepancy in the hundreds of years of life for the patriarchs, versus the thousands of years reigned for the pre-flood kings, misrepresents the case. It should not be surprising that Sumerologists have been every bit as prone to error as Bible translators, and similarly reluctant to make corrections.³⁷

Third, confusion can arise when more than one name pertains to a single individual. Among the difficulties is that titles or occupations have been used at times, rather than proper names, and will look dissimilar, especially when recorded in different languages. There are many instances where the Bible itself uses more than one name for one person, for example: Abram = Abraham, Jacob = Israel, Saul = Paul, Peter = Simon = Cephas, and even: Jesus = Emmanuel (corresponding, perhaps, to the Accadian "Ea").

Table 2									
Pre-Flood Patriarchs and Kings									
Patriarchs		Revised King List	City		Berossus		W-B 444		UCBC 9-1819
1 Adam	1	Alulim	Eridu	1	Alorus	1	Alulim	1	Alulim
2 Seth	2	Alalgar	"	2	Alaparos	2	Alalgar	2	Alalgar
3 Enosh	3	Enmenluanna	Badtabira	3	Amelon	3	Enmenluanna	3	Ammeluanna
4 Cainan	4	Enmengalanna	"	4	Ammenon	4	Enmengalanna	4	Ensipazianna
5 Mahalalel		—	—	5	Megalaros		—		—
	5	Dumuzi	Badtabira	6	Daonus	5	Dumuzi	5	Dumuzi
6 Jared	6	Ensipazianna	Larak	8	Amempsinos	6	Ensibzianna		—
7 Enoch	7	Enmenduranna	Sippar	7	Edoranchus	7	Enmenduranna	6	Enmenduranki
8 Methuselah	8	Ubartutu	Shuruppak	9	Otiartes	8	Ubardudu	7	Ubartutu
9 Lamech	9	Suruppak	"						
10 Noah	10	Ziusudra	"	10	Xisuthros			8	[Ziusudra?]
The Flood									

Fourth, Adam is a virtual shoo-in as Alulim at Eridu. Seth, or conceivably Enosh, could be the second king, Alalgar. But the fourth patriarch, Cainan, does not and should not appear on the king lists. Eridu was overthrown. Kingship passed to the victorious city — a Sumerian city — Badtabira. A Sumerian city at that early date was probably devoid of foreigners speaking strange languages. The three kings of Badtabira should *not* be in the Adamic line.

So a dissimilarity is what we should expect concerning those three kings, and that is the case. Also, no connection can be seen between any of the kings and Jared, or with Mahalalel outside of Berossus. This sets apart at least three or four out of the ten patriarchs as absent from the Sumerian king lists, and that is about as far as dissimilarity can be extended.

Finally, there are complicating factors. The genealogies are in Hebrew, while the king lists are in Sumerian, an unrelated language, and Berossus wrote in Greek. Still, these are not insurmountable obstacles. In Table 3 we will see that the list of patriarchs and the lists of kings are not completely independent: there is a relationship.

Line-by-line Explanation

Line 1. Isn't there as much similarity between Adam and Alulim as there is between Richard and Ricardo? Parallels between the Sumerian Alulim, the Accadian Adapa, and the Hebrew Adam point toward a commonality. Clay proposed that Alorus

from the Berossus list was "El-Or" found in early Aramaic inscriptions³⁸ — and therefore, a Semitic (Adamic) name. Who would have been the first father or king of the forerunners to the Semites if not Adam? And if Adam, special in many respects, was in residence at Eridu from the start, who better to serve as king?

Line 2. Some scholars make the connection: Alaparos = Adapa = Adam, making Adam the *second* king. This raises a question. If Adam was the second king, who was the first? It seems equally reasonable to suggest that Seth, or one of Adam's other sons, or even Enosh, could have been this monarch.

Alalgar may have been one of Adam's offspring. There is no way of knowing, but Poebel credits Berossus's Alaparos as the "son of" Alorus.³⁹ Furthermore, if the first king at Eridu was Adam, a non-Sumerian, the next king, if directly related, would also have been non-Sumerian. Keep in mind, the first two names, Alulim and Alalgar, are Semitic (or Adamic), not Sumerian names.

The Semitic (Adamic) name Alalgar is entirely appropriate as applied to the covenant family. Among the meanings offered for Alaparos are "Ox of the god Uru," and "Lamb of El."⁴⁰ "El," Assyrian for God, (and seen in Hebrew as "Elohim," "El Shadai") was the father god, first in the early Accadian trinity. Thus, the name could be literally rendered "Lamb of God." This description of profound theological significance used of Jesus (John 1:29,36) might have been applied to Seth, or even Enosh, when men began "to call upon the name of the Lord"

Table 3
Comparison of Pre-Flood Patriarchs with Revised King List

	Patriarchs	Revised King List	City	Relationship
1	Adam	Alulim	Eridu	Probably the same man
2	Seth	Alalgar	"	Could be the same man
3	Enosh	Enmenluanna	Bad-tabira	Probably different men
4	Cainan	Enmengalanna	"	Should be different men
5	Mahalalel	Dumuzi	"	Virtually have to be different
6	Jared	Ensipazianna	Larak	No similarity seen
7	Enoch	Enmenduranna	Sippar	Quite possibly the same man
8	Methuselah	Ubartutu	Shuruppak	Should be the same man
9	Lamech	Suruppak	"	Probably the same man
10	Noah	Ziusudra	"	Essentially must be the same man

The Flood

(Gen. 4:26). Seth, one of his brothers, or his son may have been this second pre-flood king.

Line 3. Alagar's rule was closed out when Eridu was overthrown and kingship passed to the victorious Enmenluanna, king of Badtabira, a Sumerian city. It would be shocking to think that one of Adam's immediate generations (for example, Enosh) would have made war on his own father or grandfather. Also, Enmenluanna is a Sumerian name, making him the first genuine Sumerian on the Sumerian king list. It follows that a non-Adamic ancestry would be implied for this Badtabiran king and his successors.

Considering Adam's longevity (930 years), he and at least some of his kin must have escaped the bloodshed at Eridu. A move north of about 50 miles to Erech, adjacent to Enoch (the city Cain built), would have brought Adam to a location where he and his family could find refuge and safety among family members.

Line 4. From the name Enmengalanna, we might suspect he was son and successor to the throne of Enmenluanna. Adamic ancestry is therefore equally unlikely, and is reflected by a dissimilarity between his name and that of the fourth patriarch, Cainan.

Line 5. Clay allowed, "It seems that Mahalal-El may be represented by Megalaros ..."⁴¹ A link between Mahalalel and the fifth king on the Berossus list looks credible, but he is probably not the fabled Dumuzi, who corresponds to Daonus, sixth on the Berossus list. Also, Dumuzi and Daonus are identified as "a shepherd" and "the shepherd."⁴² Dumuzi was consort to Inanna "queen of heaven and earth." W-B 444 offers no additional data on any of its kings with a single exception, declaring Dumuzi "divine," and his vocation as "the shepherd."⁴³ "Tammuz," the Semitic name for Dumuzi,⁴⁴ was famous in Accadian literature, with a cult following to rival that of Elvis today.

In the Accadian legend, Adapa gained entrance to heaven by flattering Tammuz. "At the gate of Anu," Adapa told Tammuz how much he was missed on earth.⁴⁵ A thirty-eight line liturgical hymn to the departed Tammuz "represents the people waiting for the lord of life who now sleeps in the lower world."⁴⁶

The prophet Ezekiel had a vision where he was "brought to the door of the gate of the Lord's house," and "there sat women weeping for Tammuz" (Eze. 8:14). Thus the prophet Ezekiel bestowed biblical recognition on the celebrated Dumuzi, the fifth Sumerian king.

Line 6. Demonstrating that kingships were temporary and easily terminated in the land of Sumer, "kingship passed to Larak" when Badtabira was overthrown, and Ensipazianna became king.⁴⁷ It is doubtful that Jared, sixth in the line of patriarchs, could have been king of Larak, almost assuredly an entirely Sumerian city at that early date.

Line 7. "Sevens" often indicate that something may be unusual or important. Here may be another example. In Clay's words, "This king (Enmenduranna) is generally regarded as the original of the biblical Enoch."⁴⁸ We might argue what he meant by the word, "original," but commonality seems apparent. Berossus has "Edoranchus," so all of these lists show a commonality.

Enmenduranna is deemed identical with Enmeduranki, sage and king of Sippar.⁴⁹ Zimmern, who first made the identification, said the name was pronounced "Evvedoranki." "Evved or Eved suggests the Hebrew 'Ebhed," Clay contends.⁵⁰ If so, this would dictate Adamic ancestry for the king of Sippar who according to Sumerian legend was taken by the gods and taught divine mysteries.⁵¹ And, "By faith Enoch was translated (taken up) that he should not see death" (Heb. 11:5).

Another consideration is that Sippar was the cult center of the sun god. The sun completes a cycle every 365 days, which corresponds to Enoch's 365 years.⁵² If Enoch was the king of Sippar who wrested power from Larak's control, and then was taken by God, a void would have been left in the kingship. Or perhaps someone not of good standing took his place. Either way, "Sippar was overthrown, its kingdom passed to Shuruppak."⁵³

Line 8. The next three men on the revised list lived at Shuruppak until the flood, after which kingship was re-established at Kish. The Sumerian records show a direct line of descent from the king of Shuruppak, Ubartutu, through his son Suruppak to the last pre-flood king, Ziusudra. Ubartutu was Ziusudra's grandfather, while Noah's grandfather was Methuselah. Are Methuselah and Ubartutu one and the same?

W-B 62 ends in Ziusudra, although from W-B 444, only "one king reigned" at Shuruppak.⁵⁴ This was Ubartutu. If Ubartutu is Methuselah, who died near the time of the flood, this could explain the discrepancies in the two king lists. One list (W-B 62) recognizes Ziusudra, who, if he ruled at all, reigned for less than a year, or at most only a few years before the flood. The other list (W-B 444) gives him no credit for an abbreviated rule at Shuruppak.

Line 9. "With a brilliant name, let me make you famous," Suruppak told his son Ziusudra.⁵⁵ If Noah and Ziusudra are the same person, then unless he had two fathers, Lamech, the ninth patriarch, should be synonymous with Suruppak. One reason Suruppak never reigned could have been because his father outlived him. And Methuselah outlived Lamech.

Line 10. There is no need to recite the accomplishments of Noah. Legends about him are contained in ancient texts. The names may not look alike, gift-wrapped in different languages, and touching on different facets of the man: "he who laid hold on life of distant days" (Ziusudra); "he saw or found life" (Utnapishtim); "the exceeding wise" (Atrahasis); and "rest or comforter" (Noah).⁵⁶ But corresponding flood stories using these names, recorded in Sumerian, Accadian, and Assyrian, all parallel the biblical deluge. These remarkably similar accounts would be impossible to attribute to other than one man. Unequivocally, Ziusudra equates to Atrahasis, Xisuthros, Utnapishtim, and Noah.

What Does It All Mean?

After a detailed analysis of Berossus, Delitzsch agreed with Zimmern and concluded:

The ten Babylonian kings who reigned before the Flood have been accepted in the Bible as the ten antediluvian patriarchs, and the agreement is perfect in all details.⁵⁷

What Delitzsch failed to recognize is that agreement could be expected only in instances where patriarchs were rulers, or conversely, when the kings were also in the covenant line from Adam. Evidently, some of the patriarchs did reign over small kingdoms. Yet, concurrent kingdoms were also established in Southern Mesopotamia ruled by non-biblical monarchs. Clearly, it was the intent of Berossus and the king lists to record a sequence of kings without regard to ancestry, just as it was the Bible's intention to record a certain line of ancestry whether or not they were kings.

In Sumerian, the first two letters "en-" of a ruler's name denotes kingship in a way similar to the way "lord" does in English. The god "Enki" combines "en" for "lord" and "ki" for "earth" to mean literally, "Lord of the Earth." The Sumerian word "lil" can mean "air," "breath," or "spirit."⁵⁸ Enlil was second in the Sumerian pantheon after the father god, An. The possible interpretations of this name should be obvious. A parallel could exist between this Sumerian and Accadian god and our Holy Spirit.

If we survey the list of pre-flood fathers, in both the line of Seth and the line of Cain we see "En-" as the first two letters more often than any other combination (Enosh once, and Enoch twice). It is quite possible, then, that both Cain's son and Seth's son were rulers over Sumerian subjects. This offers another clue that the seventh patriarch, Enoch, was also a ruler.

One final thought. The Bible submits no data whatsoever on seven of the ten pre-flood patriarchs beyond their age when the first son was born, age at death, and that they had "other sons and daughters." Details beyond that are given for only three: Adam, Enoch, and Noah. And the supplementary biblical information provided for each of them correlates directly to Sumerian and Accadian narratives.

Likewise, in all the Sumerian king lists pertaining to the pre-flood era, additional particulars are given on only one man, "divine Dumuzi, a shepherd." And he is the only Sumerian king, outside of the line of Adam, corroborated in the Bible by his Semitic equivalent, "Tammuz." All coincidence, do you suppose?

Giants in the Earth

And it came to pass, when men began to multiply on the face of the earth, and daughters were born unto them; that the sons of God saw the daughters of men, that they were fair, and they took wives, of all which they chose. (Genesis 6:1-2)

In light of all we now know this clearly describes the mixing of the Adamite populations with the Ubaidans and Sumerians. Has archeological discovery confirmed the mixing of covenant generations with non-covenant generations? Hawkes says:

Another break in cultural tradition and an acceleration in civic advance began around 4000 BC. Some historians believe that these changes were due to the arrival of the Sumerians on the plain, perhaps again coming from the north. Others do not accept a distinct immigrant group but see the Sumerians as an amalgam of all the prehistoric peoples of the region. The language, however, when it came to be recorded, does suggest a Sumerian tongue overlaying a more primitive one that might well have been that of the Ubaidans. It also contains some Semitic elements and it is likely that Semites were already drifting into the valley from the north.⁵⁹

"Semites" technically refers to the descendants of Shem, because historians do not universally recognize Adam or Noah. Is it possible, though, that the Sumerian language contained not "Semitic ele-

ments," but Adamic or pre-flood Accadian language elements? If so, then the presence of those loan words in the Sumerian language supports Genesis 6:1-3.

We do know that after the flood, Semites spread out and encountered peculiar populations in their path (Gen. 15:20, Deut. 2:10,11, and Josh. 13:12, for example), but 4000 BC is pre-flood history.

There were giants ("Nephilim" in the Hebrew) in the earth in those days; and also after that, when the sons of God came in unto the daughters of men, and they bare children to them, the same became mighty men which were of old, men of renown. (Genesis 6:4)

The term "Nephilim" means no more to us today than does "the land of Nod" or "gopher wood." These are words of antiquity and will always remain obscure. And yet, the term "Nephilim," or "giants," seems to pertain to some kind of men who were different, were of ancient origin, and were well known at the time.

Noah's Wife Is the Key to the Ancestors Question

For those who may wonder how all of us today could be related to a primordial ancestor who lived 100,000 years or so ago, and yet Adam, father to the Semites among others, could have been specially created, the Bible offers clues previously mentioned. Noah is the key to this seeming puzzle — or rather, Noah's wife is.

Genesis 5:23: "Noah was five hundred years old: and Noah begat Shem, Ham, and Japheth." We have no way of knowing how old Noah's wife would have been, but she could have been in her teens at the birth of Shem. The flood took place in Noah's 600th year. His wife was still alive after the flood (Gen. 8:16,18), although there were no more children.

If Noah's wife was short-lived, she would have been past her childbearing years when the flood ended. This is the last passage about her. We do not know when she died, but Noah's drunkenness and lying naked in his tent (Gen. 9:21) might have resulted partly from his despondence after her death.

It is entirely possible that Noah's wife came from the indigenous populations (or she had mixed Cainite ancestry), and died before reaching her 120th birthday, although she could have lived a little longer.

Significant differences stand out between Noah's family life and that of the preceding patriarchs. First of all, starting with Adam, every one of the first nine patriarchs was less than 200 years old when he became a father, whereas Noah did not have children until he was 500 years old! This is too great a difference to be without significance. In all likelihood, Noah married late in life, very late.

All of Noah's predecessors had sons and daughters. Even post-flood patriarchs for seven generations after Noah "begat sons and daughters" (Gen. 11:11-25), but Noah had no other children after the three sons. Noah was unique in parenthood for some reason. The most obvious answer is that Noah's wife must have been unique. Noah married outside the covenant line.

Noah's wife and the wives of Noah's three sons must have had ancient ancestry. Their mitochondrial DNA extends back to ancient "Eve," preserving the links to the distant past.

* * * * *

Adam was specially created, responsible to God, and yet biologically compatible with other human beings who were already living in the region at the time of Adam's introduction. Adam could not possibly have started all the Near East peoples, let alone the human race, due to his late entry. Instead, he was placed in a locale which was already sparsely populated by that time.

Cain entered the world of flesh and took a wife. Sons from Seth's line, including perhaps male descendants from other sons and daughters of Adam, took wives from one or more of the local farming communities, and possibly from the mixed line from Cain. This caused their subsequent generations to be mixed, being both of "spirit" and of "flesh."

The flood destroyed a multitude of men, and, of course, all of Adam's descendants except for Noah and his family. The judgment of the flood was brought down upon the Adamites, those who were accountable for sin. Other unfortunates in the vicinity were swept up in the tide.

Although Noah was a direct descendant of Adam, and "perfect in his generations" (Gen. 6:9), we are not told from where his wife or his son's wives originated. Someone had to be the source of the narrative of Cain and his line. The most probable source is Noah's wife, or maybe, the wife of Shem. Noah's wife, and the wives of his sons, must have had mixed

Cainite ancestry, or simply came from the local populace.

Adamic ancestry accrues to only a small percentage of people scattered around the globe today. Traces of Adam's genes might be found in present-day Arabs, Jews, and their offshoots, and should have been present in early populations such as Amorites, Hittites, Canaanites, and others. But even among modern peoples who might have Adamic blood ties, there is still no escaping ancient history, and with it, ancient ancestry.

Some may claim Adam as a forefather, others may doubt it, and most just don't know. But, because of the intermarriages, even those who feel they can boast of biblical ancestors can also be assured that their roots may reach back 100,000 years or even beyond. *

Notes

- ¹Samuel Noah Kramer, *History Begins at Sumer* (Philadelphia: The University of Pennsylvania Press, 1981), xx.
- ²Albert T. Clay, *A Hebrew Deluge Story in Cuneiform* (New Haven: Yale University Press, 1922), 39-41.
- ³"Semite" is the term archeologists and historians use to denote not only descendants of Shem, but also descendants of Japheth, Ham, or any of Adam's line in the pre-flood period (if such a person as Adam ever existed, or if there was such an event as the Flood). Thus, Canaanites spoke a "west semitic" language, notwithstanding Canaan was the son of Ham, according to the Bible. One might think "Hamites" would have communicated in a "hamitic" tongue. But the secular world does not recognize the Bible as being historically accurate. Therefore, "Semites" are universally recognized, but "Adamites," "Hamites," and "Japhethites" are not, shall we say, "politically correct."
- ⁴Gwendolyn Leick, *A Dictionary of Ancient Near Eastern Mythology* (New York: Routledge, 1991), 37.
- ⁵*Ibid.*, 2.
- ⁶Clay, *A Hebrew Deluge Story in Cuneiform*, 40.
- ⁷*Ibid.*, 41.
- ⁸James B. Pritchard, *Ancient Near Eastern Texts Relating to the Old Testament* (Princeton: Princeton University Press, 1955), 103.
- ⁹Claus Westermann, *Creation* (Philadelphia: Fortress Press, 1971), 108.
- ¹⁰*Ibid.*, 108.
- ¹¹Seton Lloyd, "Ur-Al 'Ubaid, Uquair and Eridu," *Iraq*, n. s., 22 (1960), 25.
- ¹²John Oates, "Ur and Eridu, The Prehistory," *Iraq*, n. s. 22 (1960), 33.
- ¹³Fuad Safer, *Sumer* 6 (1950), 28.
- ¹⁴S. R. Driver, *The Book of Genesis* (London: Methuen & Co. Ltd., 1938), 38.
- ¹⁵C. C. Lamberg-Karlovsky and Jeremy A. Sarloff, *Ancient Civilizations: The Near East and Mesoamerica* (Menlo Park: The Benjamin/Cummings Publishing Company, Inc., 1979), 110.
- ¹⁶Clay, *A Hebrew Story in Cuneiform*, 41.
- ¹⁷Lamberg-Karlovsky and Sarloff, *Ancient Civilizations: The Near East and Mesoamerica*, 145.
- ¹⁸Yohanan Aharoni and Michael Avi-Yonah, *The MacMillan Bible Atlas* (New York: MacMillan Publishing Company, 1977), 20.
- ¹⁹Thorik Jacobsen, *The Sumerian King List* (Chicago: University of Chicago Press, 1939), 71.
- ²⁰Arno Poebel, "The Assyrian King List from Khorsabad," *Journal of Near Eastern Studies*, (1942) Vol. 1, No. 3, 252.
- ²¹L. A. Waddell, *The Phoenician Origin of the Britons, Scots, and Anglo-Saxons* (London: Williams and Norgate, Ltd., 1924), 239, 253.
- ²²Pritchard, *Ancient Near Eastern Texts Relating to the Old Testament*, 3.
- ²³Jacobsen, *The Sumerian King List*, 85.
- ²⁴L. A. Waddell, *The Makers of Civilization* (New Delhi: S. Chand, 1968), 62.
- ²⁵Jacobsen, *The Sumerian King List*, 85.
- ²⁶Samuel Noah Kramer, *From the Poetry of Sumer* (Berkeley: University of California Press, 1979), 174.
- ²⁷Driver, *The Book of Genesis*, 80.
- ²⁸Lloyd, "Ur-Al 'Ubaid, Uquair and Eridu," 24.
- ²⁹I. E. S. Edwards, C. J. Gadd and N. G. L. Hammond, eds., *The Cambridge Ancient History Vol. I, Part 2*, (Cambridge: Cambridge University Press, 1971), 730.
- ³⁰*Ibid.*, 107.
- ³¹Jacobsen, *The Sumerian King List*, 77-91.
- ³²H. Zimmern, *Urknige und Uroffenbarung* (Gttingen: Vandenhoeck und Ruprecht, 1902), 539.
- ³³G. F. Hasel, "The Genealogies of Gen 5 and 11 and their Alleged Babylonian Background," *Andrews University Seminary Studies*, n. s. 16 (Autumn 1978), 361-74.
- ³⁴Bendt Alster, *The Instructions of Suruppak* (Copenhagen: Akademisk Forlag, 1974), 43-49.
- ³⁵Stephen Langdon, *Oxford Edition of Cuneiform Texts*, Vol. II (London: Oxford University Press, 1923), 2-3.
- ³⁶Archbishop Ussher calculated the year of creation at 4004 BC from his analysis of the Genesis chronologies.
- ³⁷One method of reconciling ages of Sumerian kings is outlined in an article by Hildegard Wiencke-Lotz, "On the Length of Reigns of the Sumerian Kings," *Chronology and Catastrophism Review, Journal of the Society for Interdisciplinary Studies* (vol. XIV, August 1992), 20.
- ³⁸Albert T. Clay, *The Origin of Biblical Traditions* (New Haven: Yale University Press, 1923), 131.
- ³⁹Arno Poebel, *Historical Texts* (Philadelphia: The University Museum, 1914), 85.
- ⁴⁰Clay, *The Origin of Biblical Traditions*, 132.
- ⁴¹*Ibid.*, 135.
- ⁴²Langdon, *Oxford Editions of Cuneiform Texts*, Vol. II, 3.
- ⁴³George A. Barton, *The Royal Inscriptions of Sumer and Akkad* (New Haven: Yale University Press, 1929), 347.
- ⁴⁴Samuel Noah Kramer, *Myths of Enki The Crafty God* (New York: Oxford University Press, 1989), 7.
- ⁴⁵Stephen Langdon, *Sumerian Liturgical Texts* (Philadelphia: University of Pennsylvania Museum, 1917), 42.
- ⁴⁶*Ibid.*, 285.
- ⁴⁷Barton, *The Royal Inscriptions of Sumer and Akkad*, 347.
- ⁴⁸Clay, *The Origin of Biblical Traditions*, 135.
- ⁴⁹*Ibid.*, 135.
- ⁵⁰*Ibid.*, 136.
- ⁵¹Alexander Heidel, *The Gilgamesh Epic and Old Testament Parallels* (Chicago: The University of Chicago Press, 1963), 141.
- ⁵²Lloyd R. Bailey, *Noah: The Person and the Story in History and Tradition* (Columbia: University of South Carolina Press, 1989), 125.
- ⁵³Barton, *The Royal Inscriptions of Sumer and Akkad*, 347.
- ⁵⁴Wiencke-Lotz, "On the Length of Reigns of the Sumerian Kings," 22.
- ⁵⁵Alster, *The Instructions of Suruppak*, 43.
- ⁵⁶Heidel, *The Gilgamesh Epic and Old Testament Parallels*, 227.
- ⁵⁷Frederich Delitzsch, *Babel and Bible* (Chicago: The Open Court Publishing Company, 1906), 41.
- ⁵⁸Samuel Noah Kramer, *History Begins at Sumer* (Philadelphia: The University of Pennsylvania Press, 1981) 76.
- ⁵⁹Jacquetta Hawkes, *The Atlas of Early Man* (New York: St. Martin's Press, 1976), 63-64.

"In The Beginning..." I Think There Was A Big Bang!

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My eleven-year old daughter came to me recently and asked if God created everything, or if our family believed in evolution.

"Whether you have the small nautilus," I explained, "which has been unchanged for millions of years, or a horse which was small during pre-historic times and evolved into the horses of today, they are all part of God's creation process. I believe evolution is a method of creation that he set into motion."

"Oh," she said, seeming perfectly satisfied. But later a friend pointed out that a horse was, in the beginning, still a horse (micro-evolution — defined as minor changes below the species level). What about the theories, she asked, that we evolved from apes, or amoebas that slithered their way out of the ocean (macro-evolution — defined as large and complex changes as in a species evolution)?

Because of my study of astronomy and the Bible, I have come to believe that whether God created man from clay in an immediate act, or programmed an amoeba to crawl out of the sea, or a prehistoric man to stand erect at an appointed time and evolve into a man, it was still God's creation.

That brings us to the question of who first created and programmed living things to evolve. To paraphrase a line from Carl Sagan's "Cosmos" series, before we can make an apple pie, or theorize about evolution, the universe needs to be created. That poses the next potential problem, which usually puts scientists and creationists on opposite sides of the fence.

The Big Bang theory, supported by exciting scientific data gathered from NASA Satellite COBE, is

consistent with creationism in that it hypothesizes the universe was created in a single cosmic explosion. "Explorer" detected the energy, or thermal radiation, left over from the moment of creation, which astronomers believe occurred approximately 20 billion years ago.

The account of creation according to Genesis 1:1, 2 states: "In the beginning God created the heavens and the earth. The earth was without form and void, and darkness was upon the face of the deep..." Similarly, Carl Sagan's description of the Big Bang hypothesizes that "...for unknown ages after the explosive outpouring of matter and energy of the Big Bang, the Cosmos was without form. There were no galaxies, no planets, no life. Deep, impenetrable darkness was everywhere, hydrogen atoms in the void" (Sagan, *Cosmos*, p. 281). The congruence between the Genesis account and the scientific explanation is astounding. I believe that the beautiful verse, "In the beginning God created the heavens and the earth..." was the description of the moment, or beginning, of the Big Bang.

With that primordial cosmic explosion, all the elements of our universe — all matter, as well as the physical and mathematical laws — were put into place. Imagine the highest superior intelligence in a dramatic command or commands casting forth his creation which contained the inherent ability to mold itself, forever stabilize itself, adapt and procreate, never straying from the disciplinary physical laws he gave to it. Of course, all matter in the universe continues to expand and move within those absolute physical laws.

In his "Cosmos" series, Carl Sagan charmingly stated, "We are all made of star stuff." What he was referring to is that every atom that ever existed,

existed at the moment of the Big Bang, but in different forms. The atoms that formed these creatures of clay called man were there also (Genesis 3:19).

Albert Einstein believed that the universe and all life forms were not accidents. "God does not play dice," he often said. But with the study of quantum mechanics came the discovery of the uncertainty principle which describes the unpredictable behavior of particles: both their position and velocity cannot be exactly computed. Scientists have interpreted this to mean that random chance played a part in the formation or evolution of matter and living things. But it seems reasonable that this divine "catch-22," the uncertainty principle, was designed and programmed into matter by our Creator for a reason. It obviously works — we and an immeasurable universe are the evidence.

The uncertainty principle did not shake Einstein's belief in his theory of relativity, or in his vision of an orderly universe. He regarded relativity as artistically beautiful and philosophically simple, in addition to being correct mathematically.

We cannot understand God without recognizing him not only as the original mathematician and scientist, but also as the first artist and philosopher, imparting beauty, harmony, and balance into his creation. To separate and discard some aspects of his personality would cause us to see only a partial picture of a whole concept. To leave beauty and design out of mathematics and physics, then, is as erroneous as it is to leave mathematics, proximity, and perspective out of art. Einstein knew this.

It was God's choice to create all matter the way he wanted to create it, in his own method, manner, and time. In our search for truth about his creation and evolution's role in it, we must ask ourselves if we are going to allow God to be God.

Theoretically, you cannot accept God as your Creator unless you accept him as the *only* Creator of *all things* (John 1: 1-3), which includes neanderthals, dinosaurs, and evolutionary processes. If God is the only author of the entire universe, then he alone created and programmed the evolutionary capabilities within all species. From a philosophical perspective, it is difficult to imagine that God would *not* give his creation the ability to adapt itself to its environment. It would have been the gesture of a loving parent equipping his "child" for the cold winter to come.

But Christians do not get to know God as the author of all biological processes taking place in the

universe by analyzing the total sum of scientific data. We have acquired only an infinitesimal amount of data; most is still to come and is for scientists to analyze. We know him as the sole author because, as Christians, we understand his character and nature as it is revealed through his Word. It is a matter of reason and faith that scientifically proven biological processes will never disprove the existence of their author. "Faith is the substance of things hoped for, the *evidence* of things not seen" (Hebrews 11:1).

Let's take a brief inventory here. So far we have invisible evidence of an invisible God credited with a creation that happened approximately 20 billion years ago. This is the kind of stuff that confounds the wise, but from a theological viewpoint it is the truth universal.

Though we will not agree with all scientific theories, the natural selection of micro-evolution is being taught in our schools and is still being studied and evaluated by scientists. Macro-evolution remains a theory. However, if these micro-evolutionary changes reveal God's methods of creation, they will actually allow us to witness creation in progress — an exciting thought.

If scientific facts do not validate God's Word or support his role as Creator, it is because there has been a misinterpretation on the part of scientific evidence and theory, or a misinterpretation of God's Word. The two factors, scientific evidence and holy scripture, must harmonize together because they are evidence of the same creation by the same Creator. The key is to stop worrying that scientists will produce facts we do not want to hear. That would be an impossibility — God would not have created a "house divided against itself." (Matthew 2:25) His universe and his holy Word will not contradict one another. It is mankind who is confused.

As we approach the turn of another century, the interpretation of scripture is probably still more challenging than the analysis of scientific data. The Bible is a history with some passages to be taken literally, some metaphorically, and some to remain veiled in mystery as to their meaning. For instance, a sheep herder who four thousand years ago lived in a tent and drew water from a well, might have had difficulty grasping the idea that it took billions of years for the solar system to form and the earth to become habitable. He had no frame of reference for such a concept. It was easier to say "let the waters under the heaven be gathered and let the dry land appear" (Genesis 1:9). This does not mean that God's Word is not accurate. It means only that the explanation

given at the time was perhaps epochal, covering different time eras in accordance with the people's understanding.

*Of old thou didst lay the foundation of the earth,
and the heavens are the work of thy hands,
They will perish, but thou dost endure,
They will wear out like a garment.
Thou changest them like raiment,
and they pass away... Psalm 102:25,26*

David wrote these words approximately three thousand years ago. Astronomers now know that all heavenly bodies, including our own sun, are born, live, and eventually die. Our sun has about five billion years left of its' main-sequence or active life cycle. It is estimated the earth will not be habitable 500 million years from now, during our sun's final stages, because it will eventually become a red giant, transforming even remote icy Pluto into a desert.

Scientists work diligently to prepare an orderly presentation of facts resulting from their systematic, organized observations. Their intentions are not to disprove God's existence but rather to form a hypothesis based upon the facts at hand. The Big Bang theory of creation, now accepted among scientists, is not necessarily in opposition to creationism. It has attempted to explain the origin of the universe from a scientific viewpoint, and for the first time in the history of man, has provided physical evidence for us to consider. This should be a time for celebration and for embracing further challenging study.

We cannot keep our children from the classrooms, or shield them from new scientific discoveries. (Nor should we!) Mankind will continue to seek for truth and to discover the mysteries of our universe, but the Holy Trinity will never be threatened by an earthly collection of scientists or scientific facts.

I believe any valid evolutionary process taking place in the universe, whether past or present, has been authored by God and is a planned part of his creation process. If we accept that he created all matter and all living things, then he likewise designed and created the inherent genetic ability within each species to evolve within the processes he planned.

The scientific facts of evolution and the Big Bang theory then do not oppose the idea of God's creative activity, but should give us further insight into his miracle of creation. We can, therefore, have confidence in our Lord Jesus Christ, who is able to stand up to all of the scientific scrutiny of all men, for all time.

The heavens declare the glory of God... Psalm 19:1,2 *

References

- The Holy Bible*, Revised Standard Version, Thomas Nelson, Inc., 1972.
Kirk D'Amico and Susan Lacy, *A. Einstein; How I See The World*, Videofilm Producers International, Ltd. and Lumen Productions in Association with WNET/New York, 1991.
Ken Crowell, "The H-R Diagram-Cornerstone of Stellar Astronomy," *Stardate*, McDonald Observatory Public Information Office, November/December Issue, 1990.
Billy Goodman, "Ancient Whisper," *Air & Space/Smithsonian*, Smithsonian Institution, April/May issue, 1992.
Stephen W. Hawking, *A Brief History of Time; From the Big Bang to Black Holes*, Bantam Books, Toronto and New York, 1988.
Donald H. Menzel and Jay M. Pasachoff, *A Field Guide to the Stars and Planets*, Second Edition, revised, Houghton Mifflin Company, Boston, 1983.
James Packer, A.M., D. Phil., Merrill Tenney, A.M., Ph.D., and William White, Jr., Th.M., Ph.D., *The Bible Almanac*, Thomas Nelson Publishers, Nashville, Tennessee, 1980.
Peter Rüst, "How Has Life and Its Diversity Been Produced?" *Perspectives on Science and Christian Faith*, American Scientific Affiliation, Vol. 44 No. 2, June 1992.
Carl Sagan, *Cosmos*, Ballantine Books, New York, 1985.
Carl Sagan, *Cosmos*: Episode 1; "The Shores of the Cosmic Ocean;" Episode 2; "One Voice in the Cosmic Fugue;" Episode 9; "Lives of the Stars;" Episode 10; "The Edge of Forever;" Carl Sagan Productions, Inc. and TBS Productions, Inc., 1989.
Webster's Ninth New Collegiate Dictionary, Merriam-Webster, Inc., Springfield, Massachusetts, 1989.
Daniel Whitmire and Ray Reynolds, "The Fiery Fate of The Solar System," *Astronomy*, April, 1990.

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The Death Penalty and Christianity: A Conceptual Paradox

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Public sentiment in the U.S. over capital punishment has undergone tremendous shifts over the past three decades. From 1966 to 1976 a complete moratorium on executions was observed. In 1966, forty-two percent of the American people supported the death penalty, but that number had risen to over 72 percent by 1988 (Walker, 1989). As public opinion shifted, so did the number of persons awaiting execution and the number of people actually being executed. After the 1976 reinstatement of the death penalty there were only six executions until 1982, when five persons were executed. This was followed by the execution of 21 persons in 1984 alone. The general trend in the 1980s was an increased use of the death penalty. The population of Death Row more than tripled over this same period, with close to 2500 people awaiting execution in 1988 in the 35 states which utilize the death penalty (NAACP Legal Defense and Education Fund, 1988; Greenfield, 1989).

Many believe that over the next ten years the number of death sentences and executions will continue to increase due to several 1980s court rulings and the exhausting of many appeals (Pulley v. Harris, 1984; Barefoot v. Estelle, 1983; McClesky v. Kemp, 1987).

These dramatic changes lead us to wonder what has changed about the public sentiment regarding capital punishment. Are society's members more thirsty for vengeance? Have the moral and ethical underpinnings of society been radically altered because of the fear of crime and the states' utilitarian agenda? (See Kappeler et.al. 1993 and Walker, 1989.) As academicians in sociology and criminal justice, we frequently encounter students, colleagues, the media and close associates with questions about the issues surrounding capital punishment. Our experience suggests that many people have opinions

about capital punishment based on their own feelings, experiences, knowledge and present situations. Though those who hold these opinions have a diverse set of what are, to them, salient reasons to criticize or defend capital punishment, often times their justification and/or rationalization is based on precepts that have no relationship to the issue of executing human beings.

The major arguments for and against the death penalty have included philosophies based on economics, retribution, deterrence, irreversibility, discrimination, cruel and unusual punishment, brutalization, and public protection (Inciardi, 1990). Walker (1989) argues that capital punishment is generally debated in one or all of three major areas.

- 1) The *constitutionality*; concerning state utility and judicial processing.
- 2) The *deterrent effect* of capital punishment both specific and general; a scientific question of whether one action (execution) brings about a desired reaction (a cessation of killing by the individual and the generalized dissuasion of the public to commit similar acts).
- 3) The *morality* of capital punishment; whether putting a person to death is, under any circumstances, morally just. (pp. 96-97)

The Supreme Court has not ruled on whether the death penalty is right or wrong for society, but only whether with regard to due process guarantees in the Eighth Amendment to the Constitution it is "cruel and unusual punishment" and/or discriminatory (Furman v. Georgia, 1972; Gregg v. Georgia, 1976). In a related case, Baldus, Pulaski and Woodworth (1983) found discriminatory sentencing continued in Georgia, where black defendants were eleven times more likely to be sentenced to death

for killing whites as whites were for killing blacks. In the case of *McKlesky v. Kemp* (1985), the court was asked to invalidate Georgia's capital punishment statute based on the new research evidence. The Supreme Court ruled that if discrimination was present, that it was at a "tolerable level." Thus, the questions dealing with the issue of capital punishment from a judicial and legal perspective do not address whether capital punishment is right or wrong, but only whether legal guarantees have been judiciously implemented.

Instead, the individual states have been left to decide the moral issue of right or wrong. The states, with the exception of just a few, have also failed to address the moral issues of capital punishment, except to further justify its application on constitutional legality. The legal arena is not a suitable forum for addressing the moral ramifications of capital punishment, and it is unlikely that it ever will be.

Proponents of the death penalty argue for its deterrent effect. They believe that not only can we evoke specific deterrence (that is, the offender will never be able to kill or otherwise offend again) but that, most importantly, the general public, after witnessing or having knowledge of an execution, will understand the state-imposed consequences for certain heinous behaviors and will therefore rationally choose to remove such actions from their behavioral repertoire. This argument is based on the theory of utilitarianism (Bentham, in Harrison, 1967, p. 26) which assumes that all of our decisions are calculated, and based on their likelihood of bringing happiness (pleasure) or unhappiness (pain). This theory claims that people weigh the relative probabilities of present and future pleasure against present and future pain as they make decisions. Described as "felicitous calculus," it argues that humans are constantly and rationally calculating their behavioral decisions. Economist Ehrlich and his colleagues made this argument (Ehrlich, 1975), which fell on responsive ears in the Supreme Court in 1976, where the *Gregg* decision (*Gregg v. Georgia*, 1976) was upheld. Ehrlich and his colleagues concluded that one execution would prevent seven or eight murders. Even though the Court was not deciding the merits of crime prevention, no doubt Ehrlich's research had a great impact on the Court's decision (Walker, 1994).

However, this line of reasoning only holds true if we assume that humans are totally rational beings and that those who take the life of another human being have, through premeditation, carefully weighed the consequences of their behavior. On the contrary, however, the majority of murders perpetrated in this society are not committed under rational cir-

cumstances. Instead, they are committed in anger, under the influence of drugs, under stress, retributively and psychotically (Walker, 1994).

Rather than deterring heinous crime, capital punishment may actually *encourage* some to kill. Bowers and Pierce (1980) contend that:

... the effect [of executions] is felt among a limited group of people who, independently, have "reached a state of readiness to kill," in the sense of having an intended victim already in mind. The legal execution conveys the message that vengeance is justified. (p. 483)

The deterrent effect is at best a weak argument for the death penalty. Even if we specifically deter an individual offender from committing crime through imprisoning them for life, in general the deterrent effect of capital punishment simply has little or no effect on "potential" murderers (Bowers and Pierce, 1980, Sellin, 1980). Furthermore, we would not have achieved any improvements in crime prevention or reduction.

Eliminating one offender who happens to get caught "weakens" public security by creating a false sense of diminished danger through definite remedial measure. Actually, it does not remedy anything, and it bypasses completely the real and unsolved problem of "how to identify, detect, and detain potentially dangerous citizens" (Menninger, 1977, p. 108).

Let us then move to the more central theme of this discourse which addresses the moral underpinnings of our society with regard to the death penalty. More specifically, how does supporting the death penalty square with a Christian value system which, for many in America, is the system that provides a moral framework for their social and individual choices?

A Conceptual Paradox

Our position is that the debate about the death penalty should be a debate of morality. The debate on the constitutionality of the death penalty is perennial, and the evidence to support the penalty's deterrent or preventative effect, with respect to crime, is questionable. Morality, however, is "concerned with the goodness or badness of human action and character" (Morris, *The American Heritage Dictionary*, 1975). Furthermore, how do the notions of vengeance and retribution equate with fundamental Judeo-Christian ethics and doctrine? Many who profess a Christian value system concurrently ex-

press their support for executions. According to Pollock-Byrne (1989):

Religious ethics have been used to support *and* to condemn capital punishment. Old Testament law supporting the taking of an eye for an eye is used by retentionists, while the commandment, "Thou shalt not kill," is used by the abolitionists ... It is a telling commentary that for as long as society has used capital punishment to punish wrong-doing, critics have defined it as immoral. (p. 140)

The idea of vengeance is not new, nor is it unique in any fashion. Roughly four thousand years ago the Hammurabi Code (1750 B.C.) prescribed specific punishments for Babylonia. Examples include:

- If a man knocks out the tooth of a man of his own rank, they shall knock out his tooth.
- If a son strikes his father, they shall cut off his fingers.
- If a man destroys the eye of another man, they shall destroy his eye.
- If a man of higher social rank destroys the eye of a man of lower rank, the man shall pay a fine.

(Allen & Simonson, 1989, p. 6)

Here it is interesting to note that the degree of vengeance was based on social standing (pick on somebody of a lower social class, and money would buy your pardon). This sounds strikingly familiar to our modern judicial system (Bonger, 1969, Quinney, 1970, 1974, 1980; Chambliss, 1975). We know of no theistic genesis to these Babylonian codes, only that they were created to mitigate family feuds. Feuds, however, escalated as increasing numbers of appendages were lost.

There are numerous examples throughout history of codes designed with vengeance in mind, whether the codes had secular or sacred beliefs as their basis — for example, the Koran or Roman Law (Allen and Simonson, 1989). Modern American society was more influenced by the Laws of Moses, the Old Testament rules of conduct and penalties. These laws were specific and vengeful, recommending executions and restitution, even for conduct that today may seem less than serious. (See Exodus 20-22.)

Do doctrines of Christianity support the retributive "eye for eye, tooth for tooth, tit-for-tat" remedies for addressing human problems? Present day Christian doctrine relies on the teachings of Jesus as recorded by his immediate followers. If patterning our lives after Jesus is basic to a Christian belief system, then his fundamental teaching would supersede previous Mosaic pronouncements. This is what was particularly problematic for the leadership of orthodox

Jewry at the time of Jesus. The Jewish religion's elite were critical of Jesus' teachings because they claimed that he was striking down the existent scriptures and blaspheming God by contradicting Abraham, Moses and God's other mouth-pieces. Nonetheless, Christ's response to the criticism was not to destroy the existing legal system (that is, to bring about a religious and political coup), but instead to introduce principles to fulfill the law. The Christian faithful should now "turn the other cheek," relegating the judgment of sinners and criminals (historically synonymous) to post-mortal judgment. Vengeance would no longer play a role in human interaction. Rather than espousing vengeance, which belongs only to God, Jesus introduced an alternative approach as a template for dealing with the human condition.

- Love one another and enemies. (Matt. 5:43-48, Luke 10:27)
- Go the extra mile. (Matt. 5:41)
- Do unto others as you would like others to do to you. (Like 6:31)
- Forgive. (Matt. 18:21-35)
- Killers will be in danger of God's judgment. (Romans 12:17-21, Hebrews 10:30, Matt. 5:19-22) (All references from KJV.)

To our knowledge, nowhere in the New Testament is there any reference to taking another human being's life as a prescriptively acceptable response to various infractions of Christian doctrine. Though public stoning, maiming and executing were the prescription of the Orthodox Jews and the Roman state, Christian precepts and doctrine are antithetical to these modes of recourse ("ye that are without sin cast the first stone"), because transgressions will receive judgment and processing by God after death.

What then of the individuals and organized sects of Christianity that today espouse support for state initiated executions and yet also profess a fervent belief in the teachings of their versions of Christian doctrine? Are these principles conditional — that is, relative with regard to social history, increasing crime rates, prison overcrowding, deterrence or constitutionality? Is capital punishment in diametric opposition to a Christian belief system? Looking at the New Testament, it seems to us that it is difficult, if not impossible, to be a proponent of both.

Why then do so many support the death penalty? Of the over 72 percent of the population (Walker, 1989) in favor of the death penalty in the United States, how many simultaneously profess a Christian belief system? It is difficult to know, though it is interesting to observe that many individuals structure their mental framework for making sense of

the world to reconcile this paradox in their mental constructs. Perceiving themselves as principled, and indeed with good intentions, they nonetheless may be cognitively dissonant (Hoffer, 1951, Festinger and Schachter, 1956). You see what you want to see, hear what you want to hear, and then call it truth. Humans have an extraordinary capacity to neutralize cognitive conflicts so that they may ceaselessly continue to justify a wide array of behaviors while condemning these behaviors in others (Sykes and Matza, 1957). Rather than adhering to any particularly concrete principle which may be difficult to follow, humans would typically prefer to re-interpret their principles and beliefs to square with their existing lifestyles and mental structures of reality (2 Corinthians 10:12-13). That is, instead of altering their beliefs and morals to conform with a pre-defined doctrine, many people would rather redefine the *situation* so that distressing personal change can be avoided and their present attributes of attitude and behavior may consistently be retained. Thus, individuals rid themselves of personal responsibility for injustices and institutionally violent behavior by rationalizing and assimilating conflicting values. Proactive growth and dynamic processual change are abandoned for value-altered dogma. This self-serving, myopic dogmatism is the very stuff of which prejudice, hate, fear, and violence are made.

What is behind such vindictiveness? Certainly not Christianity, not Judaism, nor indeed any religion! And yet certainly not specific hatred! And surely not an expectation of eliminating crime! ... Today criminals rather than witches and peasants have become the official wrongdoers, eligible for punitive repayment. Prosecuting attorneys have become our agents, if not God's, and often seem to embody the very spirit of revenge and punishment. They are expected to be tough, and to strike hard. (Menninger, 1977: p. 193)

We suppose as a nation and society that we have the prerogative to engage in any conduct held to be for "the good of society" while dissonantly we espouse vengeance and justify this by "saving grace" as our forgiver of poor decisions. Punishment of any form is a moral issue, not a political, judicial or scientific issue (Menninger, 1977). If the problem of society is a lack of moral fiber, perhaps we should consider *not* relinquishing the greatest portion of our socialness, with commensurate social bargaining, to political, judicial, and sectarian authorities who have a vested interest in usurping power, control, and death over others (Mills, 1956; Chapman, 1971).

Our existence as social beings is dependent on our ability to actively filter and critique social and

legal conventions. However, we have stopped choosing to try to resolve community and social conflicts and making moral determinations, giving these responsibilities to our legal system. This is evidenced by the tremendous backlog of cases pending because time is spent by a legal system attempting to solve moral and ethical issues (e.g. class actions, affirmative action, abortion, gambling, pornography issues, and small claims actions among individuals who are unable or unwilling to settle minor disputes which are basically grounded in a lack of honesty or integrity by one or both parties).

The legal system does not and cannot address morality, nor can morality be legislated, unless a large social consensus already exists. The legal system of any nation may only reflect social morality in an attenuated fashion to social realities, and very probably can never keep pace with social morality. Should a legal system attempt to dictate morality, it will be destined to fail, because legal systems do not inherently deal with right and wrong, but only with legal and illegal matters. The morality of society's social norms is actively changing. The law should reflect these changes. However, if the law attempts to *dictate* these norms rather than serve them, it will become ineffective and brutal.

It is unfortunate that many of society's participants ask only if a given behavior omitted or committed is *legal*, reasoning that if it is legal, then it is right and justified. It is clear to us that to maintain a consistent belief in Christianity is antithetical to supporting vengeful punishment and capital executions. These two positions cannot conceivably be joined together, except by a re interpretation of the positions to rectify the cognitively dissonant conflict.

Each of us are continually at the crossroads of moral dilemmas and legal exigencies about many perplexing issues of human affairs. It seems clear that the concept of death by state-sanctioned executions is in no way reconcilable with a Christian belief system. It seems more likely that it is a matter of confusing law with morality, and of the re-interpretation of personal morals to coincide with contemporary law and popular public opinion. *

References

- Allen, H.E. and Clifford E. Simonsen, *Corrections in America*. Macmillan Publishing Company: New York. 1989.
- Baldus, D., C. Pulaski and G. Woodworth, "Comparative Review of Death Sentences: An Empirical Study of the Georgia Experience," *Journal of Criminal Law and Criminology*, 74: 661-678. 1983.
- Barefoot v. Estelle, 103 S.Ct. 3383. 1983.
- Bonger, W., *Criminality and Economic Conditions*, abridged edition. University Press: Bloomington, Indiana. 1969.

- Bowers, William J. and Glenn L. Pierce, "Deterrence or Brutalization: What Is the Effect of Executions?" *Crime and Delinquency* 26 (October 1980), 453-484. 1980.
- Chambliss, W., *Criminal Law in Action*. John Wiley and Sons: New York. 1975.
- Chapman, I. *The End of Free Inquiry: A Study in Reality Construction*. Ivan Chapman: Stillwater, OK. 1971.
- Erlich, I. "The Deterrent Effect of Capital Punishment: A Question of Life and Death," *American Economic Review* 65:397-417. 1975.
- Festinger, L., Reicken, H.W. and Schachter, S. *When Prophecy Fails*. University of Minnesota Press: Minneapolis. 1956.
- Furman v. Georgia, 408 U.S. 238. 1972.
- Greenfield, Lawrence A., *Capital Punishment*. U.S. Department of Justice Bulletin: Washington, D.C. 1989.
- Gregg v. Georgia, 428 U.S. 153. 1976.
- Harrison, Wilfred, ed. Bentham, J., *A Fragment on Government and an Introduction to the Principles of Morals and Legislation*, Basil Blackwell: Oxford. 1967.
- Hoffer, Eric. *The True Believer: Thoughts on The Nature of Mass Movements*. Harper and Row: New York. 1951.
- Inciardi, James A. *Criminal Justice*, 3rd edition. Harcourt Brace Jovanovich: New York. 1990.
- Kappeler, V.E., M. Blunberg and G. Potter, *The Mythology of Crime and Criminal Justice*. Waveland Press: Prospect Heights, Illinois. 1993.
- McKlesky v. Kemp, 478 U.S. 1019. 1985.
- McCleskey v. Kemp, 41 CrL 4107. 1987.
- Menninger, K. *The Crime of Punishment*. Penguin Books: New York. 1977.
- Mills, C.W., *The Power Elite*. Oxford University Press: New York. 1956.
- Morris, William, ed, *The American Heritage Dictionary*. Houghton Mifflin Company: New York. 1975.
- NAACP Legal Defense and Education Fund, *Death Row, U.S.A.* NAACP: New York. August 1988.
- Pollock-Byrne, J.M., *Ethics in Crime and Justice: Dilemmas and Decisions*. Brooks/Cole Publishing: Pacific Grove, California. 1989.
- Pulley v. Harris, U.S. Sup.Ct. 34 CrL 3027. 1984.
- Quinney, R., *The Problem of Crime*. Dodd, Mead: New York. 1970.
- Quinney, R., *Critique of the Legal Order: Crime Control in Capitalistic Society*. Little, Brown Co.: Boston. 1974.
- Quinney, R., *Class State and Crime*. Longman, Inc.: New York. 1980.
- Sellin, T. *The Penalty of Death*. Sage Publications: Beverly Hills, California. 1980.
- Sykes, Gresham M. and David Matza, "Techniques of Neutralization: A Theory of Delinquency," *American Sociological Review* 22: 664-670. 1957.
- Walker, S. *Sense and Nonsense About Crime*. Brooks/Cole Publishing Company: Monterey, California. 1989.
- Walker, S. *Sense and Nonsense About Crime and Drugs*. Brooks/Cole Publishing Company: Monterey, California. 1994.

Book Reviews

Editors' Note: We apologize for this issue's short book review section. Our next issue will include our usual wide selection of books.

GUIDE TO SCIENCE AND BELIEF by Michael Poole. Oxford, England; Batavia, Illinois: Lion Publishing Corporation, 1990. 128 pages. Paperback.

This is a remarkable little book by Michael W. Poole, Lecturer in Science Education, King's College London. I cannot avoid a personal endorsement: how often does one pick up an eminently readable, attractive book on science and Christian faith with which one is in one hundred percent agreement? This book could be used as an extended description of the major positions of most of the members of the American Scientific Affiliation.

In an especially attractive style for the nonspecialist reader, the book combines a pithy but profound text, numerous quotations from thinkers and leaders, and outstanding graphic art work on every page. Thus the book appeals to both the mind and the eye simultaneously. The book touches on every major topic that characterizes the interaction between science and faith: understanding the insights that we obtain both from science and from theology based on the Bible, comparing the different kinds of inputs that we receive from these two insights, a popular but critical treatment of the nature of explanation and how it applies in the two disciplines, the relationship between faith and evidence, miracles, the importance of using the proper language, the Galileo affair, evolution and creation, and the relationship between design and chance.

Don't let the brevity of this review put you off! Rush out immediately and give a copy of this book to all your children and grandchildren, to all the high school and college students that you know, and to your church library. Put it into use in your church high school, college and careers, and adult education programs. It's good.

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

UNDERSTANDING THE PRESENT: Science and the Soul of Modern Man by Bryan Appleyard. New York: Doubleday, 1993. 269 pages, index. Hardcover; \$23.50.

This book, written by the science columnist for the *Sunday Times*, seeks to show how science has shaped the western world and extricated man's soul from his existence. The book has three basic sections: the historical development of science and the ensuing philosophies, modern science, and reclaiming the self. The index is supplemented with a helpful glossary that clarifies the author's use of some terms.

Appleyard's main thesis is that science has extricated the physical mechanism from the meaning of life. The author identifies many aspects of modern society that support his thesis and presents these ideas in a lucid and well-structured manner. This is an excellent book for those wanting a critique of the influence of science on society.

The first chapter examines the effectiveness and prestige of science and how this has led to the implicit claim that science alone can solve the world's problems. Science's powers of explanation and technological effectiveness is implicated in developing an uncritical faith in scientific conquest. This continual conquest is seen to make moral and spiritual convictions increasingly difficult to sustain. "Science-based liberal democracies, therefore, tend toward a unity of unbelief" (p. 10). Appleyard sees the resultant society as both liberal and pessimistic, as evidenced in the modern art theme of man alone, lost, and searching.

Having set the argument, Appleyard surveys the historical development of science, emphasizing the expulsion of God from the scientific realm. Science's increasing determinism is said to leave man with a sense of solitude at "how lost we were, how small, how insignificant." To counter this perspective all humans are seen to have a religious dimension. Appleyard argues that science originated from a Christian society because only the Christian mind set was akin to that required for scientific analysis: a divine order, the study of parts, and Protestantism's emphasis on reason rather than authority.

The next section introduces modern science and the ensuing technology. The scientific excesses fostered by an ivory tower mentality, the horrors of technological warfare, and pollution reveal science as an "uncontrollable extension of the human will to destruction" (p. 108). Environmentalism is suggested to have risen in reaction to this, coupled with the finding that all of creation is intricately interconnected.

Appleyard claims that the combination of the destruction that science is capable of and the fall of classical science have stripped science of the prowess previously ascribed to it by society. Society can no longer understand the new science since quantum theory and relativity both appear to oppose common sense. The author argues that the indeterminacy of quantum theory, relativity, and chaos theory have led to a variety of theories that attempt to graft meaning and significance on modern science.

Others have sought to humanize science by focusing on technological benefits. "We can cope with the cold otherness of science by humanizing it into products and opportunities" (p. 161). But many of these products cannot be understood by the layperson, which introduces an element of mystery in a culture desperate for an escape from the realm of scientific explanation. Appleyard offers the success of the genre of science fiction as but one example of this manifestation in society.

The third section, "The Assault on the Self," begins with the argument that a completely mechanistic psychoanalysis is intrinsically impossible. While science has provided bounteous explanations of creation, science has proven incapable of informing mankind of who we are. In fact, science excludes the self from the very mechanistic picture that science develops. Appleyard posits the Christian doctrine of soul and body and the uniqueness of self-consciousness among the animal kingdom as argu-

ments for the identity of the self. Appleyard goes on to argue that the soul has recently emerged battered trying to stabilize itself through self-cultivation, exercise fitness and other forms of individualism found in today's society.

The book concludes by restating that modern societies are science-based and that this science is an inadequate guide for human life. Appleyard examines the way in which society wrestles with moral issues and concludes that moral issues cannot be resolved in a liberal society and that all such issues will eventually favor a scientific world view. Appleyard examines some of the attitudes in current society that reflect liberal thinking — the lethargy of students (re: Allan Bloom), political correctness — and concludes that liberal society is deteriorating. The book closes with a call to reclaim the soul, and humble science to its proper place.

The author surveys the current social malaise and provides examples to support his view that science is the culprit. The author often approaches topics in an insightful manner. He implies, for example, that the Galileo controversy was strongly influenced by perceived threats to transubstantiation. The author makes a strong case for science duping society that ASA members will find lucid and thought provoking.

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

THE SCIENCE AND THEOLOGY OF INFORMATION by Christoph Wasserman, Richard Kirby and Bernard Rordorf (eds.), Labor et Fides, Geneva (1992).

Information has become an important concept in recent years as computers have led to an equating of information processing and intelligence, and thus to seeing humans as one instance of the genus "information processor." This book is the Proceedings of the Third European Conference on Science and Theology held in Geneva, March 29 - April 1, 1990, which discussed information from a Christian perspective.

Most of the contributions are in English, with several in French and one in German. The material is organized, as was the conference, into a series of plenary lectures (Information and Creation, Sciences *exactes et verite*, Biological Information — Its Origin and Processing) and workshops with several participants each (Information and Hermeneutics; Models and Metaphors as Carriers of Information; The Evolution of Coding Systems and their Interpretation, and Information in Biological Systems; Artificial Intelligence, Human Intelligence and the Intelligence of Faith; Information in the Emergence of Societies and Religions; The Constructive and Destructive Power of Information; Miscellaneous Topics).

As is frequently the case with such volumes, the contributions vary in style and significance. The material here

clearly represents the results of a working meeting rather than final elaborately-articulated positions. For example, some of the various participants even have different working definitions of the term "information." In spite of this, the collection of material as a whole is stimulating to read and to think about but difficult to summarize here.

Perhaps more importantly for readers of this Journal, the conference reported in this volume was the first one organized by the relatively newly created (in 1989) European Society for the Study of Science and Theology. A group with this name will doubtless address issues of interest to *Perspectives* if it continues to be active, and we can hope for continued reports like this one.

Reviewed by David T. Barnard, Queen's University, Kingston, Canada.

COUNTERTRADITIONS IN THE BIBLE: A Feminist Approach by Ilana Pardes. Cambridge, MA: Harvard University Press, 1992. 156 pages, notes, bibliography, index. Hardcover.

This short book presents an analysis of selected Old Testament matriarchs, with an emphasis on those who demonstrate the variety of voices present in the biblical text (Pardes calls this heteroglossia). The book's purpose is not to create a "feminist manifesto." As Pardes states in her conclusion, her purpose is to show that "if we avoid patriarchalizing or depatriarchalizing it [the Bible] and defy comfortable categorizing of the biblical stance on gender issues, then unknown reaches of the past may open out before us, revealing faded figures of female precursors who, through their very otherness, have the striking capacity to add much color and intensity to our own lives." Pardes is also not afraid of "hard" texts: the women selected are Miriam, Eve, Rachael and Leah, Ruth and Naomi, Zipporah, the Shulamite in the Song of Solomon, and Job's wife!

Pardes is a Hebrew scholar and teacher at Princeton University. She is very well informed regarding Middle Eastern culture, higher criticism, and psychoanalysis as well as with previous feminist attempts to interpret the Bible. Her knowledge of Hebrew is to my mind the most important reason why she is so well qualified to write on this topic. Pardes is a strict constructionist. By analyzing the original language she illuminates the meaning and shows how the various texts she has selected are thematically connected. For example, in her analysis of the naming of Naphthali (*Naftuley Elohim*: a wrestle with God) she draws a parallel between Rachael's struggle with Leah over having children and Jacob's struggle with Esau over obtaining and keeping the birthright (Genesis 30:8 vs. Genesis 32:28). For this reviewer this parallel really makes Rachael and Leah come alive as human beings.

The book has many strengths. It is short and easy to read. There are almost no mechanical errors. But it is not

superficial. The portrait of each woman is clearly drawn and each argument for heteroglossia is clearly presented. The views of other feminist writers that she considers inadequate, such as Elizabeth Stanton and Phyllis Tribble, are given fair treatment. The Hebrew text is analyzed very convincingly. However, she states unequivocally that the God of the Bible is male. Thus she will disappoint feminists looking for fuel for their fires. She will also disappoint evangelicals who wish to avoid facing the types of textual difficulties Pardes presents.

Countertraditions in the Bible is not an evangelical treatment of the biblical record. Pardes' Bible is "far more of a heteroglot text than [even] higher criticism would have it." How so much heteroglossia came to be incorporated into the canon baffles her; she expresses her surprise at its inclusion by the statement, "the watchmen of Holy Writ could not fully prevent the admission of ideologically alien voices with the canon, especially those other voices which filled (unconscious) needs in the biblical array."

Yet I believe Pardes' evidence for heteroglossia cannot be ignored. The findings of higher criticism do contain some validity. God as presented in much of the Old Testament does seem to be a different God than the Father of our Lord Jesus Christ. However, if we can accept that the heteroglossia of the Bible is the direct and intentional result of the moving of the Holy Spirit (II Pet. 1:21), then I believe that the female figures of the Old Testament will open out before us, revealing gloriously colored personalities who, through their differentness from the primarily male tradition, will add much depth and intensity to our understanding of God's purpose for our lives and for the world.

Reviewed by Elizabeth M. Hairfield, Professor of Chemistry, Mary Baldwin College, Staunton, VA 24401.

REACHING A NEW GENERATION by Alan J. Roxburgh. Downers Grove, IL: InterVarsity Press, 1993. 140 pages. Paperback.

The author is director of the Center for Mission and Evangelism at McMaster Divinity College in Hamilton, Ontario. He has also directed an urban-based residency training program and was for nine years pastor of Danforth Baptist Church in Toronto. When he became pastor the congregation had dropped from 400 to 30. In a few years it had grown to 240 people in several congregations.

Roxburgh builds his study around a health food store named the Big Carrot, which was located near his church. Later, Carrot Commons was built across the street from the store. Roxburgh observed that these businesses were prospering while his and other city churches were losing members. His response was to visit the Commons frequently and get acquainted with the patrons. He soon realized that these people were interested in making the world a better place, especially with regard to ecology.

The health food store and related businesses were able to bring people together who had common interests. The result was the building of a community that met many of the needs of the patrons — protection of the environment, the search for community, and empowerment. The patrons and the owners were building an ecologically superior way of life.

This community's change in consciousness perceived the church as part of what must be *rejected* in the name of hope, survival and transformation. This world view is traced back to the fathers of modernity—Bacon, Descartes, Newton and others. Gradually these intellectuals rejected the answers to life as given by tradition and religions. Instead, reasoning was seen as the route to knowledge. "Wherever we look in the world of modernity, the church struggles to redefine its place in a culture that appears to have dismissed it as irrelevant."

Roxburgh says that we need churches whose people have invested in a common cause bigger than themselves. The life of Christ given for the life of the whole world is the church's most powerful response to the search for transcendence.

The epilogue, "Evangelism in a Time of Change," repeats the author's conviction that the improved world people are searching for has not been achieved by the church, government, or society. But it is a worshipping church that "will evangelize our culture." And evangelism, or congregation building, will succeed only if the local church understands the context. By developing contextualization, the church may discover a worship that speaks to the people outside the walls of the church building.

The book is well written, but references to many philosophical ideas make it somewhat difficult to follow. Also, the various arguments obviously lead to chapters seven and eight, "Community: Making the World Whole Again," and "The New Spirituality: Quest for Transcendence," but in terms of congregational guidance there were few concrete suggestions. The book seems best suited to a college or seminary class in missiology.

Reviewed by Ralph C. Kennedy, Professor Emeritus, John Brown University, Siloam Springs, AR 72761.

Letters

Wiester's "Real Meaning of Evolution"

John Wiester's writing in his Communication, "The Real Meaning of Evolution" (*Perspectives* 45:3, p. 182-186) sounds rather similar to that of the young earth creationists I assume he'd criticize. He feels that teaching "evolution" is equivalent, in the public mind, to teaching that humans came about through "purposeless, unguided processes," and he finds this offensive. While I agree that too many non-theistic science popularizers do incorrectly equate "random" with "unguided," I must disagree with Wiester's apparent objection to the appeal to chance and random processes in the teaching of evolutionary theory.

Should teachers explain the hydrologic cycles as being guided by God's hand? If rather they give purely mechanistic explanations for evaporation, condensation and precipitation, do they not in effect teach that no God need be invoked to explain rain? According to Wiester's analysis this would be equivalent to preaching atheism. There is no direction or purpose evident in the track of a hurricane to which a meteorologist need appeal, yet God directs the storm. In the chemist's description of the reaction of two substances in a test tube, should she refer to God's hand on each molecule, or to thermodynamically random molecular collisions, driven to create, by chance, a resulting new chemical? If she chooses the latter, does she promote atheism? Statistically random, or "chance" processes are no less under God's control than ordered ones, though both Christians and atheists err and assume the opposite.

In my explanation of electromagnetic waves, should I speak of God's guidance and driving of each photon? I

presently explain how each of Maxwell's equations was derived from empirical observations and describe how electrons behavior make no appeal to God's direction of those particles. I can, and generally do, say that I personally believe electrons behave the same way today as they did in 1870 because God made them and has not seen fit to alter their properties, but is that statement necessary lest I propagate atheistic beliefs?

This same argument can be made for all scientific theories and how they are taught. Why is evolution so different from theories of electromagnetics, chemistry or gravity that we must specifically address the design hypothesis, as Wiester seems to advocate? Is this the last gap, whose filling will disprove God? But how could anyone ever prove God, and humans still have free will? And why is this gap so much deadlier than any other which science has apparently filled? As Christians and scientists, we do both theology and science a disservice if we insist that this gap be treated differently — we concentrate Christian efforts on a small point irrelevant to salvation, and we drive scientists further from God by requiring that they deny evolutionary theory in order to be saved.

I believe the same thermodynamically random processes occurring in a chemist's test tube drive the evolution of life. God is no less involved in the chemistry inside a biological cell than he is in the test tube. The chemist does not appeal to God in her explanation of a reaction — why must the biologist? That science can be understood and taught "though God be not given" is not something to be fought or feared by the Christian community. Let us rather continue to proclaim the God of all creation, whose pres-

ence is clear in all its processes for those who have eyes to see.

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Is Fisher's Search Misdirected?

Dick Fisher's inventive "In Search of the Historical Adam: Part I" (December 1993) presents solutions to perceived difficulties in biblical interpretation. Unfortunately, his constructions create grave new problems. Some minor vagaries spring from the single-minded pursuit of an obsession, like the production of nomadic Nodites (245), when a simpler reading refers *nod* to Cain's wanderings.

More serious complications require overlooking major consequences following from the "solution." For example, if Adam lived about 5000 B.C., then Noah must be dated approximately a millennium and a half later. If he lived in Mesopotamia, Ur, Kish, Erech and other communities were already in existence.

It would take at least ten-cubits of water to float a loaded vessel the size of the Ark. To this must be added the rise to reach the level where the Ark was built, plus enough additional depth to avoid grounding it on every hillock along the bank. That this is possible seems evidenced by the "flood deposits" at Ur and Kish, although a great inundation should have left a single more widespread layer of sediment. Further, the deposits may be, not the result of floods, but of shifts in the river channel. Neither of the two at Kish appear to be contemporary with the one at Ur. Even discounting this and positing a new channel to float the Ark, such a massive flow of water would carry the Ark downstream, southward into the Persian Gulf, not northward toward the mountains of Ararat. In addition, building and stocking a huge vessel seems ridiculous when, on Fisher's interpretation, a short trek would have put everyone safely out of reach of any reasonable flood crest. The Zagros Mountains (ancient Elam, from the Accadian word for highlands), along with their northern extension, are within a hundred miles of the ancient Tigris. There are also hills nearly as close to the Euphrates.

The original settlers of the Americas came long before 3500 B.C., for the Bering land bridge closed more than 8,000 years ago. How, then, can aboriginal Americans have flood legends? Additionally, the geographic isolation of Australians, like Americans, long precedes Fisher's date for Adam. They can, by descent from the same remote ancestor as Adam, be of one blood. But what are the theological consequences of having no part in the Adamic or Noahic covenants? How were they made sinners by one

man's disobedience (Romans 5:19, see also vv. 12, 15-18)? This seems to go beyond legislation to condemnation without representation.

If, as Fisher claims, Adam merely had a special mission given to him (p. 245), using *bara*, create, to describe this (Genesis 5:1) seems grossly excessive. Further, if Adam was only one of a large number of *Homo sapiens sapiens* alive at the time, could not God have communicated an adequate sense of this mission to a contemporary woman? Did he have to miraculously produce Eve to meet the need? Were all human females too stupid to catch on when God did the explaining? Also, why did God parade the animals past Adam in search of "an help meet for him" (2:18-20)? Would he imply that *Equus asinus* was a better candidate than any of the many available female *H. s. sapiens*?

On the other hand, if Adam were a distinct creation in the midst of a population which merely looked like him, we have a reason for Eve not being a woman from the surrounding peoples. But then Adam cannot be their representative, for he does not have the proper kinship. In this case, it is not merely the distant Americans and Australians who do not fall under Adam's hegemony. Today we cannot tell which of us is of pure Adamic descent, of mixed Adamic descent, and of non-Adamic descent. If the last class are to be saved, we need to totally rethink soteriology. Indeed, the hybrid class seems to produce problems enough.

In addition, unless Adam was severely retarded, how could he be so ignorant about clothing that God had to provide a covering? And why, coming from a long-established culture, would Adam have to name all the beasts and birds? None of this rings true.

Finally, the same issue of *Perspectives* contains Edwin Yamauchi's "Metal Sources and Metallurgy in the Biblical World," which notes that Mesopotamia has no gold sources (p. 257). Yet Fisher, citing the Biblical reference, writes that one of the rivers of Eden was located where gold was abundant (pp. 248f). This underscores the problem of uncritically locating the Garden of Eden in Mesopotamia, the traditional spot, while revising so many other notions.

I appreciate Fisher's attempt to look at matters in a different way. Such a novel approach is necessary to solve the problems of which we become aware. It was Nobel laureate Albert von Szent-Gyorgyi, I think, who said that we have to look beside problems to solve them. A new look is certainly somewhat askew in order to reformulate matters so that unanticipated solutions emerge. But the revised view must be comprehensive, broad enough to encompass all the evidence. Tunnel vision like Fisher's cannot produce the desired results.

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American Scientific Affiliation

1993 Annual Report

Report from the President

It is an astonishment to me that my year of being the President of ASA is over. What an honor it has been for me to serve with the other elected members of the Executive Council through the several levels of service to the ultimate role as your President! These years have been challenging and a privilege that our Lord extended to me, and I deeply appreciate his confidence in me.



This year has been one of transition. Presently we are prayerfully considering the many applications submitted for the position of Executive Director. Bob Herrmann will be retiring in 1994, and to replace him in the capacity of Executive Director is a formidable task. Bob has faithfully served ASA for over thirteen years. We truly are indebted to him for his devoted and exemplary efforts in motivating the growth of our organization both nationally and internationally. His excellent scientific credentials and sincere innate personality have been great assets for ASA.

Our talented and sparkling "W.O.E. is me" editor and author, Walt Hearn, officially retired from the Editorship of the *Newsletter* at the excellent and stimulating 1993 Annual Meeting in Seattle. There was an enthusiastic retirement reception following the "formal" presentation of an engraved Revere bowl and an original hand-painted T-shirt, which expressed a portion of our deep appreciation for his tireless efforts for excellence and dedication in writing. Dennis Feucht accepted the editorial torch for the *Newsletter* from Walt and already is making his mark on it.

In reference to some business items which were given consideration at the August and December Executive Council meetings, a number of proposals were investigated and discussed. It was proposed and accepted that ASA should join the Evangelical Council for Financial Accountability in the near future. Also, an endowment program is being set up to benefit both our members and our organization.

The T.V. series, "Space, Time and God," is still very viable, and we are seeking the required funding to produce it for public television from foundations, corporations and individuals.

Lastly, the African Institute for Research and Development (AISRED) continues to be a very important part of our Christian stewardship. We endeavor to aid our African brothers and sisters in Christ by sharing our scientific expertise, assistance and encouragement, equipment, journals and books, financial support and especially our prayer support. There is a great need for scientific credibility and Christian idealism to arise in Africa to address the tremendous problem now faced by this emerging Third World area. Ken Dormer will continue to represent ASA with AISRED.

ASA is a vital link between scientific know-how and our Christian belief. We have an obligation to share our faith in the Lord

(Continued on next page)

Report from the Executive Director

Despite the many "snow days" in Ipswich in the early part of 1993, we have seen some real progress in ASA's plans and programs. Near the top of the list for praise and thanksgiving has to be the current progress toward funding our long-awaited PBS television series, "Space, Time & God." We signed a contract with a New York fund-raising company to work with Owen Gingerich and Geoff Haines-Stiles, as narrator and producer-director, respectively, to raise \$3 million over the next three years (and hopefully much sooner). We are overjoyed that Geoff, who, with Owen, brings tremendous credibility to our proposal, has committed to working with us to bring this 6-part series to public television and its wide and educated audience.



As you know, this busy contract-writing and contract-approval period has also been a period of recruitment. Walt Hearn has phased out as Editor of the *Newsletter* over the course of 1993, and we are delighted to have Dennis Feucht, long-term ASA member and Fellow, and busy research and development engineer, phase in over the same period as our new *Newsletter* Editor. Dennis has already been busy establishing a network of correspondents to supplement his own news-gathering abilities.

Some recruiting has also gone on for the Executive Director's position. We've talked to several Christians with ability and fine personal qualities, but as of this writing, the right mature scientist with ASA or ASA-like administrative experience has eluded us. For that reason, and because so much has been happening in ASA lately, I suggested to the Council that I stay until the middle of 1994, with the plan to have my replacement on board by summer 1994, and for me to provide some guidance until the end of the year. In the meantime, I continue to seek out prospects and refer the promising ones to the Executive Council.

Both Walt and I plan to have continued contact with ASA. Walt will work with the Committee for Integrity in Science Education and our current book project, *On Being a Christian in Science*. The Committee has also just completed the fourth printing of *Teaching Science in a Climate of Controversy*, this time with special thanks to John Wiester for an added classroom exercise emphasizing the need for careful fossil classification and critical thinking.

My special interest will be directed toward the projected TV series, and I also hope to provide liaison with Templeton Foundation projects of interest to ASA. As you know, I have been impressed with John Templeton's concept of humility theology, convinced that any meaningful dialog between science and theology must begin with spiritual renewal. Both scientists and theologians carry far too much baggage, which hinders open discussion and exploration!

I am happy to report that several ASAers have been involved in our university lecture program in the past several months;

(Continued on next page)

Zipf, continued from page 70

Jesus Christ with our secular colleagues, the general public and our loved ones. Our Christian beliefs should not be concealed within our hearts so as not to offend others or embarrass ourselves. The gospel of salvation is to be shared openly and lovingly. That is the reason that the Lord Jesus calls us to be his. We are to be obedient and to follow his example to serve. May our dear Lord bless you and keep you as you daily follow him and obey his marching orders: "commit thy way unto the Lord; trust also in him; and he shall bring it to pass (Psalm 37:5).

Elizabeth M. Zipf, Ph.D.
President, ASA Executive Council

Herrmann, continued from page 70

Howard Van Till at Yale with Langdon Gilkey (Templeton Lectures), Howard again at the AAAS meetings in Boston, myself at Loma Linda (Boucek Award), Lewis Bird with Dale Matthews at Buffalo (Templeton Lectures) and Armand Nicholi (The Kurt Weiss Memorial lecture) at Oklahoma. In May 1993, John Polkinghorne and Tom Torrance gave Templeton Lectures at Princeton and Loyola College of Maryland, respectively (Cosmos and Creation Conference).

This past summer we co-sponsored two additional Templeton Lectures by John Polkinghorne in Oceania — one in Australia and one in New Zealand. In the early fall, Owen Gingerich lectured at Indiana University and Van Till and Gilkey had a "repeat performance" of their joint lectures at Notre Dame, co-sponsored by the Philosophy Department.

In October I lectured at the Universities of Ottawa and Toronto (CSCA Annual Meeting), and David Larson lectured at Colorado Springs at a research conference co-sponsored by Focus on the Family.

I am excited about this lecture program, and deeply appreciative of Sir John Templeton's support of much of it. I believe this is what ASA is about: opening honest dialog with the scientific and theological communities.

I am also grateful for the work of our Ipswich office, especially for a great Annual Meeting and the post-meeting Alaska tour this past summer. We thought the whole thing came off in grand style, with Walt Hearn's "retirement party" as the high point. The Northwest's scenery was breathtaking, and the Alaska south coast's whales and glaciers and quaint fishing towns a joy to behold amid delightfully warm temperatures. (The natives said to come back again and see the *real* Alaska — cold and rainy.)

Many thanks to Program Chair Joe Sheldon and Local Arrangements Chair Karl Krienke for putting together an excellent meeting program. Cal De Witt's lectures were superb. There were over forty papers and posters on the program, and the glimpses of Olympic Peninsula and Mount Rainier memorable.

Many thanks, too, to member Ken Olsen of Lincoln, Mass. for a gift of \$50,000 for new office computers and networking, which we are in the process of installing in the Ipswich office.

R. L. Herrmann
Executive Director

1993 ASA Approved Budget : Summary Form

Income

Operating Income:

Dues	75,000
Subscriptions	20,000
Member Contributions	100,000
General Sales, Annual Meeting, Misc.	72,700
Project Overhead	32,400

Operating Income Total 300,100

Expenses:

Operating Expense:

General Office & Salaries	209,779
Budgeted Program Expense	88,450

Total Operating Expense 298,229

Special Projects Income:

T.V. Series	31,996
Templeton Lectureship Series Yr. 2 & 3	90,500
Teaching Science Project	0
Book Project: <i>On Being a Christian in Science</i>	32,500
CHT Newsletter (RLH)	56,670
London Lectures (RLH)	49,057
Humility Theology Contest (RLH)	168,240
African Res. & Devel. Inst. (Proposal)	85,600
Endowment Fund	1400
Who's Who Project (RLH)	0
Special Projects	0

Total Projects Income 515,963

Special Projects Expense

T.V. Series	31,996
Templeton Lectureship Series, Yr. 2 & 3	90,500
Book Project: <i>On Being a Christian in Science</i>	32,500
CHT Newsletter (RLH)	56,670
London Lectures (RLH)	49,057
Humility Theology Contest (RLH)	168,240
African Res. & Devel. Inst.	2000
Endowment Fund	0
Who's Who Project (RLH)	0
Special Projects	0

Total Projects Expense 430,963

Frances Polischuk
Financial Manager

American Scientific Affiliation Financial Statements

December 31, 1992

Balance Sheet: December 31, 1992 (With Comparative Totals for 1991)

Assets				
	1992		1991	
	Operating Fund	Endowment Fund	Total	Total
Current Assets				
Cash	\$176,194	\$ 1,400	\$177,594	\$118,529
Accounts Receivable	115	—	115	441
Investments	2,612	—	2,612	2,101
Publication Inventories, at Cost	4,520	—	4,520	3,350
Supplies	1,620	—	1,620	1,500
Total Current Assets	185,061	1,400	186,461	125,921
Property and Equipment, Net	3,757	—	3,757	8,657
Other Asset				
Security Deposit: Rent	400	—	400	400
Total	<u>\$189,218</u>	<u>\$ 1,400</u>	<u>\$190,618</u>	<u>\$134,978</u>
Liabilities and Fund Balances				
Liabilities				
Accounts Payable	\$ 4,783	\$ —	\$ 4,783	\$ 4,944
Restricted Deferred Revenue	175,081	—	175,081	127,472
Total Liabilities	179,864	—	179,864	132,416
Fund Balances	9,354	1,400	10,754	2,562
Total	<u>\$189,218</u>	<u>\$ 1,400</u>	<u>\$190,618</u>	<u>\$134,978</u>

The accompanying notes are an integral part of these financial statements.

Statement of Revenues, Expenses, and Changes in Fund Balance: Year Ended December 31, 1992 (With Comparative Totals for 1991)

	1992			1991	
	Operating Fund Un-restricted	Restricted	Endowment Fund	Total	Total
Revenues					
Contributions	\$ 92,525	\$181,522	\$ 1,400	\$275,447	\$187,509
Dues	77,549	—	—	77,549	75,558
Subscriptions	19,064	—	—	19,064	22,172

Independent Auditor's Report

February 25, 1993

Board of Directors
American Scientific Affiliation

We have audited the balance sheet of the American Scientific Affiliation (A Non-Profit Organization) as of December 31, 1992, and the related statements of revenues, expenses and changes in fund balance, and cash flows for the year then ended. These financial statements are the responsibility of the Organization's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of American Scientific Affiliation as of December 31, 1992, and the results of its operations and its cash flows for the year then ended in conformity with generally accepted accounting principles.

Vance, Cronin & Stephenson, P.C.
Boston, Massachusetts

Notes to Financial Statements December 31, 1992

Note 1 — Summary Description of the Organization

The American Scientific Affiliation is a Christian organization founded in 1941. The stated purposes of the Organization are to "investigate any area relating Christian faith to science" and "to make known the results of the investigations for comment and criticism by the Christian community and by the scientific community."

Conferences and Meetings	46,804	—	—	46,804	37,211
Sales of Publications	7,940	—	—	7,940	6,851
Advertising and Royalties	1,484	—	—	1,484	1,849
Investment Income	5,612	—	—	5,612	4,996
Gain (Loss) on Securities	(654)	—	—	(654)	(429)
Miscellaneous Income	1,233	—	—	1,233	—
Total	251,557	181,522	1,400	434,479	335,717

Expenses

General Administrative Expenses	148,684	37,334	—	186,018	179,696
Program Service Expenses	96,081	144,188	—	240,269	144,462
Total	244,765	181,522	—	426,287	324,158

Excess of Revenues Over Expenses

Excess of Revenues Over Expenses	6,792	—	1,400	8,192	11,559
Fund Balance, Beginning of Year	2,562	—	—	2,562	(8,997)
Fund Balance, End of Year	\$9,354	\$ —	\$1,400	\$10,754	\$2,562

The accompanying notes are an integral part of these financial statements.

Statement of Cash Flows: Year Ended December 31, 1992
(With Comparative Totals for 1991)

	1992		1991	
	Operating Fund	Endowment Fund	Total	Total
Cash Flows from Operating Activities				
Excess of Revenues Over Expenses	\$6,792	\$1,400	\$8,192	\$11,559
Adjustments to Reconcile Excess of Revenues Over Expenses to Net Cash Provided by (Used for) Operating Activities:				
Gifts of Stock (Stated at Fair Market Value)	(5,005)	—	(5,005)	(7,464)
(Gain) Loss on Securities	654	—	654	429
Depreciation	5,334	—	5,334	6,409
(Increase) Decrease in Assets:				
Accounts Receivable	326	—	326	(218)
Publication Inventory	(1,170)	—	(1,170)	4,223
Prepaid Expenses	(120)	—	(120)	(1,000)

Note 2 — Summary of Significant Accounting Policies

The significant accounting policies followed are described below to enhance the usefulness of the financial statements to the reader. Certain reclassifications have been made to the 1991 financial statements (which are shown in total for comparative purposes only) to conform with the presentation for 1992.

Fund Accounting

To ensure observance of limitations and restrictions placed on the use of resources available to the Organization, the accounts of the Organization are maintained in accordance with the principles of fund accounting. This is the procedure by which resources for various purposes are classified for accounting and reporting purposes into funds established according to their nature and purposes. Separate accounts are maintained for each fund; however, in the accompanying financial statements, funds that have similar characteristics have been combined into fund groups. Accordingly, all financial transactions have been recorded and reported by fund group.

The assets, liabilities, and fund balance of the Organization are reported in two self-balancing funds as follows:

Operating funds, which include unrestricted and restricted resources, represent the portion of expendable funds that is available for support of organization operations.

Endowment Fund, which represents gifts to the Organization which are to be held in perpetuity, with the income only to be used for current purposes.

Expendable Restricted Resources

Operating funds restricted by the donor, grantor or other outside party for particular operating purposes are deemed to be earned and reported as revenues of operating funds, when the organization has incurred expenditures in compliance with the specific restrictions. Such amounts received but not yet earned are reported as restricted deferred amounts.

Property and Equipment and Depreciation

Property and equipment are stated as follows:

Cost	\$46,148
Less: Accumulated Depreciation	42,391
Net Property & Equipment	<u>\$ 3,757</u>

Depreciation of equipment is provided over the estimated useful lives of the respective assets on a straight-line basis.

Increase (Decrease) in Liabilities:				
Accounts Payable	(161)	—	(161)	(10,318)
Taxes Withheld	—	—	—	(1,907)
Restricted Deferred Revenue	47,609	—	47,609	22,963
Net Cash Provided by Operating Activities	54,259	1,400	55,659	24,676
Cash Flows from Investing Activities				
Purchase of Property and Equipment	(434)	—	(434)	(1,661)
Proceeds from Sale of Stock	3,840	—	3,840	5,927
Net Cash Provided by Investing Activities	3,406	—	3,406	4,266
Net Increase in Cash	57,665	1,400	59,065	28,942
Cash at Beginning of Year	118,529	—	118,529	89,587
Cash at End of Year	<u>\$176,194</u>	<u>\$1,400</u>	<u>\$177,594</u>	<u>\$118,529</u>

The accompanying notes are an integral part of these financial statements.

Operating Fund General Administrative Expenses:
Year Ended December 31, 1992
(With Comparative Totals for 1991)

	1992		1991	
	Unrestricted	Restricted	Total	Total
Bad Debts	\$120	\$—	\$120	\$109
Commissions	—	—	—	175
Depreciation	5,334	—	5,334	6,409
Employee Benefits	16,200	—	16,200	13,200
Equipment Maintenance	6,906	—	6,906	6,779
Insurance	500	—	500	500
Office Supplies and Expense	2,691	—	2,691	2,357
Overhead Allocation - Restricted Funds	(37,334)	37,334	—	—
Payroll Taxes	10,267	—	10,267	10,630
Payroll Services	584	—	584	573
Postage and Shipping	7,638	—	7,638	7,650
Printing	3,573	—	3,573	4,180
Professional Fees	2,725	—	2,725	2,480
Rent	10,838	—	10,838	9,900
Salaries	115,245	—	115,245	111,527
Telephone	3,397	—	3,397	3,171
Utilities	—	—	—	56
Total	<u>\$148,684</u>	<u>\$37,334</u>	<u>\$186,018</u>	<u>\$179,696</u>

Tax Exemption

The American Scientific Affiliation is a not-for-profit organization and is exempt from income taxes under section 501(c)(3) of the internal revenue code.

Other Matters

All gains and losses arising from the sale, collection, or other disposition of investments and other noncash assets are accounted for in the fund that owned the assets. Ordinary income from investments, receivables, and the like is accounted for in the fund owning the assets.

Legally enforceable pledges less an allowance for uncollectible amounts are recorded as receivables in the year made. Pledges for support of current operations are recorded as operating fund support. Pledges for support of future operations and plan acquisitions are recorded as deferred amounts in the respective funds to which they apply.

Note 3 — Cash Flow Information

American Scientific Affiliation has adopted Statement of Financial Accounting Standards No. 95 which replaces the statement of changes in financial position with the statement of cash flows. Although this change is not required of non-profit organizations the Affiliation has adopted the change for its financial statements.

Supplemental Disclosures of Non-Cash Financing Activities

During the year ended December 31, 1992 American Scientific Affiliation received gifts of stock valued at \$5,005.

Note 4 — Investments

Investments are presented in the financial statements at the lower of cost or market. Cost of investments at December 31, 1992 was \$3,125.

Note 5 — Commitments

The Organization has entered into agreements for the production of a television series. The total cost of these agreements can not be determined as of December 31, 1992.

Note 6 — Concentration of Credit Risk

The Organization maintains two accounts under the same name at the same bank. As such, the combined balances in the accounts at times exceed the federally insured limits.

Operating Fund General Program Service Expenses:
Year Ended December 31, 1992
(With Comparative Totals for 1991)

	1992		1991
	Unrestricted	Restricted	Total
Annual Meeting Expense	\$45,311	\$—	\$45,311
Editor Stipend and Expense	5,075	—	5,075
Executive Council	1,190	—	1,190
Field Representative	—	—	—
Geology and Biology Divisions	1,202	—	1,202
Mailing Costs	5,144	—	5,144
Public Relations	10,528	—	10,528
Publicity and Advertising	1,069	—	1,069
Printing	26,562	—	26,562
Special Projects			
Various Conferences	—	2,685	2,685
Lectureship Foundation	—	52,175	52,175
London Lectures	—	19,889	19,889
Printing - "TS" Project	—	369	369
Subscription Campaign	—	—	—
TV Series	—	20,060	20,060
Walter Hearn Project	—	11,250	11,250
Humility Theology Project	—	37,760	37,760
Total	\$ 96,081	\$144,188	\$240,269

The accompanying notes are an integral part of these financial statements.

**Independent Auditor's
Report on Additional
Information**

February 25, 1993

Board of Directors
American Scientific Affiliation

Our report on our audit of the basic financial statements of American Scientific Affiliation for 1992 begins on page 72. We conducted our audit in accordance with generally accepted auditing standards for the purpose of forming an opinion on the basic financial statements taken as a whole. The schedules of expenses are presented for purposes of additional analysis and are not a required part of the basic financial statements. Such information has been subjected to the auditing procedures applied in the audit of the basic financial statements and, in our opinion, is fairly stated in all material respects in relation to the basic financial statements taken as whole.

Vance, Cronin & Stephenson, P.C.
Boston, Massachusetts

**The Canadian Scientific and Christian Affiliation
Annual Report**

Canada's vast land area keeps many CSCA members separated for extensive periods of time, but periodically members and friends do meet under the CSCA banner at centres in Vancouver, Ottawa, Guelph and Toronto. Bob George's book, *Classic Christianity*, was studied by the Guelph section during the past year. Two Toronto local section meetings were held at the Hart House, University of Toronto. On September 29, 1992 Daniel Osmond spoke on, "Theology of Humility: Scientists Discover God," discussing the movement led by J. M. Templeton. On November 24, 1992 Eric Moore repeated his presentation on "Time: A Scientific and Christian Perspective."

Many of you are aware that the American Scientific Affiliation (ASA) has been setting the stage for a special TV series, "Space, Time and God." At a meeting on Monday, June 7, 1993, the Executive Council of the CSCA passed the following motion: "The CSCA Executive Council recommends to the membership that the CSCA accepts and supports the project, 'Space, Time and God,' and will assist it financially and in any way possible." Your prayerful support is eagerly sought now and your financial

assistance will be requested later. A brief description of the proposed TV series and the main participants is available.

The TV series will be on our minds as we gather for the Annual CSCA conference on Saturday, October 23, 1993 on the campus of the University of Toronto. The duration of the conference will be 9:30 a.m. to 2:30 p.m. and our keynote speaker for the day is Dr. Robert Herrmann of ASA. We can promise you a very interesting and informative few hours as Dr. Herrmann guides us through the fascinating subject of, "Seeing God through Science" in the morning session and provides the details of the six-part TV series, "Space, Time and God" during the early afternoon.

This may be my final letter to you as President of CSCA. It has been a valuable experience for me as I have conversed and conferred with so many wonderful Christians in the scientific world. Gary Partlow of Guelph and Eric Moore of Toronto are waiting in the wings to take the position of President and Vice-President, respectively. I know that they want and need your prayers as God guides them at the helm of CSCA.

Norman MacLeod
President, CSCA

The Report of the Editor *Perspectives on Science and Christian Faith*

The fourth year of my tenure as editor has seen a busy flow of activity. Almost fifty manuscripts have been processed with the generous support of reviewers and Managing Editor Patsy Ames. We have material in hand for the next six issues. The June 1994 issue will feature representative environmental papers from the 1993 Annual Meeting. Additional papers and discussion on this important theme will take place in subsequent issues.

This year has seen an increasing number of "Essay Reviews." These provide opportunity for reflective discussion of important new works. The area of science/religion discussion continues to grow with new journals and organizations appearing around the world. It is an important part of my task to maintain contact with these groups. A productive editorial board meeting took place at Seattle Pacific University in August. We continue to seek new manuscripts and suggestions for improving our journal.

J. W. Haas, Jr.
Perspectives Editor

Report of the Book Review Editor of *Perspectives on Science and Christian Faith*

During the past year, I received from publishers approximately 80 percent of the books I requested for review (about 120 books received; 150 books requested). This percentage has remained the same over the years in which I have requested books for review. Some publishers have a limited number of copies for review; others value some outlets for reviews more than others; others do not produce the books on scheduled publication dates. Expenses for postage and supplies for the year were \$100.37. The four issues of *Perspectives* from September 1992 to June 1993 included 102 book reviews, an average of approximately 25 book reviews per issue.

I have been pleased in recent years to deliver more up-to-date book reviews for publication in *Perspectives*. Most quarterly journals review books that have been in print for several years. Each year *Perspectives* book reviews become more contemporary. Also, there is a decreasing number of *Perspectives* book reviews which are only tangential to science or which are intended for the general public. However, some reviews of these types of books will continue to be published because they are written by members of the American Scientific Affiliation or they are books with which scientists should be familiar.

Thanks to everyone who made the book review section of *Perspectives* possible, including Jack Haas, Editor, and Patsy Ames, Managing Editor. The book reviewers are especially important and are to be commended for the hours they devote to reading and writing. It is a privilege to serve as the Book Review Editor, and I am grateful for this avenue of service to the American Scientific Affiliation. I love books on all topics, and enjoy trying to keep up with the avalanche of titles produced by book publishers.

Richard L. Ruble
Perspectives Book Review Editor

Report of the ASA Managing Editor

Jack Haas and I continue to work together well in producing *Perspectives on Science and Christian Faith*. All four 1993 issues seem to have been very well received. Paid advertising published in the Journal more than doubled from 1992's total (approximately \$800), with approximately \$1700 worth of solicited and unsolicited

ads being published in 1993. (These amounts were not necessarily collected in the same year.)

Walt Hearn and I produced the first three issues of the 1993 *ASA Newsletter*, and then Walt retired, handing the reins over to Dennis Feucht. Dennis and I have also developed a good working relationship and a slightly different system to produce the *Newsletter*.

A new version of *Teaching Science in A Climate of Controversy* came out in 1993, including the unchanged body of the 1987 version and 18 pages of new material. The book is now a smaller size and bound with a spine to increase its marketability. With grant funding, we were able to send free copies of the new book to all high school biology teachers in California. As a result, we have gotten a fair bit of nationwide press coverage — mostly helpful. We have also put significant efforts into marketing the book, which generally appears to have been well received.

The 1993-1994 edition of the *Membership Directory* came out in early summer, and included several new types of information to increase its usefulness.

We have continued to pursue an upgrade for our office computers, and have received a generous grant to do this. We expect the new systems will be fully in place in early 1994. This upgrade will include an email link.

Based on a report developed since the Annual Meeting in August, the ASA Executive Council voted in December 1993 to explore the possibility of instituting the American Scientific Affiliation Press to oversee ASA's publishing activities. In some ways, this would probably be simply a formalization of the publishing activity that ASA already does.

Patricia Ames
Managing Editor

ASA/CSCA Newsletter

In the twelve months since my 1992 report, Volume 34 of the *Newsletter* was completed and I edited the first four issues of Volume 35, terminating my editorial responsibilities on June 30 by mailing the copy for the August/September 1993 issue (No. 4), to Managing Editor Patsy Ames in Ipswich. At the same time I was corresponding with Dennis Feucht, the incoming Editor, to help insure a smooth changeover. In August I "covered" certain aspects of the Seattle meeting for the new Editor and have continued to send him stories based on material left over from my tenure.

The success of Dennis Feucht's first issue (October/November 1993) indicates that he has gotten the hang of being Editor sooner than I've caught on to *not* being Editor. It has taken about four months to break some habits of the past 24 years, but at least I've learned simply to forward potential items to the new Editor rather than saving them to write the stories myself. I continue to notify sources of regular press releases, newsletters, prayer letters, etc., that material should now be sent to the new editor. I have sent a form letter announcing the change of Editorship to at least two dozen such sources, which should eventually cut down on the time I spend opening and reading mail. Soon I hope to cut back from half-time work (20 hours/week) for ASA to the quarter-time I'm now paid for. I anticipate continuing as a *Newsletter* reporter or "gatekeeper," in response to the new Editor's request, as many other ASA/CSCA members should be doing.

Walter R. Hearn
Former Editor, ASA Newsletter

Affiliation of Christian Geologists

Regular gatherings of the Affiliation of Christian Geologists continue to take place at the annual ASA meeting and at each of the national meetings of the Geological Society of America (GSA).

Official ACG events at each of the two meetings are planned to achieve different purposes. The GSA meeting provides business-session time for the formulation of policy as well as for fellowship among members. Sponsorship of a geology field trip is also becoming a regular occurrence. The GSA meeting provides opportunities for outreach ministry to the wider geoscience community, as well as to local Christian organizations such as seminaries or colleges. Members attending GSA also try to find time together for a field experience.

Keith Miller reports from the 1993 ASA meeting in Seattle that ACG business focused on environment education, the sponsorship of field trips at ASA meetings and the development of an active speaking bureau. At the 1992 Geological Society of America meeting in Cincinnati the ACG attempted some sensitive evangelism. This was done through the provocative invitation to see if there is any conflict between legitimate science and supernatural faith.

The 1993 GSA meeting in Boston again featured an ACG public forum on the spiritual dimension of our lives. Even though outsiders have not been greatly attracted to the outreach efforts, the organization receives significant respect from influential individuals such as William Dickinson, the president of the GSA and Fr. James Skehan, the 1993 Boston meeting chairman. Furthermore, we continue to gain several new members as a result of each year's publicity.

ACG members and friends connect through our newsletter, *The News!* Those who would like to be on the ACG mailing list should write the Geology Department at Wheaton College, Wheaton, IL 60187.

Jeffrey K. Greenberg
President, ACG

Affiliation of Christian Biologists

The Affiliation of Christian Biologists is about to begin its fourth year. The affiliation continues to grow and is now at an all-time high of 83 members, who come from thirty states and Canada. Roman Miller completed the editing of the first volume of our newsletter (four letters) before turning the editorship over to Stanley Rice, who will soon be completing Volume II. Much thanks should go to both men for their hard work. The low point of our year was the death of our secretary, Anne Whiting, who had done marvelous work organizing the membership. At our meeting this summer Marilynne Flora was elected to serve as secretary over the next three years. She is already busy getting things on a computer. Mike Sonnenberg continues as our treasurer. We would like to set up ways for more communication and mentoring among our membership. During the summer of 1994 we will meet at Bethel College and Seminary, where the emphasis of the ASA meeting will be on bioethics. This should attract a lot of biologists. We hope to sponsor a field trip at the meeting and have a time of sharing our faith and ideas about our field of study. We continue to seek members and have kept our yearly dues low — \$5 for students, \$10 for full members and \$25 for a three-year membership. Information can be obtained from either Marilynne Flora or Don Munro.

Don W. Munro
President

Computer Applications Committee Report

Our work this year consisted primarily of updating and augmenting the ASA journal database, and giving it wider distribution. The database is now a file of all articles and most communications in *Perspectives on Science and Christian Faith* from its inception through Volume 44 (1992). It contains over 1600 citations, which can be searched on any combination of about 650 subject keywords as well as authors and titles. The database, along with its driver program PCFile+, is distributed through ASA headquarters for \$20. The database does not include the text of the articles, only the citations.

This year we have uploaded the database, in a compressed format, to CompuServe, in their Religion forum, in the Religion & Science library. It is available for downloading from there at no charge. We have encountered some bugs in the data, however, and are presently attempting to fix them. If you can, please download the data file 'ASADB4.EXE' from this library and expand it by typing 'ASADB4'. The PCFile+ program can be found in library 3. Please let me know if this works or doesn't work for you.

Dave Siemens has again this year assisted in the database indexing. Joe Carson has been trying to encourage ASA members to participate in real-time conferencing on CompuServe. John Miller is in the process of converting the database to run on a Macintosh. Thanks to all for your contributions!

Incidentally, CompuServe is by far the largest of the commercial network services, with over a million subscribers, and for a few dollars a month it opens up a vast work of text, free software, and graphics information. I encourage all ASA members to participate in the rapidly growing information revolution. Also, by now practically all US schools and corporations have free access to the Internet — get connected now! The ASA membership directory lists Internet addresses for many of our members, but there should be more. We should certainly be supporting and participating in any new means of communication.

Many additional projects remain to be done. As always, your ideas and contributions are appreciated.

Paul Arveson
Chair

Committee for Integrity in Science Education

Supplies of the 1989 version of *Teaching Science In A Climate of Controversy* were already low by December 28, 1992, when the booklet was mentioned in a *Time* magazine cover story which also located ASA in Ipswich. As requests for *Teaching Science* began to exhaust the remaining supply, the Committee began work on a 1993 version, with grant support from The Santa Ynez Foundation and The Stewardship Foundation.

After a careful review, the Committee decided that the text of the 1989 version was still scientifically valid and useful, so it was let stand. Minor changes were made in front and back material (raising the single-copy price to \$7.00, for example, and changing the description of ASA). We made two important additions, however. After a one-page update of the situation faced by science teachers in the '90s, the front of *Teaching Science* now sets forth the resolution honed by ASA members and passed on December 7, 1991 by the ASA Executive Council. "A Voice for Evolution as Science" urges teachers to define the terms *evolution* and *theory of evolution* carefully and to use those terms in a consistently scientific manner. It further recommends that unsolved problems and unanswered questions be presented along with well estab-

lished facts, and that students be taught to distinguish between evidence and inference.

A 16-page "Addendum" at the end of the text now outlines classroom exercises to teach critical thinking skills, with materials to be copied by teachers for classroom use. The exercises are built around a fossil display called "The Hard Facts Wall" in a generally outstanding exhibit, "Life Through Time: The Evidence for Evolution," at the California Academy of Sciences in San Francisco. When students arrange cards depicting fossils from the display on a geological time scale, they discover that their arrangement differs from the one presented by the museum experts, giving substance to the distinction between evidence and inference stressed in ASA's 1991 resolution.

With the inclusion of the 16 new pages it was possible to make one other significant change without massive redesign. The size of *Teaching Science* was reduced to 7 x 10 inches and the 1993 version is now bound with a spine containing the title so bookstores can more easily carry it on their shelves. With the heroic efforts of Ginny Hearn and Patsy Ames, the book came off the press at Science Press in time for the Annual Meeting in August. It is now available in some Christian college bookstores. Ideas for marketing to a wider audience are welcomed by the Committee. An attractive advertising flyer is available on request from the ASA Ipswich office.

National coverage of the election of a conservative Christian majority to a school board in Vista, California, opened a window of opportunity for our mailing of a free copy of *Teaching Science in a Climate of Controversy* to each of the more than 3,000 public high school biology teachers in California. The cover letter accompanying the book urged teachers not to let the turmoil in Vista keep them from teaching evolution as science, as recommended in the ASA resolution. A press release to all major California newspapers and to national media generated a number of stories about the mailing, which in turn have generated further inquiries about *Teaching Science* and ASA to the Ipswich office.

Having given up his responsibilities as *Newsletter* editor, Walt Hearn is able to devote additional attention to the booklet *On Being a Christian in Science*. Walt expects this guidebook for graduate students to be published in 1994.

BIOETHICS: Promise and Perils

The Annual Meeting of
The American Scientific Affiliation

with keynote speaker

John F. Kilner, Ph.D.
Park Ridge Center for the Study
of Health, Faith, and Ethics, and
Northwestern University

July 29 - August 1, 1994
Bethel College, St. Paul, MN

At the 1993 Annual Meeting in Seattle, the Committee sponsored a symposium on the topic, "Can There Be a Scientific Theory of Intelligent Design," with four excellent speakers: mathematician William A. Dembski; philosopher of science Stephen C. Meyer; chemist Michael J. Behe; and philosopher/biologist Paul A. Nelson. The symposium was organized by Steve Meyer and chaired by biologist David L. Willis. At the end of the symposium Dave Willis commented that ASA should be encouraged by the relative youth of the four speakers, by their obvious professional competence, and by the fact that together they are working on a book that should bring a sharper focus to discussions about origins.

A new project of the Committee in 1993 was the announcement of "Caring Research Awards" for the best empirical papers given at the Annual Meeting. Both the rules governing the awards and the procedures for judging papers in the competition need to be refined, but the Committee was pleased with the quality of the winning papers. We will again sponsor such a competition in 1994. A small cash award of \$100 went to each of three investigators for high-quality research to demonstrate (1) Caring for the Earth (to be called Caring for Creation in 1994); (2) Caring for People; and (3) Caring for Science. Strong runner-up papers in each category made the judging difficult, but the three winners (in the same order) were:

1) Ronald J. Vos and two colleagues at Dordt College, Sioux Center, Iowa, for a poster session, "Monitoring and Modeling Cropping System Nitrates for a Sustainable Agriculture." Their results are helping to protect ground water supplies from contamination by nitrates from fertilizers.

2) Rolf Myhrman and two of his undergraduate chemistry students at Judson College, Elgin, Illinois, for a paper on "Measurement and Removal of a Toxic Substance in Velvet Beans." Their results were immediately put to use by subsistence farmers in Honduras who eat the prolific velvet bean.

3) Steven E. Fawl of Napa Valley College in California, for a poster session on "Creation, Evolution, and Taxonomy." He investigated the computer generation of molecular phylogenies of cytochrome-c using various assumptions and several different numerical methods.

Walter R. Hearn and John L. Wiester, Chair
Committee for Integrity in Science Education

Archive Report

ASA's archives are kept in the Special Collections department of Buswell Memorial Library at Wheaton College, Wheaton, IL.

Accessions to American Scientific Affiliation Archives (SC-26) *Perspectives*, 44.3; 45.1, 45.2, 2 copies each = 6 vols. *Newsletters* 34.4 (2c), 34.5(2c), 34.6, 35.1, 35.2 = 7 vols. Manuscripts (administrative records) = 5.7 linear feet. Total volumes in American Scientific Affiliation Archives (SC-26) Books: 40 vols.; Bound Serials: 11 vols.; *Journal/Perspectives* and *Newsletter* Serials: 49 vols.; *Journal/Perspectives* and *Newsletter* Computer Disks: 3 document cases (d.c.); Manuscripts: 86.3 linear feet.

Six researchers used material in SC-26 for varying periods. Hours for the Special Collections/Buswell Memorial Library at Wheaton College are M-F 9-12, 1-4, during the academic school year. Adjustment in hours can be made to suit researchers. (708) 752-5705 — Reference Desk (David Malone); (708) 752-5851 — Curator (Larry Thompson); (Fax 708) 752-5855.

Larry Thompson, Special Collections
Buswell Memorial Library

WHAT EXACTLY IS THE AMERICAN SCIENTIFIC AFFILIATION?

The American Scientific Affiliation (ASA) is a fellowship of men and women of science who share a common fidelity to the Word of God and to the Christian Faith. It has grown from a handful in 1941 to a membership of over 2,500 in 1990. 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."

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 mathematics, engineering, medicine, psychology, sociology, economics, history, etc., as well as physics, astronomy, geology, etc. Full member dues are \$45/year.

Associate membership is available to anyone 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. Associate member dues are \$40/year.

Full-time students may join as Student Members (science majors) or Student Associates (non-science majors) for discounted dues of \$20/year. Full-time missionaries are entitled to a complimentary Associate membership.

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. Payment of a yearly fee of \$45 entitles "Friends" to receive all ASA publications and to be informed about ASA activities.

Subscriptions to *Perspectives on Science & Christian Faith* only are available at \$25/year (individuals), \$35/year (institutions) and \$20/year (students).

MEMBERSHIP/FRIEND OF ASA APPLICATION/SUBSCRIPTION FORM

(Subscribers complete items 1-3 only)

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

1) Name (please print) _____ Date _____

2) Home address _____

_____ Zip _____ Phone _____

Office address _____

_____ Zip _____ Phone _____

3) I would prefer ASA mailings sent to: ☐ home ☐ office

4) Place of birth _____ Date of birth _____

Marital status _____ Sex _____ Citizenship _____

Is spouse a member of ASA? _____ Eligible? _____

5) ACADEMIC PREPARATION

Institution _____ Degree _____ Year _____ Major _____

Field of study (major concentration) _____

Area of interest (20 character limit) _____

Recent publications _____

Please complete back of this form 

WHAT DOES THE ASA BELIEVE?

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

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

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

WHY MUST THERE BE AN ASA?

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

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

Church Affiliation _____

What was your initial contact with the ASA? _____

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

Name _____

Street _____

City _____ State _____ Zip _____

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

STATEMENT OF FAITH

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

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

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

Amount enclosed _____ Category _____

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

OTHER RESOURCES AVAILABLE FROM ASA

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

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

Please enter gift subscriptions for:

Name _____

Address _____

City _____ State _____ Zip _____

Name _____

Address _____

City _____ State _____ Zip _____

All rates and conditions subject to change.

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

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

AS A MEMBER YOU RECEIVE:

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

* * * * *

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

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



The American Scientific Affiliation

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

EXECUTIVE DIRECTOR, ASA:

Robert L. Herrmann, P.O. Box 668, Ipswich, MA 01938-0668

EDITOR, ASA/CSCA NEWSLETTER:

Dennis Feucht, RD 1 Box 35A, Townville, PA 16360-9801

EXECUTIVE COUNCIL, ASA:

Fred S. Hickernell, Motorola, 8201 E. McDowell, Scottsdale, AZ 85252—President

Elizabeth Zipf, P.O. Box 127, Barrington, NJ 08007—Past President

Raymond H. Brand (Biology), Wheaton College, Wheaton, IL 60187—Vice President

David L. Wilcox, 2 South Cedar Hollow Road, Paoli, PA 19301-1703 —Secretary Treasurer

Kenneth V. Olson, 3036 Hillside Drive, Burlingame, CA 94010

Canadian Scientific & Christian Affiliation

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

EXECUTIVE DIRECTOR, CSCA:

W. Douglas Morrison, P.O. Box 386, Fergus, Ontario N1M 3E2

EXECUTIVE COUNCIL, CSCA:

Gary Partlow (Neuroanatomy), Guelph, Ontario — President

Norman MacLeod (Mathematics), Toronto, Ontario — Past President

Charles Chaffey (Chemical Engineering), Toronto, Ontario — Secretary

Robert Mann (Physics), Waterloo, Ontario

Esther Martin (Chemistry), Waterloo, Ontario

Don McNally (History of Science), Hamilton, Ontario

Eric Moore (Chemistry), Toronto, Ontario

Dan Osmond (Physiology), Toronto, Ontario

Robert E. Vander Vennen (Chemistry), Toronto, Ontario

Lawrence J. Walker (Psychology), Vancouver, British Columbia

LOCAL SECTIONS

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

Central California	Chicago-Wheaton	Delaware Valley	Eastern Tennessee	Guelph, ONT
Indiana-Ohio	New England	NY-New Jersey	North Central	Oregon-Washington
Ottawa, ONT	Rocky Mountain	St. Louis	San Diego	San Francisco Bay
South Central	Los Angeles	Southwest	Toronto, ONT	Vancouver, BC
D.C.-Baltimore	Western Michigan	Western New York		

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).

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

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

"Upholding the Universe by His Word of Power"

Hebrews 1:3

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