

PERSPECTIVES on Science and Christian Faith

JOURNAL OF THE AMERICAN SCIENTIFIC AFFILIATION

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and the God-of-the-Gaps

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Eternity and the Personal God

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

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

On Intelligent Design, Irreducible Complexity, and Theistic Science

Readers may have noticed that discussion of these themes has emerged from the halls of the ASA and evangelical academic enclaves to draw the attention of the popular religious and secular press. Recent conferences at Biola University (<http://www.arn.org/arn>) and the University of Texas (<http://www.dla.utexas.edu/depts/philosophy/faculty/koons/ntse/ntse.html>) have released torrents of words on what is seen by some as "a move to a new paradigm" and others as the latest maneuver by those "who don't want evolution to be true." The Biola meeting originally billed as a small "invited only" working session for the faithful ended up with a much larger audience which included many skeptics. The University of Texas Philosophy Department sponsored conference (not yet held at this writing) pits advocates of "theistic science" against those of "naturalistic science." With sixty accepted papers (available on their web site), the issues should be clearly defined. The ASA List Serve has provided a heavily used discussion forum for these ideas.

How is the discussion going? Most evangelical observers — especially working scientists — are deeply skeptical. They have no objection to developing world views about science and faith but draw the line when asked to add "divine agency" to their list of scientific working tools. Also, it seems that the methodological discussion centers only on certain areas of biology. The rest of us as physicists, chemists, mathematicians, or geologists, are allowed to go our 'godless' ways in spite of the complexities we face at the quantum level or with the weather. Britain's most prominent defender of evolution, Richard Dawkins calls Michael J. Behe's conclusion that the flagellum of bacteria are too complicated to have evolved (in *Darwin's Black Box: The Biochemical Challenge to Evolution*, 1996) "a pathetic cop-out of his responsibilities as a scientist." Behe in turn chides Dawkins for attempting "to popularize non-existent science." Clearly, snappy come-backs are not going to resolve the issues. Instead, hard work on the part of the scientific community is needed to provide data and develop lower level mechanisms.

There is a long history of science-religion relationships. Advocates of theistic science would do well to examine the past in the light of their new paradigm. Also, each of us should be willing to examine their conclusions with an open mind. If the ideas are flawed — work toward improvement; if fatally flawed, drop them. Our responsibility to the Christian community demands no less.

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In This Issue

Our first two papers cross swords on aspects of theistic science. First, philosopher J. P. Moreland argues against the complementarian approach to science and Christianity especially where its advocates are opposed to what they see as a god-of-the-gaps mentality in theistic science. Theistic scientists "see gaps in the natural world due to direct acts of God which can, in principle be relevant in scientific methodology." The enemy is methodological naturalism, the view that only natural forces and objects are proper elements of scientific investigation. On the other hand, philosopher Robert C. O'Connor argues that methodological naturalism is "well-grounded, intrinsically valuable, and, when properly understood, a critical component of *Christian* inquiry." He concludes that "permitting direct reference to divine agency in natural science undermines the overall quest for truth."

David L. Woodall's study of Robert Boyle reminds us of how much we owe this seventeenth-century physical scientist who developed a view of the new science that took into account his deeply held Christian faith. In our final paper, Karl M. Busen deals with the alleged conflict in biblical revelation of God as a personal and eternal being. He offers a complementarian explanation which ties together these simultaneously exclusive concepts at a higher level of complexity.

This issues concludes with a diverse set of reviews and a letter. Your comments are welcome.

Complementarity, Agency Theory, and the God-of-the-Gaps

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There has been a growing debate about the proper way to integrate science and theology. On the one side are those who accept a complementarity view of integration and claim that science must presuppose methodological naturalism. On the other side are those who accept some form of theistic science. Central to this debate is the nature of divine and human action and the existence of gaps in the natural causal fabric due to such action that could, in principle, enter into the use of scientific methodology. In this article, I side with the second group. To justify this position, I first state the complementarity view and its implications for the nature of human personhood, second, explain libertarian agency in contrast to compatibilist models of action, and third, show why "gaps" are part of divine and human agency and illustrate ways that such a model of agency for certain divine acts could be relevant to the practice of science.

The relationship between science and miracles contains many aspects that are worthy topics of study in their own right. Currently, however, there has been a growing and sometimes heated dialogue about the proper way to view the integration of science and theology. A major part of this dialogue is a debate between those who accept the idea that science must presuppose methodological naturalism and those who reject this notion. The different camps in this dispute accept very different ways of viewing the nature of a direct, miraculous act of God and its relationship to the practice of science. Given the ideological importance of science in contemporary culture, it is not surprising to see naturalists claim that miracles, even if they happened, are totally outside the limits of scientific theory formation, explanation, and confirmation and, thus, are unscientific in this sense. For example, atheist philosopher 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."¹ Elsewhere, Ruse asserts 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."² What I find surprising is the fact that a significant number of Christian intellectuals agree with this position.

Let us define theistic science as a viewpoint which includes a commitment to the following three propositions:³

1. God, conceived of as a personal, transcendent agent of great power and intelligence, through direct, immediate, primary agency and indirect, mediate, secondary causation created and designed the world for a purpose. He acted directly through immediate, primary agency in the course of its development at various times (including prehistory — history prior to the arrival of human beings).⁴
2. The commitment expressed in Proposition 1 can appropriately enter the very fabric of the practice of science and the use of scientific methodology.
3. One way this commitment can appropriately enter the practice of science is through various uses in scientific methodology of gaps in the natural

world. These gaps are essential features of direct, immediate, primary divine agency properly understood.

The Christian intellectuals mentioned above reject theistic science because, among other things, it supposedly uses an inappropriate god-of-the-gaps strategy for doing science and integrating it with theology. Instead, science requires the adoption of methodological naturalism, the idea that science must study natural (physical) entities from a natural point of view and seek explanations for things in terms of natural events and laws that are part of the natural causal fabric of the spatio-temporal world. Thus, theological beliefs in general, and direct, immediate, miraculous acts of God lie outside science, properly understood. The proper way to integrate science and theology is to view them as noninteracting, complementary approaches to the same reality; as such, they adopt very different standpoints, ask and answer very different kinds of questions, involve different levels of description, employ very different cognitive attitudes (e.g., objectivity and logical neutrality in science, personal involvement and commitment in theology), and are constituted by very different language games. These different, authentic perspectives are incomplete and, therefore, must be integrated into a coherent whole. But, each level of description (e.g., the chemical vs. the theological) is complete at its own level, with no gaps at that level for other perspectives to fill, and with no possibility for direct competition, conflict, or mutual epistemic reinforcement.⁵

I do not agree with this perspective if it is taken as the total picture of science/theology integration. In my view, theistic science is a legitimate research program. I have defended my views elsewhere and cannot undertake here a general treatment of this controversy.⁶ Instead, I shall focus on Proposition 3 above and defend the idea that a certain understanding of agency theory shows that the complementarity view is inadequate and that libertarian, agent acts (human and, in some cases, divine) leave

gaps in the causal fabric of the natural world that could play a role in the practice of science. In what follows, I will, first, state the complementarity view; second, explain libertarian agency in contrast to compatibilist models of action, and third, show why "gaps" are part of such agency and illustrate ways that such a model of agency for certain divine acts could be relevant to the practice of science.

The Complementarity View

Currently, the complementarity view enjoys wide popularity among both Christian and non-Christian intellectuals. Among its Christian proponents are D. M. Mackay,⁷ A. R. Peacocke,⁸ Richard Bube,⁹ Howard J. Van Till,¹⁰ Paul de Vries,¹¹ and David G. Myers.¹² While scholars differ about certain details of this approach, nevertheless, there is broad agreement among them regarding the following components.

The Nature of Science

The goal of natural science is to study the spatio-temporal natural world of matter and energy and seek natural explanations for the physical properties, behavior, and formative history of the physical universe. The very nature of natural science requires one to adopt methodological naturalism, the idea that explanations of phenomena are to be sought within the nonpersonal causal fabric of events and processes in the created order. For example, in describing how two charged electrodes separate hydrogen and oxygen gas when placed in water, the "God hypothesis" is both unnecessary and out of place. In general, an appeal to personal intentions or actions of an agent, especially a supernatural one, violates the methodological naturalism that constitutes proper scientific methodology. Methodological naturalism is unrelated to metaphysical naturalism (the view that the spatio-temporal world of physical entities open to scientific investigation is all there is) because philosophical theses about the existence,



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nature, and acts of God are beyond the limits of, and are complementary with, science.¹³

Reality: A Hierarchy of Systems Standing in Part/Whole Relationships

In nature, wholes are often more than the additive sum of their parts. Reality consists in a hierarchy of different levels of systems or things that are parts of and give rise to wholes (systems or things) at higher levels of organization due to the complex interaction of the parts at lower levels. For example, ascending from bottom to top through the hierarchy we have the following: energy, subatomic entities, atoms, molecules, constituents of cells (e.g., organelles), cells, biological systems (e.g., the respiratory system), whole biological organisms, the psychological level, the sociological level, and the theological level. As one ascends, each new level does not exist because some new entity has been added "from the outside," but rather, because it emerges from the lower level due to the complex interaction of parts at that level. For example, psychological states emerge and supervene upon the brain and central nervous system when the latter reaches a certain level of complexity needed to generate such an emergence.¹⁴ There are different understandings of supervenience.¹⁵ However, a generally accepted understanding of it for properties runs as follows: Property P supervenes on property Q just in case (1) P and Q are completely distinct properties in that neither P nor Q enters the very being or constitution of the other; (2) P is ontologically dependent on and determined by Q; (3) the relationship between P and Q is nonreductive; (4) For any possible world in which some entity x exists, if x has Q then that is sufficient for its having P; there cannot be two entities alike in having Q but differing with respect to P. An entity cannot change in respect to P, cease to be P, or become more or less P without changing in respect to Q.

In this view, human persons are not genuine substances with natures, but rather, are property-things (ordered aggregates) — structured collections of externally related parts with emergent properties. To clarify this point, it will be helpful to step back for a moment and compare two different metaphysical positions about two very different kinds of wholes with parts: substances, understood in the classic interpretation of Aristotle and Aquinas, vs. property-things or ordered aggregates.¹⁶

According to the traditional view, living organisms, historically, were taken to be paradigm cases of substances. First, a substance is a thing which

has or owns properties but is not had by something more basic than it. Secondly, a substance is a deep unity of parts, properties, and capacities at a point in time; it maintains absolute sameness through (accidental) change. Substances are wholes that are ontologically prior to their parts in that those parts are what they are in virtue of what the substance is, taken as a whole. For example, a chamber of a heart is defined in terms of the heart as a whole; the heart is defined in terms of the circulation system as a whole; and the circulation system is defined in terms of the organism as a whole. Thirdly, a substance is a this-such, i.e., an individuated member of its natural kind which, in turn, constitutes its essence. For example, two dogs are different, particular animals with the same nature. The unity and nature of a substance derive from its essence that which lies within it. Its parts (e.g., the nose and claws of a dog) stand in internal relationship to each other in that if a part is removed from its whole, it loses its identity with itself. As Aristotle said, a severed human hand is, strictly speaking, no longer human — a fact that will become evident in a few days.

Substances are wholes that are ontologically prior to their parts in that those parts are what they are in virtue of what the substance is, taken as a whole.

An artifact, like a table or automobile, is a paradigm case of a property-thing. Property-things derive their unity from an external ordering principle (either in the mind of a designer or from a law of nature) imposed from the outside on a set of parts to form the object. A property-thing is structured stuff, i.e., parts placed in some type of ordering relationship. In such wholes, the parts are prior to the whole; the whole contains some sort of structural property that supervenes upon those parts (it is defined in terms of the parts and the ordering relationship); the parts are related to each other by means of external relationships; they remain identical to themselves regardless of whether or not they are in the whole property-thing (e.g., a car door is still what it is when detached from a car); and property-things do not maintain strict identity through loss of old parts or properties and gain of new ones.

Regarding human persons in particular, philosophers widely agree that the following are inconsistent with the property-thing position but are easier

to justify on the substance view (and, in fact, may have the substance view as a necessary condition): the absolute unity of a person at a time; the irreducibility of the first person perspective; the absolute sameness of a person through change; the organic unity of the human body and the distinctive, irreducible, species specific, law-like ways it changes through time; the irreducibility or uneliminability of literal biological function or, more generally, teleology; the metaphysical possibility (let alone the reality) of disembodied existence; libertarian freedom; and the existence of human nature as that which constitutes the unity of the class of all humans.¹⁷ I am not arguing that the items on this list are real, though I take that to be the case. I do think, however, that one should think carefully about how the complementarity property-thing model of living organisms — more specifically, human persons — has difficulty allowing for these things to be the case. One should ask whether the complementarity view is intellectually worth the price of jettisoning these arguably real aspects of human persons. Here is the main issue: the complementarity view does not have the intellectual resources to allow for the precise type of unity necessary for these features of human persons to obtain and if they are, in fact, genuine, then the complementarity view's response to reductionism is simply inadequate.

Interaction Between Levels

Each level in the hierarchy is capable of an exhaustive description at that level using only concepts, theories, or laws appropriate to that level. Such descriptions are complete with no gaps that need to be filled in by theories or laws referring to entities, properties, or processes at higher levels. For example, when a person chooses to eat fruit (a good choice!), a complete description of that action can be given at each level (e.g., the atomic, the psychological). Each level of description is an authentic, though partial, perspective and the whole truth requires an appeal to all the levels of description that are complementary to each other. Moreover, it is interesting that the bottom level is the one studied by physicists. Lower levels are more basic and sustain higher levels in existence. Higher levels emerge upon and are determined by the entities and patterns of interaction at lower levels. If some story is true at a higher level, then some story must be true at a lower level but not vice versa.¹⁸ In general, some physical (e.g., neurophysiological) state is necessary for a higher level (e.g., mental) state to exist and when some specific physical state obtains, that is sufficient for the occurrence of the supervening (e.g., mental) state.

We have just noted the relationship among levels as far as sustaining something in existence is concerned. A closely related, but distinct, issue involves the relationship of causality between levels. Regarding causality, the first thing to note is this: events are what do the causing in the natural world, i.e., events cause other events to occur. For example, a brain event is the cause for a mental event. Secondly, a serious problem to be probed later involves the causal efficacy (and not the reduction) of higher levels of description, most important, the mental level.

In general, some physical (e.g., neurophysiological) state is necessary for a higher level (e.g., mental) state to exist and when some specific physical state obtains, that is sufficient for the occurrence of the supervening (e.g., mental) state.

Advocates of the complementarity view appear to be caught in a dilemma. On the one hand, it is hard to avoid treating higher levels of description as causally impotent epiphenomena that supervene upon lower level systems because each lowest level physical state is (1) complete at its own level of description and (2) sufficient for the emergence of the higher level state. As philosophers Kathleen Lennon and David Charles argue, the only way to accept a psychological level of causal descriptions and also hold "that physical explanation is complete, i.e., that all physically characterizable events are susceptible to explanation on terms of physically sufficient causes ... is to accept [the] reduction [of the psychological to the physical]."¹⁹ On the other hand, in spite of the apparent inconsistency in doing so, advocates of this view allow that when higher level entities emerge, then events at that level can cause events to occur at lower levels through feedback mechanisms and event-event causation. As Jaegwon Kim has shown, the problem here is that "downward causation *prima facie* implies the failure of causal closure at the lower level, and the in principle impossibility of a complete theory of the lower-level phenomena in their own terms."²⁰ *The question here is not that such feedback occurs, but whether there is room within the complementarity view for its occurrence that does not have an air of ad hoc-ness about it.*

Agency and Free Will

Later, I will clarify the difference between libertarian and compatibilist views of freedom and agency. But for now, it should be noted that the complementarity view eschews libertarian freedom and agency in favor of compatibilist models of freedom. An illustration may help us understand the complementarity view. Consider the act of raising one's hand to vote. At the various levels of natural science, a complete account of such an act could be given in terms of biological systems, neurons, brain states, etc. These levels of description would be ignorant of the psychological level in the sense that they would be what they are, with or without the presence of the higher psychological level, and they would contain no reference to mental processes, events, properties, etc. But a complete, noninteracting account of the act could be given at a psychological level by appealing to the individual's desire to vote, his belief that raising his hand would satisfy this desire, and his willingness to raise his hand. Personal agency and action fall completely outside natural science levels of description, complementary to the psychological level.

Divine Action and Creation's Functional Integrity

If we set aside human history, especially salvation history in which God performed primary causal miraculous acts, like parting the Red Sea or raising Jesus of Nazareth from the dead, then a consistent picture of divine action in the natural world emerges from what has already been said. God is not to be seen as a direct, primary, causal agent who suspends or overrides the laws of nature (by acting in a way different from his normal, regular activity), creating a gap in the natural fabric. Rather, God is constantly active in each and every event that happens. God sustains natural processes in existence, and expresses his freedom to act by employing natural processes mediately as secondary causes to accomplish his purposes in the world.²¹ He works "in and through" the natural causal fabric, unfolds its potentialities according to deterministic or probabilistic laws of nature and he does so without leaving any causal gaps in lower level physical processes and systems. God is the ground of all causes and the ultimate cause of all things. Moreover, God's acting in and through natural events can be understood as the meaning and purposive pattern that can be seen in the providential unfolding of those events. As Howard J. Van Till puts it, God has created the world with functional integrity:

By this term I mean to denote a created world that has no functional deficiencies, no gaps in its economy of the sort that would require God to act immediately, temporarily assuming the role of creature to perform functions within the economy of the created world that other creatures have not been equipped to perform.²²

God-of-the-Gaps

Advocates of the complementarity view have a disdain and loathing for what is called a god-of-the-gaps argument. According to many complementarians, this type of argument is an epistemically inappropriate strategy in which God only acts when there are gaps in nature; one appeals to God merely to fill gaps in our scientific knowledge of naturalistic mechanism; these gaps and the appeal to God just mentioned are used in apologetic, natural-theology arguments to support Christian theism; and God is manifest and proved only by the miraculous, by that which defies natural scientific explanation. This strategy is bad for at least two reasons. First, natural science is making these gaps increasingly rare and, thus, there is less need to believe in God if such a belief is justified solely or largely by the god-of-the-gaps strategy. Secondly, this strategy is based on a faulty understanding of the integration of science and theology and the proper model of human and divine action as depicted in the complementarity model. In particular, the strategy fails because there simply are no such gaps in the natural world, given the views already presented in this section.

I have responded to this argument elsewhere, and I will address it later in this article.²³ The argument represents a caricature of advocates of theistic science who see gaps in the natural world due to direct acts of God which can, in principle, be relevant to scientific methodology. No advocate of theistic science claims that God only acts in the "gaps." God is constantly active in sustaining the world, in concurring with natural processes, and the like. But advocates of theistic science believe that there is a scientifically and epistemically relevant distinction between primary and secondary causality and that both types of actions are relevant to the task of integrating science and theology. Belief in such a gap (and an appeal to a primary causal act of God to explain it) should not merely be based on ignorance of a natural causal mechanism, but on positive theological, philosophical, or scientific arguments that would lead one to expect such a gap. While most advocates of theistic science do use such a strategy for positive apologetic purposes, such a purpose is not necessary for an advocate of

theistic science. If apologetic purposes are part of a person's employment of theistic science, then that person need not hold that the entire ground for justifying belief in God is the explanatory work that "the God hypothesis" does in explaining gaps. Thus, most critical discussions of god-of-the-gaps issues generate far more heat than light precisely because they represent a gross caricature of those who actually employ this strategy.

The real issue is this: if God acts as a primary causal agent distinct from his action as a secondary cause, does it follow that there will be miraculous gaps in the natural causal fabric that could, in principle, be relevant to scientific methodology? I believe that the answer is "Yes," and to see why, we now turn to the difference between libertarian and compatibilist views of freedom and agency. Because the natures of freedom and agency are so central to the reality of causal gaps and theistic science, I must go into some detail in describing these competing models.

Libertarian and Compatibilist Models of Agency

All Christians believe we have free will, but they differ about what free will is. We can define determinism as the view that for every event that happens, there are conditions such that, given them, nothing else could have happened. Every event is caused or necessitated by prior factors such that given these prior factors, the event in question had to occur. Libertarians embrace free will and hold that determinism is incompatible with it. Compatibilists hold that freedom and determinism are compatible with each other and, thus, the truth of determinism does not eliminate freedom. As we will see, compatibilists have a different understanding of free will from the one embraced by libertarians and hard determinists.

General Comparison

1. **Compatibilism.** For compatibilists, if determinism is true, then every human action (e.g., raising one's hand to vote) is causally required by events that obtained prior to the action, including events that existed before the person acting was born. That is, human actions are mere *happenings*, parts of causal chains of events leading up to them. Freedom properly understood, however, is compatible with determinism.

2. **Libertarianism.** Libertarians claim that the freedom necessary for responsible action is not compatible with determinism. Real freedom requires a type of control over one's action — and, more important, over one's will — such that, given a choice to do A (raise one's hand and vote) or B (leave the room), nothing determines that either choice is made. Rather, the agent himself must simply exercise his own *causal powers* and will to do one alternative, say A (or have the power to refrain from willing to do something). When an agent wills A, he also could have willed B without anything else being different inside or outside of his being. He is the absolute originator of his own actions. When an agent acts freely, he is a *first* or *unmoved mover*; no event causes him to act. His desires, beliefs, etc. may influence his choice, but free acts are not caused by prior states in the agent.

Suppose we have person P that freely did some act *e*, say changing his thoughts or raising his arm. A more precise, initial characterization of libertarian freedom and agency can be given as follows:

1. P is a substance that had the power to cause *e*.
2. P exerted its power as a first mover (an uncaused cause of action) to cause *e*.
3. P had the ability to refrain from exerting its power to cause *e*.
4. P caused *e* for the sake of some final cause, *R*, which is the reason P caused *e*.

We can delve more deeply into compatibilist and libertarian accounts of freedom by looking at four areas central to an adequate theory of free will.

Four Areas of Comparison Between Compatibilism and Libertarianism

1. **The Ability Condition.** To have the freedom necessary for responsible agency, one must have the ability to choose differently from the way the agent actually does. Compatibilists and libertarians agree that a free choice is one where a person "can" will to do otherwise but differ about what this ability is. Compatibilists see this ability as a hypothetical ability. Roughly, this means that the agent would have done otherwise had some other condition obtained, e.g., had the agent desired to do so. We are free to will whatever we desire though our desires are themselves determined. Freedom is willing to act on your strongest preference.

Libertarians view hypothetical ability as a slight of hand and not sufficient for the freedom needed for responsible agency. For libertarians, the real is-

sue is not whether we are free to do what we want, but whether we are free to want in the first place. A free act is one in which the agent is the ultimate originating source of the act. Freedom requires that we have the categorical ability to act, or at least, to will to act. This means that if Smith freely does (or wills to do) A, he could have refrained from doing (or willing to do) A or he could have done (or willed to have done) B without any conditions whatsoever being different. No description of Smith's desires, beliefs, character, or other things in his makeup and no description of the universe prior to and at the moment of his choice to do A is sufficient to entail that he did A. It was not necessary that anything be different for Smith to do B instead. *This means that there will be a gap in the universe just prior to and after a free act due to the causal activity of the agent as first mover.*

Compatibilists and libertarians agree that a free choice is one where a person "can" will to do otherwise but differ about what this ability is.

The libertarian notion of categorical ability includes a dual ability: if one has the ability to exert his power to do (or will to do) A, one also has the ability to refrain from exerting his power to do (or will to do) A. By contrast, the compatibilist notion of hypothetical ability is not a dual ability. Given a description of a person's circumstances and internal states at time *t*, only one choice could obtain and the ability to refrain is not there; its presence depends on the hypothetical condition that the person had a desire (namely, to refrain from acting) which was not actually present. *There is no causal gap just prior to and after the act of a substantial first mover who contributes causal power into the natural causal fabric because this view of agency is rejected by compatibilists.*

2. The Control Condition. Suppose Jones raises his hand to vote. Compatibilists and libertarians agree that a necessary condition for the freedom of this act is that Jones must be in control of the act itself. However, they differ radically about what control is.

To understand compatibilist views of the control condition, recall that compatibilists take cause and effect to be characterized as a series of events making up causal chains with earlier events and the

laws of nature (either deterministic or probabilistic) causing later events. The universe is what it is at the present moment because of the state of the universe at the moment before the present and the correct causal laws describing the universe. A crude example of such a causal chain would be a series of 100 dominos falling in sequence from the first domino on until domino 100 falls. Suppose all the dominos are black except numbers 40-50, which are green. Here we have a causal chain of events that progresses from domino one to 100 and that "runs through" the green dominos.

According to compatibilism, an act is free only if it is under the agent's own control. And it is under the agent's own control only if the causal chain of events — which extends back in time to events realized before the agent was even born — that caused the act (Jones's hand being raised) "runs through" the agent himself in the correct way. But what does it mean to say that the causal chain "runs through" the agent in the correct way"? Here compatibilists differ from each other. But the basic idea is that an agent is in control of an act, just in case the act is caused in the right way by prior states of the agent himself (e.g., by the agent's own character, beliefs, desires, and values). This idea is sometimes called a causal theory of action.

Libertarians reject the causal theory of action and the compatibilist notion of control and claim that a different sense of control is needed for freedom to exist. Consider a case where a staff moves a stone but is itself moved by a hand that is moved by a man. In *Summa contra Gentiles* I, Chap. 8, St. Thomas Aquinas states a principle about causal chains that is relevant to the type of control necessary for libertarian freedom:

In an ordered series of movers and things moved [to move is to change in some way], it is necessarily the fact that, when the first mover is removed or ceases to move, no other mover will move [another] or be [itself] moved. For the first mover is the cause of motion for all the others. But, if there are movers and things moved following an order to infinity, there will be no first mover, but all would be as *intermediate movers* ... [Now] that which moves [another] as an instrumental cause cannot [so] move unless there be a principal moving cause [a first cause, an unmoved mover].

Suppose we have nine stationary cars lined up bumper to bumper and a tenth car runs into the first car causing each to move the next vehicle until car nine on the end is moved. Suppose further that all the cars are black except cars 5 to 8 which are green. Now, what caused the ninth car to move?

According to Aquinas, cars 2 to 8 are not the real cause of motion for car 9. Why? Because they are only *instrumental causes*, each of these cars passively receives motion and transfers that motion to the next car in the series. Car 1 (actually, the driver of car 1) is the real cause since it is the first mover of the series. It is the source of motion for all the others. Only first movers are the sources of action, not instrumental movers that merely receive motion passively and pass that on to the next member in a causal chain.

Compatibilists and libertarians agree that a necessary condition for the freedom [to] act is that [a person] must be in control of the act itself. However, they differ radically about what control is.

For libertarians, it is only if agents are first causes, unmoved movers, that they have the control necessary for freedom. An agent must be the absolute, originating source of his own actions to be in control. If, as compatibilists picture it, an agent is just a theater through which a chain of instrumental causes passes, then there is no real control. Further, the control that an unmoved mover exercises in free action is a dual control — it is the power to exercise his own ability to act or to refrain from exercising his own ability to act.

3. The Rationality Condition. The rationality condition requires that an agent have a personal reason for acting before the act counts as a free one.²⁴ Consider again the case of Jones raising his hand to vote. In order to understand the difference between the two schools about how to handle this case in light of the rationality condition, we need to draw a distinction between an *efficient* and a *final cause*. An efficient cause is that by means of which an effect is produced. One ball moving another is an example of efficient causality. By contrast, a final cause is that for the sake of which an effect is produced. Final causes are teleological goals, ends, or purposes for which an event is done; the event is a means to the end that is the final cause.

Now a compatibilist will explain Jones' voting in terms of efficient and not final causes. According to this view, Jones had a desire to vote and a belief that raising his hand would satisfy this desire and this state of affairs in him (the *belief/desire set* com-

posed of the two items just mentioned) caused the state of affairs of his hand going up. In general, whenever some person S does A (raises his hand) to do B (vote), we can restate this as S does A (raises his hand) because he desired to B (vote) and believed that by A-ing (raising his hand), he would satisfy desire B. On this view, a reason for acting turns out to be a certain type of state in the agent, a belief-desire state, that is the real efficient cause of the action taking place. Persons as substances do not act; states within persons cause latter states to occur. The compatibilist, in possession of a clear way to explain cases where S does A to do B, challenges the libertarian to come up with an alternative explanation.

Many libertarians respond by saying that our reasons for acting are final and not efficient causes. Jones raises his hand in order to vote, or perhaps, to satisfy his desire to vote. In general, when person S does A to do B, B states the reason (e.g., a desire or a value) which is the teleological end or purpose for the sake of which S freely does A. Here the person acts as an unmoved mover by simply exercising his powers in raising his arm spontaneously. His beliefs and desires do not cause the arm to go up; he himself does. But B serves as a final cause or purpose for the sake of which A is done. Thus, compatibilists embrace a belief/desire psychology (states of beliefs and desires in the agent cause the action to take place), while at least many libertarians reject it and see a different role for beliefs and desires in free acts.

4. Causation. From what has already been said, we can anticipate a difference between libertarians and compatibilists about causation. For the compatibilist, the only type of causation is called event-event causation. Suppose a brick breaks a glass. In general, event-event causation can be defined in this way: an event of kind K (the moving of the brick and its touching of the surface of the glass) in circumstances of kind C (the glass being in a solid and not liquid state) occurring to an entity of kind E (the glass object itself) causes an event of kind Q (the breaking of the glass) to occur. Here, all causes and effects in the chain are events. If we say that a desire to vote caused Jones to raise his arm we are wrong. Strictly speaking, a desiring to vote caused a raising of the arm inside of Jones.

Libertarians agree that event-event causation is the correct way to account for normal events in the natural world, like bricks breaking glasses. But when it comes to the free acts of persons, the person, as a substance and an agent directly produces the effect. Persons are agents and, as such, in free acts they

either cause their acts for the sake of reasons (called agent causation) or their acts are simply uncaused events they spontaneously do by exercising their powers for the sake of reasons (called a noncausal theory of agency). Either way, persons are seen as first causes, unmoved movers who have the power to exercise the ability to act as the ultimate originators of their actions. It is the I, the self that acts; not a state in the self that causes a moving of some kind. Libertarians claim that their view makes sense of the difference between actions (expressed by the active voice, e.g., Jones raised his hand to vote) and mere happenings (expressed by the passive voice, e.g., a raising of the hand was caused by a desiring to vote, which was caused by x, ...).

For the compatibilist, the only type of causation is called event-event causation. ... [For the Libertarian,] when it comes to the free acts of persons, the person, as a substance and an agent, directly produces the effect.

At this point it may be helpful to discuss the relevance of quantum physics to the free will debate. According to some, certain quantum events (e.g., the precise location of an electron hitting a plate after being shot through a slit, the exact time a specific atom of uranium will decay into lead) are completely uncaused events and, as such, are indeterminate, random happenings. Thus, it is argued, a quantum view of reality abandons determinism and makes room for freedom. As chemist Michael Kellman puts it, "... the theory of quantum mechanics ... is compatible with a role for mind as agent in determining some actions of purely material portions of biological systems."²⁵

Unfortunately, quantum physics has little relevance to the free will debate. For one thing, many scientists believe that the quantum world is just as determined as the regular world of macro-objects, like baseballs and cars. We just do not (perhaps cannot) know what the causes are for some events and we cannot predict exactly the precise behavior of quantum entities. For another thing, even if we grant that the quantum world is really a place where determinism is false, it could still be argued that determinism reigns in the macro world. More important, a necessary condition of libertarian freedom is a view of the person as a substance that acts as an

agent, i.e., as a first cause or an unmoved mover. Thus, determinism is sufficient for a denial of libertarian freedom, since it says that all events are caused by prior events and there are no substantial agents that act as unmoved movers. But determinism is not necessary to deny such freedom. Completely uncaused events that randomly occur without reason (as in the quantum world) do not give the type of agency needed for libertarian freedom either. The main debate between compatibilists and libertarians is one about the nature of agency and not determinism per se, although the truth of determinism is sufficient for the denial of libertarianism as was already mentioned.

With this in mind, we can modify the understanding of modern compatibilism we have used up to this point. Compatibilism is basically the thesis that freedom and determinism are compatible with each other, i.e., that both *can* be true. But some, indeed, most compatibilists go on to accept the truth of determinism, while others do not make a commitment to accepting determinism. However, both groups of compatibilists reject libertarian agency. So while we will continue to focus on the majority of compatibilists who accept determinism, we need to remember that the nature of agency, and not determinism per se, is the main disagreement between compatibilists and libertarians. Next let us apply these insights about agency to questions regarding miracles, gaps, and theistic science.²⁶

Miracles, Agent Gaps, and Science

Complementarian A. R. Peacocke has said that the "problem of the human sense of being an agent ... acting in this physical causal nexus, is of the same ilk as the relationship of God to the world."²⁷ I agree. But whereas Peacocke uses this point to support the complementarian view and place miracles outside the bounds of science, I claim that the analogy between human and divine action actually supports theistic science and the possibility of miraculous acts being part of science. The difference between us is this: Peacocke and complementarian methodological naturalists in general adopt compatibilist models of (divine and human) action (at least for causality outside of salvation history) with the result that no gaps exist in the causal fabric. I see (divine and human) action in terms of libertarian agency and believe that free acts leave scientifically detectable gaps in the natural world.

To see why complementarian compatibilists have no room for gaps, consider the following statements from naturalist philosophers. John Searle has said that "our conception of physical reality simply does not allow for radical [libertarian] freedom."²⁸ The reason for this is that once you claim that the physical level of description is both basic and complete, you rule out the possibility of top-down feedback. As naturalist David Papineau has argued:

I take it that physics, unlike the other special sciences, is *complete*, in the sense that all physical events are determined, or have their chances determined, by prior *physical* events according to *physical* laws. In other words, we never need to look beyond the realm of the physical in order to identify a set of antecedents which fixes the chances of subsequent physical occurrence. A purely physical specification, plus physical laws, will always suffice to tell us what is physically going to happen, insofar as that can be foretold at all.²⁹

Jaegwon Kim says that someone who holds that the physical level is basic and complete must "accept some form of the principle that the physical domain is causally closed — that if a physical phenomenon is causally explainable, it must have an explanation within the physical domain."³⁰ Here is the reason for the remarks by Searle, Papineau, and Kim. In every alleged case where there is a description of top-down causation (e.g., where a state of intending to raise my arm causes the raising of the arm), there will be a corresponding description of a causal sequence of events that run along the bottom level (e.g., there will be a physical state "associated with" the mental state of intending to raise one's arm and a physical state "associated with" each moment of the arm being raised).

Moreover, when we claim that the physical is the bottom level, this means not just that each upper level event has some lower level event or another correlated with it. It means that the description of the bottom level sequence of events is complete without any gaps. For example, at each moment during the process of voting — I desire to vote, believe that raising my arm will satisfy that desire, deliberate about whether to vote, will to raise my arm, and raise it — throughout a time of a few seconds, there will be a physical state in my brain and nervous system that is sufficient to produce the next physical state without room for feedback. Remember, the physical level description is complete and basic. There is no room for mental entities to make a physical difference in the world because once the physical antecedents are fixed, so are the physical consequences (or at least their probabilities). This is simply what it means to claim that the physical

is both basic and complete at its own level of description. Moreover, each alleged description of a top-down causal connection will have a description that runs the other way and that is more consistent with the view that the physical level is at the bottom. In any case, even if one allows for top-down mental-to-physical feedback, this type of causality will still be event-event causation with no room for libertarian agency.

Complementarian methodological naturalists in general adopt compatibilist models of ... action ... with the result that no gaps exist in the causal fabric. I see ... action in terms of libertarian agency and believe that free acts leave scientifically detectable gaps in the natural world.

By contrast, in cases of libertarian action, say, just before one acts to raise one's arm and during the raising of it, the description of one's brain and central nervous system just before acting will not be sufficient to entail or causally account for the physical description resulting from the agent's own (first mover) exercise of causal power. Of course, at each moment there will be some physical state, but the events at the physical level will not form a continuous chain of causal events. Instead, there will be a causal gap due to the action of the agent. This is why some have objected to libertarian agency since libertarian acts violate the first law of the conservation of energy. I think such acts do indeed violate the first law and, in fact, this is part of what it means for an agent to be in the image of God — he or she is capable of genuine creativity and novelty. Moreover, Robert Larmer argues that we must distinguish two forms of the First Law. A strong form states that energy can neither be created nor destroyed. A weak form states that in a causally closed system, the total amount of energy remains constant. Larmer says that libertarian agency is inconsistent with the strong, but not the weak, form because the human body is not a causally closed physical system.³¹ He correctly sees that libertarian acts leave gaps in the natural causal fabric.

If we assume for a moment that libertarian agency is the correct model of divine action for pri-

mary causal miracles, then whenever God acts in this way, there will be a gap in the natural world that could figure into scientific practice in at least three ways. First, scientific methodology includes the psychology of discovery, roughly, the psychological processes scientists go through to come up with theories to guide their research. Now it is a known fact that in the history of science, a hypothesis often has suggested itself to a scientist from his theological or metaphysical beliefs. If someone held that various things in the natural world were the result of a libertarian, miraculous act of God (e.g., the beginning of the universe, the direct creation of first life and the various kinds of life, the direct creation of human beings in the Mid-East, the flood of Noah), then such a belief could guide a scientist in postulating that there will be no natural explanation for the occurrence of these things. This could, in turn, lead him or her to try to discover evidence for these events (the flood of Noah, a Mid-Eastern origin for human beings) or to try to falsify the fact that they were the result of miraculous acts by trying to discover natural mechanisms for their occurrence that he or she believes are not there.

Secondly, in a number of areas of science (forensic science, SETI, archeology, psychology), scientific explanations for some phenomenon appeal to the desires, beliefs, intentions, and actions of personal agents. Thus, for example, if one discovered that living systems are discontinuous with nonliving systems in such a way that living systems bear certain features that usually result from personal agency (e.g., information in DNA, different kinds of design such as beauty, order, etc.), and if one has grounds for thinking that it is improbable that a naturalist mechanism will be found to account for this, then one could legitimately see the origin of life as a gap in the history of the universe due to a primary causal act of God. In this case, an appeal to divine action, intentions, and so forth could be a legitimate form of *scientific* explanation.

Thirdly, these features of living systems could lend some confirmation to the hypothesis that life was, indeed, the result of a miraculous act of God. Such claims would be defeasible (i.e., they could be shown false given more data), but this is irrelevant, since all scientific theories are (in principle) defeasible. Yet they are often well enough attested to be rationally accepted. In these three ways — scientific discovery, scientific explanation that is a form of personal explanation, and scientific confirmation — gaps in the causal fabric derived from theological models of primary causal divine agency regarding some natural phenomenon could enter into scientific methodology.³²

Conclusion

In this article, I have not had the space to defend libertarian agency for human or divine (primary causal) action, though I obviously think such a defense is possible. Fortunately, such a defense is not needed for my purposes here. I have tried to show that the claim that miracles are in principle outside the bounds of science is one embedded in a backdrop that includes a complementarian, methodological, naturalist view of science and reality, along with a compatibilist view of human and divine action in the natural world (outside salvation history). This, in turn, has led many to reject any version of a theistic explanation for gaps because, among other things, the backdrop just mentioned denies that such gaps exist.

Whether miracles are outside the bounds of science, then, depends in part on one's model of divine agency ...

By contrast, I do not limit the use of theistic science to the employment of explanations that appeal to direct, primary causal acts of God. Nevertheless, if such acts have occurred in certain cases, and if libertarian agency is a good model for depicting such actions, then there will be gaps in the causal fabric that can enter scientific practice. Whether miracles are outside the bounds of science, then, depends in part on one's model of divine agency which, in turn, can be understood from an analogy with human action. Complementarians may, unfortunately, reject libertarian agency, but even if they do, I hope to have made clear why some of us who accept this model believe that miracles can, in fact, be part of scientific practice. *

Notes

¹Michael Ruse, *Darwinism Defended* (Addison-Wesley, 1982), 322.

²Ibid.

³Nothing honorific is meant by the term "theistic science." More precisely, it is not meant to imply that methodological naturalists are not solid Christian theists. The term is currently being used to label a view bearing a family resemblance to the definition I offer here. No emotional connotations should be derived from the label.

⁴It has been argued that Proposition 1 assumes that we know God has directly acted in the world from insights about what a creator would do and that we should, instead, exhaust every possible natural process for God's activity

before concluding we have a primary cause. Three things are wrong with this suggestion. First, any statement of a theory or research program contains assertions in the indicative mood, and such propositions do not imply anything whatever about commitment to the truth of those propositions or the epistemic strength of such commitment. One can use a theory to explore the natural world even if one wishes to falsify the theory. The presence of 1 does not imply that anyone holds the assumption in question, much less that someone knows it to be true. Second, even if one believes proposition 1 to be true, why can't this believe rest, in part, on prior theological or philosophical arguments. I see no reason to think that one must exhaust every possible naturalistic explanation before one is justified in believing 1. Even in science, a theory can receive some initial epistemic support from so-called non-empirical factors (elegance, simplicity, internal clarity, harmony with external conceptual problems), so such a prior commitment does not violate the nature of science. Third, many advocates of theistic science believe that we have, in fact, exhausted enough naturalistic possibilities to justify the defeasible commitment to a primary causal divine act for things like the origin of life or human beings.

⁵Richard Bube has complained that my characterization of complementarity is confused and is actually a description of what he calls compartmentalization. See his *Putting It All Together* (Lanham, MD: University Press of America, 1995), 168. Cf. chapters 6 and 10. For Bube, compartmentalization treats science and theology as different descriptions about different kinds of things with no common ground or possibility of conflict. Complementarity views science and theology as different descriptions of the same reality. Unfortunately, Bube is simply wrong in this complaint toward my position. What he calls compartmentalization is close to what I call the "two realms" view of integration and my description of complementarity is an accurate one. The source of Bube's confusion is revealing. I claim that the complementarity view eschews interaction between science and theology and Bube says that it embraces such interaction. However, Bube equivocates on what "interaction" means in this context. For me, it is "epistemic" interaction, roughly the same description of the same reality that can be in conflict or concord to varying degrees of strength. For Bube, interaction amounts to taking two different (non-interacting in my sense) perspectives and forming them into a whole. For example, a completely scientific description of the origin of life in natural terms could be described in theological terms as God's activity in bringing life into being. It is clear that his notion of interaction is not the one I deny in explicating complementarity. Moreover, my use of interaction is crucial in understanding the significance for scientific methodology of gaps in the natural causal fabric due to libertarian agency and primary causal activity on God's part.

⁶See J. P. Moreland, ed., *The Creation Hypothesis* (Downers Grove, IL: InterVarsity Press, 1994), chapters 1, 2; "Creation Science and Methodological Naturalism," in *Man and Creation*, ed. by Michael Bauman (Hillsdale, MI: Hillsdale College Press, 1993), 105-139; *Christianity and the Nature of Science* (Grand Rapids: Baker, 1989), chapters 1, 6; "Conceptual Problems and the Scientific Status of Creation Science," *Perspectives on Science and Christian Faith* 46 (March 1994): 2-13.

⁷See D. M. Mackay, *The Clock Work Image* (Downers Grove: InterVarsity Press, 1974); *Human Science & Human Dignity* (Downers Grove: InterVarsity Press, 1979), 26-56.

⁸See A. R. Peacocke, *Creation and the World of Science* (Oxford: Clarendon Press, 1979), 112-46; *God and the New Biology* (San Francisco: Harper & Row, 1986).

⁹See Richard Bube, *The Human Quest* (Waco: Word Books, 1971), 26-35, 134-59; Richard Bube, ed., *The Encounter Between Christianity and Science* (Grand Rapids: Eerdmans, 1968), 17-108; *Putting It All Together*, Chapter 10.

¹⁰See Howard J. Van Till, "The Character of Contemporary Natural Science," in *Portraits of Creation*, ed. by Howard J. Van Till, Robert E. Snow, John H. Stek, and Davis A. Young (Grand Rapids: Eerdmans, 1990), 126-65; Howard J. Van Till, Davis A. Young, Clarence Menninga, *Science Held Hostage* (Downers Grove: InterVarsity Press, 1988); Howard J. Van Till, "Categorical Complementarity and the Creationomic Perspective," *Journal of the American Scientific Affiliation* 37 (September 1985): 149-57.

¹¹Paul de Vries, "Naturalism in the Natural Sciences: A Christian Perspective," *Christian Scholar's Review* 15 (1986): 388-96.

¹²David G. Myers, *The Human Puzzle* (New York: Harper & Row, 1978), 3-22, 45-90, 201-31.

¹³Howard J. Van Till has complained that my description of methodological naturalism treats it as a scientific strategy that begins with philosophical naturalism, strips away all reference to atheistic metaphysics, and leaves room only for methodological rules that proscribe consideration of divine action. According to Van Till, this is a caricature. See "Special Creationism in Designers Clothing: A Response to *The Creation Hypothesis*" in *Perspectives on Science and Christian Faith* 47 (June 1995): 126-27. It should be clear, however, that I have done no such thing. I acknowledge that Van Till and others distinguish philosophical from methodological naturalism. The point is that for Van Till theological notions like primary causal acts of God do not play a role within the methodology of science. If Van Till thinks that this is a caricature, then he needs to point out where this description is wrong and state where theological concepts have a role within scientific methodology in his view.

¹⁴Advocates of the complementarity view differ in the details here and, in some cases, appear to be confused. Early on Peacocke advocated what is called type type identity physicalism regarding the mental, Bube seems to embrace property dualism, and Mackay appears to conflate a double aspect, a type type identity, and a functionalist view of the mind/body problem. On Mackay, see *Human Science & Human Dignity*, 26-34.

¹⁵See J. Kim, "Supervenience," in *Handbook of Metaphysics and Ontology*, ed. by Hans Burkhardt, Barry Smith (Munich: Philosophia Verlag, 1991): II, 877-879.

¹⁶For more on this see Richard Connell, *Substance and Modern Science*, (Notre Dame: University of Notre Dame Press, 1988). There are other uses of the term "substance" that I shall not consider here because they are not relevant to the line of critique I am developing. It should be pointed out, however, that the classic definition of substance is not an arbitrary construction of philosophers' fancy. It is rooted in reality as Connell's book points out.

¹⁷There are also significant implications of the property-thing view for end of life ethics. See J. P. Moreland, "Humanness, Personhood, and the Right to Die," *Faith and Philosophy*

- (Jan. 1995): 95-112; J. P. Moreland, Stan Wallace, "Aquinas, Locke and Descartes on the Human Person and End-of-Life Ethics," *International Philosophical Quarterly* 35 (Sept. 1995): 319-30.
- ¹⁸Mackay, *Human Science & Human Dignity*, 28.
- ¹⁹David Charles, Kathleen Lennon, eds., *Reduction, Explanation, and Realism* (Oxford: Clarendon, 1992), 3-4.
- ²⁰Jaegwon Kim, "Mental Causation in Searle's Biological Naturalism," *Philosophy and Phenomenological Research* 55 (March 1995): 185-6.
- ²¹I set aside debates about the exact nature of secondary causality (e.g. disputes over occasionalism and alternative accounts) because the distinction between primary and secondary causality will still be functionally and epistemologically significant irrespective of the exact nature of the metaphysical account of the difference between them because whatever else one wants to say here, secondary causality will be God's usual way of acting and the laws of nature will be regular and normal here (regardless of whether they are deterministic or probabilistic) and primary causality will be God's unusual way of acting that could be epistemically detected due to the contrast in this type of action compared to the regular, usual sequences of events that constitute secondary causality.
- ²²Howard J. Van Till, "When Faith and Reason Cooperate," *Christian Scholar's Review* 20 (September 1991): 42.
- ²³cf. J. P. Moreland, *The Creation Hypothesis*, 59-60.
- ²⁴Some libertarians allow for the existence of free acts that are not done for any reason at all, e.g., freely moving my hand back and forth or looking at one thing and then another (where these acts are not caused by, say, a nervous twitch or a sudden noise). Spontaneity is the name for non-rational, bare exercises of free will. But there libertarians agree with the fact that a crucial class of human actions are those done for certain reasons, so there is still an important area of debate between libertarians and compatibilists about the role of reason in free choices. Liberty is the name for this class of cases of free will.
- ²⁵Michael Kellman, "Science and Free Will," *First Things* (May 1994): 5.
- ²⁶Richard Bube claims that a scientific description is deterministic if it can predict a future state from a present one and chance if it can only predict the probability of a future state. See *Putting It All Together*, 22-26. Moreover, such descriptions must be one or the other. Now Bube thinks that these observations raise a paradox about human responsibility. Such responsibility is hard to square with determinism (how can I be responsible if determined) yet it also seems to require determinism (how can a responsible choice exist without being described in a definite cause [the basis of the choice] and effect [the result of the choice] sequence). On the other hand, responsibility is hard to harmonize with chance which seems to be required for responsible action yet chance is utterly random. Bube's solution to the problem is simply to assert without adequate justification that scientific descriptions of determinism or chance do not entail determinism or meaninglessness as world views and that the two types of descriptions can be complementary. However, if these descriptions are true, then anything else we would say at a different level of description could not contradict what is said at the scientific level. I think Bube misses this point because his definitions of determinism and chance are epistemological and not ontological. Unfortunately, epistemological definitions confuse the real issues of freedom and responsibility. For example, epistemological determinism in Bube's sense is neither necessary nor sufficient for ontological determinism. Moreover, Bube fails to see that the real issue is the nature of agency and that libertarian freedom is a third (and more adequate) option that renders his dilemma incomplete.
- ²⁷Peacocke, *Creation and the World of Science*, 132.
- ²⁸John Searle, *Minds, Brains, and Science* (Cambridge, MA: Harvard University Press, 1984), 98.
- ²⁹David Papineau, *Philosophical Naturalism* (Oxford: Blackwell Publishers, 1993), 16.
- ³⁰Jaegwon Kim, "Mental Causation and Two Conceptions of Mental Properties," unpublished paper delivered at the Eastern Divisional Meeting of the American Philosophical Association, Winter 1993, 21.
- ³¹Robert Larmer, "Mind-Body Interaction and the conservation of Energy," *International Philosophical Quarterly* 26 (Sept. 1986): 277-85.
- ³²When it comes to miraculous actions by God, Richard Bube admits that no scientific descriptions can be given of such acts. See *Putting It All Together*, 25-26, 65-70. Now this would seem to require a libertarian view of such acts; otherwise, they would have complementary scientific descriptions. Yet Bube claims that such miraculous acts cannot figure into scientific practice. Why? Because in such acts, there is no scientific mechanism available for scientific description and, therefore, primary causal miracles are not susceptible to scientific investigation. It should now be obvious what is wrong with this claim: Scientific investigation does not limit itself to *descriptions*, and a primary causal act of God could figure into scientific methodology in the three ways mentioned above, even though such acts themselves cannot be given a scientific description.

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Science on Trial: Exploring the Rationality of Methodological Naturalism

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*In this essay, I closely scrutinize the proposal presented in a recently edited volume entitled *The Creation Hypothesis: Scientific Evidence of an Intelligent Designer* by J. P. Moreland. Moreland chides Christians for what he takes as their failure to understand the proper integration of their faith with secular disciplines, particularly the natural sciences. Contributors to this volume propose a "theistic science" which focuses primarily on the tactical or strategic proscription against direct reference to divine agency (methodological naturalism [MN]). These authors endorse the inclusivity principle, that is, the claim that explanations in terms of the direct and immediate activity of a divine agent may constitute a proper part of natural science.*

As I see it, the recommendation takes two forms: (1) it is positively irrational for the Christian engaged in natural science to remain committed to MN, and (2) because science has no intrinsic individuating features, it is irrational for the broader scientific community to continue to resist appeal to immediate divine agency as a proper part of natural science. Specifically, I argue that the first statement is mistaken, and the second is ill-advised. The disciplinary distinction, as determined in part by MN, is well-grounded, intrinsically valuable, and, when properly understood, a critical component of Christian inquiry. I conclude that permitting direct reference to divine agency in natural science severely undermines the overall quest for truth.

In a recently edited volume entitled *The Creation Hypothesis: Scientific Evidence of an Intelligent Designer*, as well as in this journal,¹ J. P. Moreland chides Christians for what he takes as their failure to understand the *proper* integration of their faith with secular disciplines, particularly the natural sciences, and for capitulating too readily to the "question-begging Procrustean legislation" imposed by the secular practitioners of their craft.² Moreland, with support primarily from Stephen C. Meyer and William A. Dembski, proposes an alternative and distinctively Christian approach to the sciences: "theistic science" is "rooted in the idea that Christians ought to consult all they know or have reason to believe in forming and testing hypotheses, explaining things in science and evaluating the plausibility of various scientific hypotheses, and among

the things they should consult are propositions of theology (and philosophy)."³ Accordingly, the central doctrine of creation can and should "enter into the very fabric of the practice of science and the utilization of scientific methodology."⁴

When stated in these terms, this seems wholly commendable advice. There are many respects in which specifically Christian beliefs ought to bear upon scientific inquiry. Yet, their argument for "theistic science" focuses primarily on the tactical or strategic proscription against direct reference to divine agency. The central idea behind this proposal holds that, since the Christian knows that God occasionally directly interacts with the natural created order, a Christian scientist can, and should, specifically incorporate that belief into scientific accounts. Thus,

an attenuated "natural science" transforms into a fully informed "theistic science." Having this larger stock of true beliefs, the theist has available additional explanatory resources. As such, the theistic scientist has a greater prospect to achieve a fuller and proper understanding of creation, and will quite simply become a better scientist *by unapologetically drawing upon the full array of potential explanatory accounts*. The main obstacle on this royal road to truth is methodological naturalism (MN) which maintains that "only natural objects and forces can be referred to in scientific explanations."⁵ Thus, arguing that this *principle of exclusivity* is irrational, conspiratorial, and a positive impediment to truth, these authors reject this constraint. Rather, they endorse the *inclusivity principle*, i.e., the claim that explanations in terms of the direct and immediate activity of a divine agent may constitute a proper part of natural science. Taking his cue from the "postmodern" critique of the exclusivity of "enlightenment rationality,"⁶ Meyer, in particular, calls for the scientific community to grant equal consideration to divine action as comprising a legitimate *scientific* explanation. Repudiating MN, the theistic scientist ought to actively develop scientific accounts which as readily appeal to divine agency as to natural mechanisms.

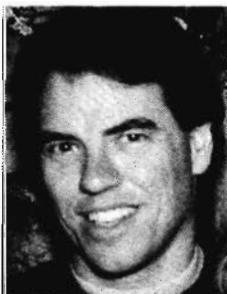
In this paper, I will closely scrutinize this proposal. As I see it, the recommendation takes two forms: (1) it is positively irrational for the Christian engaged in natural science to remain committed to MN, and (2) because science has no intrinsic individuating features, it is irrational for the broader scientific community to continue to resist appeal to immediate divine agency as a proper part of natural science. Specifically, I will argue that the first statement is mistaken, and the second is ill-advised and potentially dangerous. Indeed, the contributors to this volume, especially Stephen Meyer, do a *disservice* to Christian scholarship by advocating a position that is ill-motivated, unnecessary, and potentially damaging to Christian interests. The integration of these disciplines should not result in the assimilation of either science or theology to the other; the

disciplinary distinction, as determined in part by MN, is well-grounded, intrinsically valuable, and, when properly understood, a critical component of *Christian* inquiry. I will conclude that permitting direct reference to divine agency in natural science severely undermines the overall quest for truth. Thus, if there is a distinctively "Christian way of doing science," it does not come by repudiating MN.

Understanding MN

It must be understood as a radical departure from the present nomenclature to insist that appeal to direct nonnatural agency is a legitimate move *within the sciences*. It is clear in *The Creation Hypothesis* that by calling for an inclusive understanding of science, Moreland, et al. do not intend simply to voice support for natural theology in general, or even, as the subtitle of the book suggests, to limit their efforts to the validation of the claims regarding "Scientific Evidence for an Intelligent Designer." It is not their central interest to argue for the epistemic legitimacy of belief in divine agency, but to recommend theistic science as a legitimate successor to natural science.

This is evident in their construal of natural science's commitment to MN. Adopting a distinction used by Howard J. Van Till, we might distinguish between a *broad* and *narrow* construal of the "naturalistic" constraint on science.⁷ If MN required that scientific accounts refer only to entities whose *ultimate source were also naturalistic*, then we might read Moreland's proposal as properly objecting to the presumptive and illicit limitation placed upon the scope of divine power and influence.⁸ Read according to this broad construal, these writings constitute a (laudable) apologetic for the possibility of *natural theology*, for it is natural theology which asks whether there is an eventual point at which it is reasonable to suppose that natural explanations fail and a theological explanation should be given. The narrow, more charitable reading of MN, on the other hand, says that scientific accounts must refer to *wholly* natural phenomena, making no reference to



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immediate or *direct* contribution by nonnatural or supernatural agency, while permitting further, non-scientific appeal to the divine as the ultimate and sustaining source, meaning, and purpose of all natural phenomena. Adopting this narrow construal, the battle for inclusivity is joined at the level internal to the discipline of natural science itself, rather than at the level of overall world views.⁹ Although much of the language they use suggests that our authors intend to rebut the former, broader construal of MN, their explicit appeal for the principle of inclusivity requires us to understand their position as actually addressing the second, narrow version.

MN and the Rationality of Science

As we have seen, it is the central contention of these inclusivist authors that MN ought to be rejected for placing an "artificial limitation" upon the scientific quest for truth. Meyer holds that

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.¹⁰

According to this interpretation, MN is simply an arbitrary and prejudicial vestige of an obviously mistaken understanding of science and knowledge in general. Thus, he labels MN an example of yet "... another untenable enlightenment view of rationality."¹¹ In this section, I will consider various possible interpretations of the irrationality claim.

MN Is irrational because it is intellectually stultifying.

There is a pervasive confusion which carries portentous polemical weight. Is commitment to MN intellectually stultifying; does it constitute an impediment to the goal of science?¹² On the face of it, the answer would appear to be "No." MN does not place "artificial limitations upon theory construction," as Meyer supposes, but rather places limitations on *scientific* theory construction. MN does not have the effect of "disqualifying theories that invoke nonnaturalistic events — such as instances of agency or intelligent design," but rather simply refuses to regard such theories as comprising a proper part of "natural science."

Certainly, there are scientists who, while writing in an often strident mode, invoke MN (most often in its broad form) with the express intent of *excluding from rational consideration* appeal to divine agency. Furthermore, many secular (and Christian)¹³ theo-

rists uncritically and unwittingly collaborate with these "conspirators" by embracing the distinction between the scientific and nonscientific captured by MN, narrowly construed, *along with* an often tacit belief in the inferior epistemic status of the latter (which, in this context, becomes "pseudo-science"). However, if we, with Moreland, et al., explicitly reject broad naturalism as an intrusive and mistaken metaphysic, as well as all forms of "scientism,"¹⁴ then the disciplinary distinction entailed by MN should pose no threat to the epistemic status of a broadly theistic hypothesis. It would certainly be irrational to pursue an activity whose end, and so rationale, explicitly *contradicts* our antecedent background beliefs. But the narrow construal, which we have identified as both the species of naturalism to which natural science is actually committed and that species against which Moreland, et al. must be arguing when they press for inclusivity, is compatible with theism and should not prove equally stultifying. According to this constraint, a scientist *could* posit and examine natural phenomena — the origins, sustenance, or purpose of which may lie in divine agency.

Thus, MN need not prove an impediment to theistic scientists' search for truth, unless they mistakenly suppose that pursuit of truth is the exclusive domain of science. That is, although commitment to MN *narrowly* construed, when *coupled with* belief in either the weak or strong version of scientism, would have a stultifying effect on theological belief, it does not follow that MN itself, when narrowly construed, impedes the quest for truth. If, by endorsing MN, we risk sliding toward a tacit approval of scientism, then surely the Christian must carefully weigh this possible outcome against any evident benefits.¹⁵ Nonetheless, it would surely be infelicitous for the Christian to presume this *compatibilist* understanding of scientific method to be irrational.

MN commits science to an irrational goal.

Meyer's irrationality argument seems to be concerned primarily with *instrumental rationality*, that is, the methods used to achieve the ends toward which an activity aims. The question of instrumental rationality asks whether MN constitutes a reasonable means for achieving the goals of natural science. But the answer to this question depends on discerning the goals of natural science. How does MN fair with respect to the *goal* of accounting for experience in natural terms? Since MN simply says that natural science must (minimally, but necessarily) refer exclusively to natural phenomena without reference to immediate or direct supernatural intervention, the restriction is simply incontestable.

This suggests, then, that rather than simply challenging natural science at the level of proper methodology (the best means by which to achieve some end), the irrationality argument challenges "the goal of science" itself. By questioning the propriety of MN, the inclusivists effectively challenge the assumption that science aims to provide natural explanations. Thus, construing the irrationality argument in this manner actually serves to move the discussion from a consideration of the instrumental rationality of a particular methodological constraint to the *rationality of natural science itself*.

If the measure of good science lies in its prospects to provide a true and comprehensive understanding of reality, then it does seem positively irrational because it would be contrary to independently supported background knowledge for the Christian to remain committed to the exclusivity principle.

Is science, in its very goals, irrational? If the measure of good science lies in its prospects for providing a comprehensive and fully naturalistic understanding of reality, then, because this goal contradicts independently supported background knowledge of the Christian, it would constitute a positively irrational pursuit. Yet, is it, in fact, the aim of natural science simply to provide understanding of the natural order by appeal to *whatever* accounts hold the greatest explanatory power? Although understanding of reality is a goal of natural science, it is a shared, not the *distinguishing*, goal.¹⁶ The goal of natural science should be conceived as aiming toward an understanding of natural entities, processes, events, states of affairs, relationships, and such, *as natural entities, processes, events, states of affairs, relationships, and such*, i.e., explaining those phenomena from start to finish in natural terms.¹⁶ This does not commit the scientist to the view that all phenomena can be given a *complete* natural explanation (or indeed any), but only to the view that scientific explanations account for natural phenomena as far as they can in *completely* natural terms.

There are, of course, many ways to understand a phenomenon, including such concerns as its aesthetic value, moral significance, economic impact,

and divine purpose. From among these disparate explanatory interests, we pick out natural science as that activity specifically concerned with perceiving that phenomenon as a functional constituent of the natural created order.¹⁷ It is this peculiar interest in natural phenomena which *differentiates* a scientific pursuit from other particular interests (e.g., moral, political, theological), *as well as from the broader, more inclusive, epistemic goal* of achieving a comprehensive understanding of reality. Other accounts may also contribute to a broader understanding of reality; each may share in "the truth of the matter."¹⁸ Nonetheless, the goal of natural science cannot be conceived as "knowledge," "truth," or even "understanding" *simpliciter*. For as goals, these notions do not distinguish natural science from many other human endeavors (e.g., story-telling, poetry, torture, hypnosis, or mystical experience). Since they do not capture the goal of natural science, nor, as we shall argue, should they, MN does not fail us on the grounds of instrumental irrationality.

MN proscribes pursuit of particular scientific accounts.

Perhaps these inclusivists do not seek to broaden the very goals or aims of natural science in this manner, but rather consider MN as irrational because it doesn't allow consideration of *particular* natural explanatory accounts, such as those derived from a religious text. If MN prevented any consideration of specific hypotheses, or particular accounts of the initial conditions, then MN surely would "... leave open the possibility that the best explanations may not have been considered."¹⁹

But does MN have this effect? We have interpreted MN as demanding that a scientific explanation refer exclusively to natural phenomena, "the ontological origin of [their] existence ... [n]either specified [n]or implied."²⁰ But, this restriction on natural science leaves quite open the possibility that a particular scientific account, which has its origin in any manner of psychological, sociological, or ideological source, can be subsequently subjected to rational evaluation. If certain kinds of hypotheses are excluded out of hand, based purely on an epistemic bias against their *source*, then the comparison group will be skewed, and the quest for truth may be impeded.²¹ Unless any available account — no matter the source of inspiration, motives, beliefs, agendas, or interests of its advocates — is granted due consideration, there is a chance of missing the best account.²² Again, we ask, is it MN that has this deleterious effect? Origins research may postulate hypotheses regarding natural phenomena generated from nonscientific, or, in some cases, nonrational

sources. MN must and, in fact, does allow for consideration of these accounts as readily as those generated from other, more broadly acceptable, sources.

This is not to say that science should spend its time and energies assessing the intrinsic merits of outrageous hypotheses; science should not waste effort on hypotheses the origins of which are deemed positively irrational. Yet, this constraint is neither peculiar to natural science, nor an impediment, for instance, to Creation Science. In any case, it is not MN that constrains proper scientific investigation to those hypotheses having at least a modicum of initial plausibility. Thus, once again, *unless MN is coupled with some form of scientism (in particular the belief that all theologically motivated theories are irrational)*, commitment to MN does not — despite the polemic of prominent practitioners — constitute grounds for dismissing without consideration natural accounts for which the *only* motive is found in a particular interpretation of Scripture.

***It is not MN that constrains
proper scientific investigation to
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modicum of initial plausibility.***

Should science tolerate the kind of dissent from the “ruling paradigm” evident in Special Creationist writings? Surely it must, and has; what one hears is that, to the extent to which Creation Science posits natural explanatory phenomena (fixed species, separate origination of distinct species, a universal flood, a young earth, etc.), it must be considered science, even if deemed by some as “bad science.”²³ Does it follow from this assessment that Special Creationism is incorrect? Only if science is the sole source of our knowledge of nature. Thus, the Christian in search of the truth may judge a particular scriptural interpretation as having such independent epistemic assurance as to overwhelm a particular rival (scientific) account, particularly when that account has unresolved problems of its own.

Of course, a Christian may also wish to devote effort in redressing the scientific deficiencies in a Special Creationist story, in spite of the continued dominance of the alternative paradigm. There is a fairly compelling argument to the effect that Creation Science is judged harshly — even from within the Christian community — precisely because it has not been taken seriously and therefore not pursued as vigorously by scientists as have rival accounts.

The temptation, then, is to castigate MN for its association and (intentional?) confusion with metaphysical naturalism. According to this line of reasoning, if *scientists* were given the methodological green light to cite immediate divine agency, thereby allowing a thorough *scientific* exploration of the expectations arising from Special Creationism, then the relative strengths of “scientific creationism” would be evident. Therefore, Christians ought to reject MN. What are we to make of this apparently compelling argument?

It is right to suppose that Christians should have a strong interest in exploring those theoretical accounts suggested by their preferred reading of Scripture. As Moreland argues, “Theology can provide predictions (or retrodictions) of empirical data (e.g., that humans arose in the Mideast, various inferences from models of a universal flood, young-earth predictions about the age of the earth, gaps in the fossil record) ...”²⁴ It is simply not necessary, however, to reject the exclusivity principle in order to legitimate this line of research. MN is not in the business of making the sort of plausibility assessment which renders a particular hypothesis “available” for scientific consideration; it merely dictates that the hypothesis refers exclusively to natural phenomena.

***[MN] merely dictates that the
hypothesis refers exclusively to
natural phenomena.***

If the hypothesis does posit natural phenomena and fits well within Scripture or church tradition, then the Christian ought to explore it thoroughly and vigorously, even if (or, *especially* if) one supposes that phenomenon to result directly from divine agency. If, on the other hand, a hypothesis involves direct reference to nonnatural phenomena (powers, entities, states, etc.), then it ought to be explored thoroughly and vigorously in a manner in keeping with that discipline under which it falls. It may require theological expertise for a full explanation of that hypothesis; for instance, it is presumably the business of theology to tell us that God is the immediate source of some natural phenomenon, or why God might have created in a certain manner at a certain place and time, or what we might expect of God in the matter of creation. The relative merits of this account would then be weighed against the strongest scientific model which will provide a natural account (including appeal to chance — the null hypothesis). In any case, since MN presents no ob-

stacle to this pursuit, it should not be regarded as irrational. If, as we shall argue, MN makes a positive contribution to knowledge, then theists are well served by this constraint.

MN represents an unattainable goal for science.

Moreland, et al. may be arguing that, if MN is not *inherently* irrational, then it is irrational insofar as it is unattainable. Since the goal of providing naturalistic explanations of all phenomena is quite simply unattainable, then it would be irrational to retain a commitment to a concept of science operating under this restriction. Many in the scientific community question whether origins research will be settled in strictly natural terms. Meyer footnotes an impressive list of attempts by scientists to "explain how purely natural processes could have given rise to the unlikely and yet functionally specified systems found in biology ..." ²⁵ Given the lack of consensus and the provisional nature of these explanations, Meyer concludes that the origins of life "remains essentially mysterious on any current naturalistic evolutionary account." ²⁶ Other authors in *The Creation Hypothesis* press for a similar conclusion based on the apparent impotence of natural accounts of the origin of major groups of organisms, the origin of human consciousness and language, and the origin of the life-sustaining structure of the universe.

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cognitive value.*

Indeed, the lessons of origins research may well be the realization that the more we account for in natural terms, the more remains unexplained. Let us allow that gains in understanding are being outstripped exponentially by new puzzles and challenges. This may suggest that, if science intends to provide a complete account of natural phenomena in purely natural terms, it will never complete the task. Still, does the certain failure of science warrant charges of irrationality to commitment to MN?

In fact, it may remain rational to pursue a goal knowing that pursuit will meet with failure, if the pursuit enables one to achieve a less ambitious, but no less valuable goal — namely accounting for natural phenomena in strictly natural terms, *as far as one can*. ²⁷ Even as the evidence mounts against fulfilling

the more formidable goal, its pursuit may continue to prove valuable for those gains achieved. If the exact extent of our ability to provide natural explanations remains unknown, conceding too much too soon may serve to cut short a venture which holds forth the prospect of considerable conceptual gains. Furthermore, a relentless pursuit of natural explanations, though ultimately futile, may prove useful to our interest in a comprehensive understanding of reality. The extent and exact nature of this failure may provide a metaphysician with data useful to account for the full-orb of reality, natural and non-natural. Thus, the goal of science in providing a "purely natural account" should be viewed as having both intrinsic as well as extrinsic cognitive value. Scientific explanations are intrinsically worthwhile, since they provide valuable understanding of the world. Furthermore, that natural science only goes so far (as here demonstrated by its own breakdown) makes an equally valuable contribution to the quest for a comprehensive account of reality.

"But," the inclusivist might respond, "your suggestion misses the point, for the Christian *already knows* the nature of reality, viz. God stands as the ultimate source of all things. We don't need the evident failure of science as support for the rationality of this belief." However, in the absence of a definitive revelatory account, the exact extent and nature of immediate divine agency may only be manifest through a stubborn pursuit of a natural account. ²⁸ Setting aside for the moment the question of the exact point at which one might invoke God, there remains an important response. Christians may regard MN as representing a *pragmatic*, though no less valuable, *goal*, useful for apologetic purposes. If, as this response suggests, the Christian does not need the breakdown of natural science to support one's belief in divine agency, one may nonetheless embrace natural science for no other reason than that it takes its task so seriously as to accentuate its own shortcomings. Since there is nothing incompatible with theism and MN, it would not be irrational, even for the Christian, to seriously undertake the task of natural science, if only to evidence its ultimate impotence due to the limitations placed upon it by the naturalist constraint.

MN represents an arbitrary and artificial, thus irrational, commitment to a deficient understanding of scientific rationality.

Here the claim is that all of the above construals of the irrationality thesis understate the force of the argument against MN. When Meyer says that MN places "[a]rtificial limitations upon theory construction only [to] leave open the possibility that the best

explanations may not have been considered,"²⁹ he means to emphasize the extent to which MN stifles accounts which, *if given due consideration* — proper attention and full development by the *scientific* community — would rival the natural alternatives in strength of merit. Any view of science that stubbornly resists their inclusion should be deemed irrational. This seems to render the irrationality argument in its strongest form: it is irrational not to view progressive creationism and/or young earth creation-science "as ways of specifying creationism as a [scientific] research program."³⁰

Even if commitment to MN is not positively irrational, we may nonetheless hold out for the prudential rationality of inclusivity insofar as pursuit of that project will enable us to finally assess its intrinsic merits.

The difficulty with weighing the merits of this proposal is the difficulty in saying anything at all about the rationality of science. Meyer strongly recommends a "post-positivist" construal of science, largely, no doubt, because he views it as the correct construal of science, but not incidentally because it challenges the sort of a priori, ahistorical judgments on science as are typically leveled against inclusivity. The catch, of course, is that this also undercuts any a priori positive account of the rationality of inclusivity these authors might hope to proffer. All is not lost for the inclusivist, however. If there are no prior constraints on a proper scientific methodology, then shouldn't we allow inclusivist science its rightful day in the sun to see how it fairs?

This is a formidable argument. If we cannot rule out inclusivity a priori, then what grounds remain upon which to judge its rational merits? Presumably, only the head-to-head competition of these rival conceptions of science could reveal their respective strengths. Since MN eliminates this competition at its inception, it is literally pre-judicial, and thus irrational, to continue to regard exclusivistic science superior. Therefore, even if commitment to MN is not positively irrational, we may nonetheless hold out for the prudential rationality of inclusivity insofar as pursuit of that project will enable us to finally assess its intrinsic merits. Surely to disallow from the start this kind of healthy competition is the height of irrationality.

Thus, rather than arguing directly for the inherent rationality of theistic science, these authors challenge the very idea of *prior constraints* on a proper scientific methodology. This effectively shifts the burden of proof onto those who claim that inclusivity is not worth this kind of examination. Since, as Meyer supposes, the opponents of inclusivity cannot base their position on the very essence of science itself, the prejudicial spirit of exclusivity should be readily apparent. Yet, by adopting this strategy, these authors have significantly raised the stakes of the debate, for removing the notion of prior rational constraints might prevent us from speaking, except in relative terms, of the rationality of science at all. This move is doubly problematic for Moreland, et al. First, if our conception of a rational methodology depends on the consensus of the present scientific community, then inclusivity surely will not find favor. But, secondly, and far more significantly, we might expect a properly theistic science to be based on some objective notions of rationality. Thus, in the following section, I will examine this move with my response based on the belief that (1) there are — as Moreland, et al. surely *must* recognize — prior constraints on any legitimate scientific methodology, and (2) there are reasons based on these prior constraints — and largely ignored by these authors — which in fact do support commitment to MN. I do not intend to join those who argue that inclusivity is itself irrational. I will simply maintain that the preponderance of evidence continues to favor commitment to MN.

Inclusivity does not Violate any Necessary and Prior Constraints on Science

In the central section of his paper, Meyer shifts the burden of proof onto the exclusivist by arguing (1) that there are no criteria, definitive of science, which specifically exclude divine agency from consideration in a properly scientific account, and (2) there simply are no criteria which definitively demarcate science from nonscience. Meyer begins with this second claim, suggesting that, since no essential features distinguish science from nonscience, inclusivity cannot be disallowed on *prior* consideration. In case the reader remains unconvinced, he then argues that recent attempts to define science by means of some *particular* feature have either failed to capture all of science, or failed to exclude appeal to divine agency. Thus, Meyer argues not only that there are no necessary, a priori methodological constraints on science, but that all attempts to delineate these constraints that would rule out divine agency have failed the test of application. It is not clear

whether the latter claim is meant to provide inductive support for the first or that he does not, nor intends for his audience to, take the first claim seriously. Thus he backs off the "in principle" objection to argue against demarcation criteria by surveying the various historical attempts. In either case, we are eventually led to consider the fall-back position which holds that it is MN itself which demarcates science from nonscience. Acknowledging this as a common response to inclusivity, he insists that it must be resisted as metaphysically gratuitous, question-begging, and banefully circular.

Absence of all a priori constraints on scientific practice.

Meyer begins by addressing the view that science involves essential features which the inclusivity principle violates. In this section, he argues against the notion of science as constituting a natural kind with an "eternal essence," in favor of the construal of science as a historically developing, contingent, and ever-changing product of particular human cultures and interests. Recent analysis characterizes science as largely involving change rather than stability, not only at the level of the substantive theories, but, most significantly, at the level of its very methods and aims. "Historically, attempts to find methodological 'invariants,'" Meyer affirms, "that provide a set of necessary and sufficient conditions for distinguishing true science from pseudoscience have failed."³¹

Therefore, Meyer fully endorses the conclusion of "most contemporary philosophers of science" that "the question 'What methods distinguish science from non-science?' [is] both intractable and uninteresting."³² It is at this point that Meyer's indebtedness to the work of Larry Laudan is most evident, for it is Laudan who, in his most recent writings, argues that there are no methods or aims which necessarily delimit the bound of science. Laudan's argument is explicitly inductive: "We have ... seen," he concludes after a historical survey, "that the aims of individual 'scientists' in one epoch are very different from those in another; it would be no more difficult to document the claim that the aims of the 'scientific' community change through time."³³ Laudan believes that this historical fact should be explained by adopting an antiessentialist view of science. Although he resists the holistic picture of scientific change made famous by Kuhn (with its irrationalist overtones), Laudan claims that changes at the level of scientific theories may affect change in both the methods and aims of science; nothing is immune from revision. His "reticulated" model of scientific change holds that change in theories

can affect changes in methods, and vice versa, and changes in methods can affect changes in aims, and vice versa. Instead of a hierarchy, with the *aims* of science prescribing both the proper methods and, by extension, the substantive content of scientific theories, there is a reciprocal relationship with a feedback loop such that the very aims of science are subject to radical revision in light of changes in substantive beliefs and available methods.

Although [Meyer] rejects the possibility of "a negative a priori case" against inclusivity, he does not appear interested in rejecting the possibility of an a posteriori case for inclusivity.

Laudan's reticulated model of science suits Meyer well for it enables him to support a nonessentialist construal of science, such that theistic science does not face antecedent elimination, while simultaneously providing a framework for maintaining the propriety of a particular view of science. There is, however, a certain ambivalence in Meyer's remarks, for although he does maintain that "... no agreed criteria exist by which to judge" whether or not a certain theory is scientific, he disavows interest in "seeking to establish the impossibility of demarcation in general."³⁴ Fully endorsing a nonessentialist view of science does raise significant concerns, such as those betrayed in the following comments:

To say that some discipline or activity qualifies as scientific is to imply the existence of a standard by which the scientific status of an activity or discipline can be assessed or adjudicated. If *no such standard presently exists*, then nothing positive (or negative) can be said about the scientific status of intelligent design (or any other theory for that matter).³⁵

Does Meyer really mean to suggest that just any conjecture might count as science? If we read the notion of a theory broadly enough, this would surely place him in an uncomfortable position. Although he does suppose that we can recognize paradigmatic instances of science, he insists that the absence of "an agreed standard as to what constitutes the properly scientific"³⁶ prevents a prior exclusion of any account. Yet Meyer is careful to disavow "methodological anarchism."³⁷ He does not wish to open the door of scientific legitimacy to "intelligent design," at the cost of granting legitimacy to any conceivable account.

His reluctance, I suspect, stems from his unwillingness to consider science as being wholly malleable. Thus, although he rejects the possibility of "a negative a priori case" against inclusivity, he does not appear interested in rejecting the possibility of an a posteriori case for inclusivity. In fact, Meyer does not fully sanction Laudan's construal of science. In the course of his discussion, Meyer allows that we might not want to call "design" science after all: "What we want to know is not whether a theory is scientific but whether a theory is true or false, well confirmed or not, worthy of our belief or not."³⁸ This comment evidences a deeply significant difference between his "nonessentialism" and Laudan's.

*[Meyer's concern with] the truth
of a hypothesis or theory, rather
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This comment on the ultimate interest in the *truth* of a hypothesis or theory, rather than whether we call it "science," suggests a significant disanalogy between his nonessentialism and the nonessentialism of an antirealist like Laudan. One way to understand the significance of the difference between Meyer and Laudan on this point is to focus on the question of *why* they each consider the demarcation question not only intractable, but also *uninteresting*. For Laudan, an antirealist who considers science an impotent means for attaining knowledge of reality, the question of demarcation loses import when it ceases to delineate claims of particular epistemic significance.

[L]eaving aside the fact that agreement was lacking about precisely what the scientific method was, there was no very good reason as yet to prefer any one of the proposed 'scientific methods' to any purportedly 'non-scientific' ones, since no one had managed to show either that any of the candidate 'scientific methods' qualified them as 'knowledge' (in the traditional sense of the term) or, even more minimally, that those methods were epistemically superior to their rivals.³⁹

While Laudan recognizes that scientists regularly speak in terms of knowledge, truth, and reality, he nonetheless argues that truth as a goal of any human endeavor is either unachievable or else unrecognized-

able. If so, then it can serve no useful purpose as the goal of the enterprise, nor can it provide the grounds for recommending a particular methodology. Since Laudan rejects the notion that truth constitutes a coherent goal of science, it cannot be viewed as a distinctive goal. Therefore, the task of separating the scientific from the nonscientific on epistemic grounds is rendered wholly impertinent.

For Meyer, a realist in both the sciences and theology, the distinction also lacks significance for lack of *epistemic* significance, but for a very different reason. In his view, *both* science and nonscience can deliver the epistemic goods. Meyer is right to suppose that "one does not need to adopt a relativistic or antirealist view of science to accept what Laudan and others say about the demarcation problem. Indeed, the two positions are logically unrelated."⁴⁰ That is, one does not have to be a relativist or antirealist to accept that historical attempts to demarcate science (knowledge) from nonscience (opinion) have failed. Yet, this difference is absolutely crucial for the assessment of science as governed by fixed constraints, because from the antirealist perspective, science may ultimately take any imaginable form (even if moving from its present to this latter state in incremental, and individually justified, steps).⁴¹ Since Laudan rejects the notion that truth is an achievable goal to be served by scientific methods, then the only constraints on scientific method are those provided by those "ends which we [currently] find cognitively important."⁴²

For Meyer, on the other hand, the nature of science is governed by its aim toward truth — only truth-conducive practices can be considered scientific. For the realist, then, *certain external constraints do bear down upon the aim, and thus the methods, of science*. Either truth, or representation of reality, are goals of science, or they are not. If they are, as Meyer maintains (and why not, if accessible), then they will strongly determine what types of activities properly fall under the rubric of "scientific" — a chemical analysis of tea leaves does; reading tea leaves does not. The relevant difference between these two actions is their effectiveness in conveying the nature of the world. We regard the former as science, and the latter as superstition, not merely based on its reference to occult qualities, but because of their respective abilities to track truth.

One might respond to Laudan by questioning his claim that both the methods and the aims have undergone the sort of substantive change he claims.⁴³ The question of immediate concern, however, is where Meyer's analysis of science leaves the overall framework of his argument. Invoking a

nonessentialist view of science does open the door for inclusivity. Furthermore, his commitment to realism, although providing important methodological constraints, does not dictate particular a priori restrictions on science; it may well warrant inclusivity. Nonetheless, Meyer is committed to the notion of discernible methodological criteria, viz. those operational strictures which in fact are, and are understood to be, truth-conducive. For Meyer, knowledge (traditionally understood) and understanding (of a mind-independent reality) provide the fixed and stable goals of science, even if these *goals* do not distinguish science from other human endeavors. So the question remains: Is there a methodology both *distinctive* to the sciences while justified according to this inclusive goal of truth? In particular, even if inclusivity, as a methodological principle, cannot be ruled out in advance, it remains to be seen how well it serves the aim of providing an accurate understanding of reality. Surely, for the Christian, divine agency plays a central role in a proper overall world view, yet it remains to be seen whether *reference* to agency in the course of scientific theorizing furthers our understanding the structure of nature, and ultimately the relationships among all the components of reality — natural and non-natural. Since MN does not necessarily impede the quest for truth, there is no reason to reject it out of hand as providing a proper constraint on the discipline of science. If, in fact, it proves positively beneficial to the overall goal of knowledge, then we will have reason to suppose that it ought to be retained.

There are no methodological criteria which exclude appeal to divine agency, which do not also exclude examples of good science.

One way of preserving a distinctive domain for science is to argue that the goals of science, whether these are regarded as fixed or merely conventional, place methodological constraints on science — constraints which effectively exclude reference to divine agency. In particular, if the aim of science is to gain knowledge of reality, and if this knowledge is attainable only by means of procedures which do not apply to our study of the nonnatural, then reference to divine agency would be rendered beyond the bounds of good science. Thus, following Laudan's analysis, Meyer focuses attention on those attempts to distinguish between science and nonscience by the means of the method by which science must proceed. Meyer considers whether what he terms "design"⁴⁴ or theories of direct creation "(a) do not explain by reference to natural law, (b) invoke unobservables, (c) are not testable, (d) do not make predictions, (e) are not falsifiable, (f) provide no mechanisms, (g) are not tentative, and (h) have no

problem-solving capability."⁴⁵ In an ultimately, and admittedly, futile attempt to inductively establish a negative universal,⁴⁶ he argues specifically against (a)–(c), and in general terms against (d)–(h). Meyer maintains that when such criteria are leveled against design, they either (1) fail to exclude design, (2) exclude paradigmatically good science (specifically evolutionary theory), or (3) beg the question.

If the aim of science is to gain knowledge of reality, and if this knowledge is attainable only by means of procedures which do not apply to our study of the nonnatural, then reference to divine agency would be rendered beyond the bounds of good science.

The following analysis will focus on this third claim, which Meyer identifies as the central issue in this dispute.⁴⁷ We have argued above that the aim of science is not simply to gain understanding of the natural order, or an account of natural processes, but to gain an understanding of the natural order, or account of natural processes in terms of further natural phenomena. If various of these criteria rule out reference to agency just because it does not make an appeal to strictly natural phenomena, doesn't that just beg the question against inclusivity? "Simply asserting that such [immaterial] entities [such as creative intelligence, mind, mental action, divine action, or intelligent design] may not be considered, whatever the empirical justification for their postulation, clearly does not constitute a justification for an exclusively naturalistic definition of science."⁴⁸

Surely the point at issue is whether there are independent and metaphysically neutral grounds for disqualifying theories that invoke nonnaturalistic events — such as instances of agency or intelligent design. To assert that such theories are not scientific because they are not naturalistic simply assumes the point at issue. ... What noncircular reason can be given for this assertion? What independent criterion of method demonstrates the inferior scientific status of nonnaturalistic explanation?⁴⁹

Meyer is correct to point out that support for several of these criteria rests on the assumption of MN; some of these specific criteria simply function as corollaries to this broader methodological constraint. Therefore, one cannot justify appeal to the

ancillary criterion by appeal to MN, if it is the warrant for MN that is ultimately in question.

It is a straightforward appeal to instrumental rationality which grounds our commitment to MN; MN has proven amply able to serve the goals of science.

So, are there *independent* grounds for MN, or do those scientists committed to MN "simply assert" this methodological constraint? That the answer cannot be determined a priori, based on advance knowledge of the essence of science, does not rule out the possibility of an empirical and broadly inductive response. That answer, in short, is that the goals of science are as we have suggested — to provide a naturalistic explanation of the phenomena of our experience, and it is a straightforward appeal to instrumental rationality which grounds our commitment to MN; MN has proven amply able to serve the goals of science. Of course, as we have seen, this begs the further question concerning the adoption of these goals. Again, in the absence of a rationalist insight into the essence of the enterprise, how does one go about deciding what the proper goals of a discipline like science should be?

First, it must be recognized that since science is a human invention and a wholly human endeavor, its goals will have been determined conventionally. That is, these goals are not transcendent, handed down from above, discernible by simply thinking about the practice of science. The goals of science are determined by fallible human participants. Since scientific practice has developed and matured in historically specific world views, with specific socio-cultural pressures, by specific individuals and cultures with specific values and interests, we must expect a significant element of subjectivity, contingency, and historicity embedded in them.

Nevertheless, even on this historicist construal, there remains something enduring amid the flux, namely the ongoing quest for an understanding of reality. There is a very important sense in which the goals of science, whether fixed or in flux, are not purely conventional or arbitrary human constructs. They are discovered, i.e., the goals humans propose have been *discovered to be attainable* by having been *discovered to have been attained*. If a particular goal, viz. to gain an understanding of natural phenomena strictly in terms of natural phenomena, has

been deemed significant (a contingent matter), and yet found to have been achieved, then that goal should be regarded neither as "simply [i.e., arbitrarily] asserted," nor capriciously forsaken. Furthermore, examining the actual practice of science might enable us to discern the means by which to accomplish that end. Certainly, throughout the history of science, there has been a disparity in self-understanding of how scientists have carried out their activity; there appears, as Laudan insists, a strong element of contingency at the methodological level.⁵⁰ Nonetheless, recognizing historical contingency of these methodological commitments would not prevent their *validation* by their service to such an achievable and manifestly significant goal. Therefore, absence of a prior, rationalist justification still leaves open the possibility of a retroactive, empirical vindication of both the aim and methods of science.

There is a very important sense in which the goals of science, whether fixed or in flux, are not purely conventional or arbitrary human constructs.

Does this approach avoid the charge of circularity? Not entirely, for ultimately this argument rests on the claim that science *has been successful* in accomplishing the goal of understanding natural phenomena. Why think that we can comprehend reality, i.e., why suppose that this goal is fulfillable? Because we have, in some limited fashion, actually fulfilled it. Of course, it is precisely on this point that a skeptic like Laudan balks, and I doubt that there is a noncircular argument available to drive the skeptic from this view. So, ultimately this position is dependent on the belief that the enterprise has enjoyed some limited success in accomplishing the end toward which it aims. But this is not a circle which should worry Meyer. He is, I take it, a scientific realist, willing to assign a degree of reality to those natural explanations by which scientists explain the phenomena of experience. To the extent to which he recognizes the, albeit limited, success of science, he must pay some heed to whatever method has made possible that achievement. What then of MN? I take it that the defense of MN rests on the belief that restricting science to naturalistic explanations has (historically) contributed to the success of science in providing knowledge of natural phenomena.⁵¹ It could have been that we would have gained an understanding of natural phenomena (i.e., known the truth about them) by appealing straight-

away to divine agency, or readily countenancing nonnatural accounts; God may have regularly acted directly or immediately in the natural domain. But, as it turns out, for various political, philosophical, theological, and sociological reasons, scientists tenaciously seek fully mechanistic accounts, a methodological choice which has proven remarkably fruitful.

Does Meyer really wish to deny this point? I don't think so. His position, as I understand it, is not that MN has *no* authority in governing scientific practice, but rather that the (Christian) scientist, *qua* scientist, should not give it *final* authority. That is, there will be a point where strictly natural science appears unable to account for some phenomena, and this is precisely that point at which appeal to divine agency is deemed a plausible scientific response. "Intelligent design can be offered ... as a necessary or best causal explanation *only* when naturalistic processes seem incapable of producing the *explanandum* effect, and when intelligence is known to be capable of producing it and thought to be more likely to have produced it."⁵² Of course, from the Christian perspective, intelligence can produce *any* explanandum effect. So the question concerns the weighted likelihood of "the two possible types of causes: mechanistic [or] intelligent."⁵³ In this event, as Meyer himself warns, "if competing hypotheses are eliminated before they are evaluated, remaining theories may acquire an undeserved dominance."⁵⁴ Thus, the sciences ought to grant as much initial credence to intelligence as a purely natural mechanism.

There will be a point where strictly natural science appears unable to account for some phenomena, and this is precisely that point at which appeal to divine agency is deemed a plausible scientific response.

We have cited this last point repeatedly, because the argument for full and fair consideration of all competitors is absolutely crucial; it does, however, cut both ways. To render this judgment, a scientist must explore *all available natural accounts* in order to gain a fair reading of the prospect for the success of each. Different natural hypotheses will carry different probability assignments, and so will compare more or less favorably with appeal to agency, based on its "theological plausibility" for the given case.⁵⁵

Even for the inclusivist, then, at some juncture a comparison must be made between the best *available* natural account, and appeal to divine agency as the nonmediated cause of the phenomena. That is, in order for this analysis to reveal the best overall theory, the comparison must be between the best account restricted, noninclusive "science" has to offer and the best direct interventionist "theological" account.⁵⁶

Constraining scientists forces them to persist in their investigations into the natural causes of natural phenomena in such a manner as to effectively service the goal of science.

Yet, for this comparison to carry maximal epistemic authority, we must have full confidence that natural science has in fact proffered the strongest natural account. Traditionally, this confidence has been born along on the steadfast devotion of the scientific community to relentlessly seek and evaluate natural, and only natural, explanations. The tenacity attached to this methodological constraint has ensured that any plausible natural account will have been given due consideration. It has also, in fact, served to uncover the nature of reality — that is, to reveal the predominant manner by which God has chosen to interact with the world. The evident worry concerning the sanction of inclusivity stems, then, from the belief that science has established a notable track-record for providing insight into reality *precisely when constrained by MN*. Science has enabled us to make progress in our understanding and comprehension of the nature of reality, and MN must be considered a central part of that story.⁵⁷

What Meyer needs here is an argument to the effect that the Christian goal of attaining an overall understanding of reality is not served by retaining MN. Unfortunately, there doesn't seem to be evidence available to support this contention.⁵⁸ On the contrary, the accuracy of our understanding of the created order has been vastly enhanced by so delimiting the explanatory resources of the scientist. Constraining scientists forces them to persist in their investigations into the natural causes of natural phenomena in such a manner as to effectively service the goal of science — understanding reality, as far as possible, in natural terms. Herein lies the intrinsic value of a purely natural science. In this respect,

the competition between these rival accounts has already been waged with the results decidedly in favor of exclusivity. Further, since natural science should not make exclusive claims to truth, revisiting this old battle is neither necessary nor promising for gaining a full understanding the nature of reality.

Not only has exclusivity served to uncover the structure of the natural world, it has revealed the limitations of the best natural accounts.

As we have seen, exclusivity has also worked to promote the goal of achieving an unrestricted understanding of reality by seeing to it that any non-natural account gain ascendancy over its *strongest competitor*. Thus, not only has exclusivity served to uncover the structure of the natural world, it has revealed the limitations of the best natural accounts. When one reads some other chapters in *The Creation Hypothesis*, one finds that the arguments for design are clearly dependent on the evident inability of science, restricted as it is to providing strictly natural accounts, to explain certain phenomena. Herein lies the instrumental value of a distinct, purely natural science.⁵⁹ Natural theology, and our overall goal of understanding reality, are served in a crucial manner by insisting that science resolutely avoid appeal to divine agency.⁶⁰

In fact, the present argument can be strengthened by maintaining that the scientist must be granted epistemic license (in the form of instrumental rationality) to explore natural accounts, even when they appear *less* promising than nonnatural accounts. If *scientific* rationality *allows* for appeal to divine agency, then there will be occasions when, for the Christian at least, appeal to divine agency will provide a more promising account than any available natural account. In that case, the rational course to take, *as a scientist*, would be to leave aside the search for natural processes, and pursue a non-natural explanation. If, then, science merely *permits* appeal to divine agency, then scientific rationality will *compel* appeal to that account. But, again, history shows that a stubborn commitment to MN has resulted in the discovery of natural accounts which have gained wide acceptance, even among Christians. Where the decided implausibility of the natural account would have forced the scientific community to affirm immediate divine agency, *if that were scientifically permissible*, MN served our interest

in truth. The methodological constraint rationally enables, even encourages, pursuit of a largely implausible natural explanation, if, that is, it were the most promising natural explanation. Occasionally, this strategic commitment pays dividends in our understanding of reality, a payoff that would have remained quite out of reach if science itself had not been constrained. Christians, just as anyone with an interest in truth, need a haven for the rational pursuit of lines of inquiry which may not, but then again just might, develop in a way that ultimately renders them rationally preferable.

Taking MN Seriously

The criticisms of the principle of inclusivity given above intimate reasons for remaining committed to MN. Fundamentally, that reason involves the availability of the best competing explanations. If, as we have assumed, a form of abductive reasoning characterizes the sciences, or at least a historical science which addresses questions of origins, then this procedure will be most effective when it examines the respective merits of the best hypotheses available.

Ultimately, natural science faces a nonnatural competitor.

Unless one has prior reason to suppose that natural science will provide the final word on the nature of reality, that is, that the scientific hypothesis deemed strongest must be considered best overall, one should expect the strongest scientific hypothesis to ultimately confront nonscientific competitors. Ultimately, natural science faces a nonnatural competitor. It is, as Dembski argues, "... as soon as empirical resources are exhausted, [that] naturalistic explanation loses its monopoly as the only legitimate explanatory strategy for science."⁶¹ This seems quite right, except for these last two words. Is it the best strategy to allow *science* to appeal to divine agency? Again, as Dembski rightly insists, we may appeal to God, not to "mask ignorance of natural causes," but because "we have exhausted the full range of possible natural causes."⁶² However, the fundamental worry, addressed by MN, concerns the task of determining *if* we have exhausted the full range of possible natural causes. History intimates that only when unreserved effort is expended within the scientific community to provide the best natural account can there be any assurance that its full resources will have been exhausted; preserving the disciplinary boundaries by means of a proscribed methodology has been quite successful in producing

the best natural account. Sometimes that account proves correct, i.e., preferable to direct appeal to divine agency; sometimes, as is inevitable in origins research, it does not. When it does not, however, confidence in the rival theological account is grounded, in part, on the belief that it has been deemed superior to the best natural account currently available.

If this line of defense is sound, then, the mere fact that there are no direct a priori grounds for rejecting inclusivity does not mean there are no grounds at all; the overall interest in truth, a fixed and apparently achievable goal of all scientists, especially Christian, is best served when natural science is constrained by MN. *

Notes

- 1J. P. Moreland, "Conceptual Problems and the Scientific Status of Creation Science," *Perspectives on Science and Christian Faith: Journal of the American Scientific Affiliation*, 46 (March 1994): 2-13; see also, Stephen C. Meyer, "The Use and Abuse of Philosophy of Science: A Response to Moreland," *Ibid.*: 14-18.
- 2J. P. Moreland, Ed., *The Creation Hypothesis: Scientific Evidence of an Intelligent Designer*, (Downers Grove, IL: InterVarsity Press, 1994), 55.
- 3*Ibid.*, 12-13.
- 4*Ibid.*, 13.
- 5*Ibid.*, 46.
- 6"... those hoping to find a post-positivist philosophy of science," he charges, "to assist them in defining creationist theories out of existence may have to look long and hard." Meyer, "The Use and Abuse of Philosophy of Science," 16.
- 7Howard J. Van Till, "Special Creationism in Designer Clothing: A Response to *The Creation Hypothesis*," *Perspectives* 47 (June 1995): 127-8.
- 8Note that MN, even broadly conceived, is distinct from *metaphysical* naturalism. The latter stipulates that there is no nonnatural, or supernatural, dimension to reality; the former only requires of science that it appeal only to entities, processes, relationships, mechanisms, etc. which are naturalistic in origin, leaving open the possibility of *other* areas of human inquiry and experience involving the non-natural.
- 9Ernan McMullin utilizes this distinction in "Plantinga's Defense of Special Creation," *Christian Scholars Review* 21 (September 1991): 57-58.
- 10Meyer, "The Use and Abuse of Philosophy of Science," 17, original emphasis.
- 11*Ibid.*
- 12Dembski says: "The prejudice is this: that naturalistic explanation is somehow intrinsically better than nonnaturalistic explanation. This is certainly a value judgment. I call it a prejudice because its effect on inquiry is limiting and de-

structive." J. P. Moreland, Ed., *The Creation Hypothesis*, 131. Notice the extent to which this analysis requires not only commitment to MN, but to some form of scientism as well.

- 13Moreland in *The Creation Hypothesis* ascribes to the notion that attempts to defend MN are at heart defense of some form of scientism. "Now this is clearly the explicit cognitive goal in the MN of de Vries and Van Till, however laudable their motives and intentions are on other grounds" (pp. 50-51). But, "Science has never exhausted the rational, nor has science ever been a discipline or set of disciplines intellectually isolated from direct interaction, mutual reinforcement or competition from *other* fields of study, especially philosophy and theology" (p. 51, my emphasis, intended to highlight the tacit recognition that NT should not be assimilated to NS). Here, again, we find Moreland strapping the defender of MN with scientism, a view to which the proponent need not be committed.
- 14Including "weak scientism," the view that "scientific propositions have greater cognitive authority than those of other fields" (p. 16). "Strong scientism is the view that some proposition or theory is true or rational to believe if and only if it is a scientific proposition or theory — that is, if and only if it is a well-established scientific proposition or theory, which in turn depends upon its having been successfully formed, tested and used according to appropriate scientific methodology. There are no truths apart from scientific truths, and even if there were, there would be no reason whatever to believe them" (p. 14).
- 15Phillip Johnson considers the "power of scientific naturalism in the academic world" to be "so intimidating ... that hardly anyone is willing to challenge it" (*Reason in the Balance: The Case Against Naturalism in Science, Law & Education* [Downers Grove, IL: InterVarsity Press, 1995], 97). But challenge it we can, and (we philosophers!) *must*, without presuming upon natural science itself. As I see it, the proper philosophical response to the apparent prevalence of metaphysical naturalism is to challenge the mistaken philosophical interpretation of science, rather than prescribing a revised set of rules for conducting research. Ironically, these inclusivists have adopted a strategy in keeping with modernity and a positivist spirit, pronouncing to scientists the demands of rationality itself on the manner in which they conduct their activities.
- 16The aim of science is often spoken of in terms of prediction and control. There are many crucial issues which ride on the manner in which one views the scientific enterprise. I do not intend to dispute the claim that scientists are, often centrally, interested in prediction and control, but only intend to suggest that those interests are best served by achieving the sort of accurate understanding of natural phenomena necessary to facilitate these other concerns.
- 17Another way to approach this topic is to assign to science the task of determining just how it is that God works in the created order. As Pearcey and Thaxton argue in *The Soul of Science: Christian Faith and Natural Philosophy* (Wheaton, IL: Crossway Books, 1994), this debate occurred primarily among Christian scientists in the last several hundred years, a debate that has resulted in our present understanding of science in largely mechanistic terms. The *materialistic* mechanistic world view predominant in science is a philosophical extension of an older, nonmaterialistic form of mechanism, evident today in the writings of theistic evolutionists.

- ¹⁸One need not suppose that if science is not taken as providing a complete account of reality, it thereby fails to meet its goal of truth; to suppose so would be to commit the "no truth but the whole truth" fallacy.
- ¹⁹Meyer, 17.
- ²⁰Van Till, in "Special Creationism," 127-8. Although Van Till prudently shies from discussion of MN, he offers these comments as characterizing the narrow construal of "naturalistic." He goes on to say: "Nor is the ultimate source of its capacities for behaving as it does, or its purpose in the larger context of all reality, or its relation to divine action or intention [specified or implied]." He hereby rightly allows ample room for a "design hypothesis" which accounts for the remarkable effectiveness of these natural phenomena.
- ²¹As Meyer rightly reminds us:
The deployment of flawed or metaphysically tendentious demarcation arguments against legitimate theoretical contenders has produced an unjustified confidence in the epistemic standing of much evolutionary dogma, including "the fact of evolution" defined as common descent. If competing hypotheses are eliminated before they are evaluated, remaining theories may acquire an undeserved dominance (p. 100).
- ²²James Robert Brown offers an extremely helpful discussion of the role of social factors in science, especially, on this point, in *The Rational and the Social* (New York: Routledge, 1989), 155ff., and again, 176ff.
- ²³Does there come a point at which the scientific support is so weak that a hypothesis ought to be ruled "unscientific," simply for playing the game so badly? I would think so. This sort of challenge, however, which may figure prominently in resistance to "Creationism" in public schools, is not where these authors choose to meet the attack.
- ²⁴Moreland, Ed., *The Creation Hypothesis*, 54.
- ²⁵*Ibid.*, 68.
- ²⁶*Ibid.*
- ²⁷Maybe it should simply be considered the goal of science "to provide a naturalistic account as far as one can," leaving open the question of how far this might take one. This would allow both the theist and the thoroughgoing naturalist to engage in the same activity, in pursuit of the same goal, with differing expectations concerning the unexplained remainder once that goal has been fulfilled. Kitcher, for instance, maintains that "... the cognitive goal of science is to attain significant truth ... insofar as it is possible for beings with our limitations to do so" (Kitcher, *The Advancement of Science: Science without Legend, Objectivity without Illusions* [New York: Oxford University Press, 1993], 157).
- ²⁸In the context of the philosophy of mind, John R. Searle (in *The Rediscovery of Mind* [Cambridge, MA: A Bradford Book, 1994], 24) provides the following sound methodological advice: "But we should never forget who we are; and for such as us, it is a mistake to assume that everything that exists is comprehensible to our brains. Of course, methodologically we have to act as if we could understand everything, because there is no way of knowing what we can't: to know the limits of knowledge, we would have to know both sides of the limit."
- ²⁹Meyer, 17.
- ³⁰Moreland, "Conceptual Problems and the Scientific Status of Creation Science," 5.
- ³¹Moreland, Ed., *The Creation Hypothesis*, 72.
- ³²*Ibid.*, 75.
- ³³Larry Laudan, "Progress or Rationality? The Prospects for Normative Naturalism," *American Philosophical Quarterly*, 24 (Jan. 1987): 23.
- ³⁴Moreland, Ed., *The Creation Hypothesis*, 75.
- ³⁵*Ibid.*, 98, my emphasis.
- ³⁶*Ibid.*
- ³⁷*Ibid.*, 100.
- ³⁸*Ibid.*, 99.
- ³⁹*Ibid.*, 342.
- ⁴⁰*Ibid.*, 76.
- ⁴¹Even though Laudan cannot be labeled an anarchist, his reticulated model does not have the resources to prevent science from eventually becoming unrecognizable by present lights. In the absence of any external constraints, his views on (scientific) rationality resembles Richard Rorty's ethnocentrism. Ernan McMullin comments on this possibility in, "The Shaping of Scientific Rationality: Construction and Constraint," (in *Construction and Constraint* [Notre Dame, IN: University of Notre Dame Press, 1989], 18). Rorty describes the difference between his ethnocentrism and relativism in "Solidarity or Objectivity?" (in *Objectivity, Relativism and Truth* [New York: Cambridge University Press: 1991], 21-34).
- ⁴²Laudan's reticulated model allows that not just any goal will qualify at a given time, for some goals, according to our current scientific theories, are not realizable. Along this vein, Laudan would surely resist the inclusivity principle insofar as it fails to move us closer "to a realization of ends that most of us [presently happen to] hold to be important and worthwhile." (Larry Laudan, "Progress or Rationality? The Prospects for Normative Naturalism," *American Philosophical Quarterly*, 24 [Jan. 1987]: 28). "[A]s soon as there is a record of people whose behavior has been largely successful at realizing many of the cognitive aims which we hold dear, then a proposed methodology of science cannot afford to ignore that record" (*Ibid.*).
- ⁴³See James Robert Brown, in *The Rational and the Social* (London and New York: Routledge, 1989), 117ff., for a penetrating critique of this sort. Philip Kitcher argues that scientists have advocated different aims, but these are to only be considered different "derivative" aims (Kitcher, *The Advancement of Science*, 159).
- ⁴⁴As we shall see, this language suggests a false dilemma which serves to obscure the alternative advocated in this present account.
- ⁴⁵Moreland, Ed., *The Creation Hypothesis*, 77.
- ⁴⁶"Since some may yet doubt that demarcation *always* fails, the following section will examine some of the specific demarcation arguments that have been deployed against design by proponents of descent" (*Ibid.*, 76-77).
- ⁴⁷*Ibid.*, 87.
- ⁴⁸*Ibid.*
- ⁴⁹*Ibid.*, 82.
- ⁵⁰Is Laudan right in identifying a diversity of methods in the history of science? Maybe, but even so, this would not entail a diversity of aims, for it is not unreasonable to expect that scientists will have learned something about how to best go about the task of uncovering the underlying structures of reality.
- ⁵¹As Wesley Salmon points out in the opening paragraphs of his *Scientific Explanation and the Causal Structure of the World* (Princeton, NJ: Princeton University Press, 1984), "Not only do we desire to know *what* happens; we also what to

understand *why*. Moreover, it is widely acknowledged today that science *can* provide explanations of natural phenomena; indeed, to many philosophers and scientists, this is the primary goal of scientific activity" (p. 3). Salmon proceeds to give a "causal-mechanical" account of science, maintaining that "scientific explanation is designed to provide understanding, and such understanding results from *knowing how things work*" (p. 240, original emphasis). It is by no means Salmon's belief that this account of science is as it must inevitably be, for he disavows commitment to the necessity or even universality of his account. "I have not been trying to lay down conditions that must be satisfied by all admissible scientific explanations in all possible worlds," he insists in his concluding remarks. "My aim has been to articulate contingent features of scientific explanations in this world as we presently conceive it" (p. 278). Nevertheless, the remarkable success of science in fulfilling these goals warrants granting the causal/mechanical model significant, if ultimately limited, application (pp. 237, 240).

⁵²Moreland, Ed., *The Creation Hypothesis*, 97, first emphasis mine.

⁵³*Ibid.*, 87-88.

⁵⁴*Ibid.*, 100.

⁵⁵*Ibid.*, 97.

⁵⁶The interesting cases would be those in which the scientist concludes that the phenomena in question is simply the result of randomness or chance. By requiring both "empirical warrant" and "theological plausibility," Meyer seems to recognize the possibility that the lack of a naturalistic explanation does not of itself justify appeal to divine agency. The preferred hypothesis, in such a case, may be the null hypothesis (we don't want to rule the evolutionary account out by default!).

⁵⁷Richard S. Westfall, in his book *The Construction of Modern Science: Mechanisms and Mechanics* (Cambridge: Cambridge University Press, 1971), documents how seventeenth-century science represents the movement away from appeal to occult and mysterious forces with which the universe was thought to be filled, toward what he identifies as the mechanical philosophy. "As he [Boyle] summed it up, the mechanical philosophy traces all natural phenomena to the 'two catholic principles,' matter and motion. He might have added that by 'matter' the mechanical philosophy means qualitatively neutral stuff, shorn of every active principle and of every vestige of perception. Whatever the crudities of the seventeenth century's conception of nature, the rigid exclusion of the psychic from physical nature has remained as its permanent legacy" (p. 41). Commenting on his own "mechanical philosophy," Wesley Salmon writes, "We have to change our mechanistic view from the crude atomism that recognizes only the motions of material particles in the void to a conception that admits such nonmaterial entities as fields, but for all of that, it is still a mechanistic world view. Materialism is untenable, but the mechanical philosophy, I believe, remains viable" (in *Scientific Explanation and the Causal Structure of the World*, 241). For a fine treatment on the complex interface between the mechanical philosophy and the Christian faith, see the excellent discussion in Colin A. Russell's *Cross-currents: Interactions Between Science & Faith* (Grand Rapids, MI: Eerdmann's Publishing Co., 1985), especially chapter 4.

⁵⁸In fact, that evidence may be forthcoming, as Meyer, Dembski, and Paul Nelson collaborate on a project which seeks to apply the principles of Theistic Science. This work may well command the sort of respect which not only changes our substantive views on the natural world, but also precipitates the sort of revolution foreshadowed in the writings we have been examining.

⁵⁹In his contribution in *The Creation Hypothesis*, Hugh Ross makes this observation:

The more astronomers learn about the origin and development of the universe, the more evidence they accumulate for the existence of God, and for the God of the Bible in particular. Ironically, those who fought hardest against God as the explanation for the cosmos often were the ones whose work provided the most powerful new evidence for him today, with the measuring of the creation has come the scientific equipment to make a positive identification of the Creator (p. 171, my emphasis).

Although there is indeed irony in this situation, there is no irony in the suggestion that commitment to MN would have the same effect of providing "the most powerful evidence" for a Creator today.

⁶⁰This suggests that the real value of Moreland and Meyer's argument may lie in the poignancy of their call for Christian scientists to be very clear and articulate concerning the exact limitations of the best scientific account. Christians involved in science need to sort out and delineate the extent to which the evidence supports the various elements of a particular scientific theory. The weaknesses of that account should be frankly acknowledged by the scientist, whether Christian or not. The evidence will underdetermine any scientific account, and it may fall to the particular province of the Christian to highlight the shortcoming of the overall best scientific account, effectively limiting the pretense of naturalistic science.

⁶¹Moreland, Ed., *The Creation Hypothesis*, 132.

⁶²*Ibid.*



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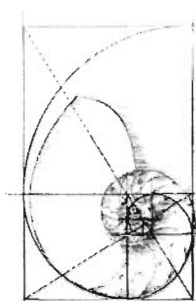
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The Relationship between Science and Scripture in the Thought of Robert Boyle

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The writings of Robert Boyle advance the thesis that Christianity in seventeenth-century England advocated and facilitated scientific development. As a scientist and theologian, he rejected the popular view that the Bible was a scientific textbook and yet believed in the absolute harmony between scientific statements in the Bible and experimental science. Conflicts between the two were explained as either a mistake in science or an incorrect interpretation of Scripture. Boyle followed Calvin's view of accommodation.

There is a connection between the development of modern science in seventeenth-century England and the theological presuppositions of the time.¹ Based on the assumption that genuine science discredits the Bible, it is popular to propagate a historiography which credits the rise of modern science in seventeenth century England with the demise of biblical authority.² However, we will discover that scientists like Galileo, Kepler, Boyle, and Bishop John Wilkins not only embraced the new science, but believed it to be in perfect harmony with an authoritative Bible. Rather than driving them away from Christianity, the new science gave them a context in which they could better understand and glorify God. From the writings of Robert Boyle, we will advance the thesis that Christianity advocated and facilitated scientific development. Boyle is a paradigm for such a study because he was both a respected scientist and theologian who wrote extensively in both areas.

The goal of this paper is to describe Boyle's views on the authority of the Bible and the relationship between science and Scripture. We will do so by first identifying his beliefs and accomplishments as a scientist at a time when science was experiencing a radical change. Secondly, we will survey his theological writings concerning the nature and authority of the Bible. Finally, the first two sections will be synthesized in order to describe his views on the relationship between science and Scripture. This

analysis will aid in the development of a historiography of Enlightenment thought in England and provide a model for a discussion of the authority of the Bible in matters of science.

Robert Boyle the Scientist

Boyle joined other scientists of his time in rejecting certain traditional Aristotelian scientific concepts. He explained that many of his contemporaries rejected his experiments because of their "mistaken persuasion, that those *Phænomena* are the effects of Nature's abhorrency of a *Vacuum*, which seem to be more fitly ascribable to the weight and spring of the Air."³ The idea that "nature abhors a vacuum" implied a certain animation in nature which caused it to sense a vacuum and move to eliminate it. He called this the "vulgarly received notion of nature" and determined to de-deify nature based on his understanding of the Bible.⁴ Although he was cautious about the Copernican system in his writings, he clearly embraced the heliocentric views of Galileo.⁵ He advanced the inductive reasoning of Bacon to focus on a philosophy which he called "new, corpuscularian, atomical, Cartesian or Mechanical" that was built on two foundations: "reason and experience."⁶ Through detailed experimentation, he proved that the volume of a gas is inversely proportional to its pressure. The mathematical expression of this relationship is called Boyle's law.⁷

The Relationship between Science and Scripture in the Thought of Robert Boyle

During the explosion of scientific discussion in seventeenth century England, the term "Virtuoso" or the plural "Virtuosi" began to be used. On the one hand, it referred to men of leisure who used their free time to engage in an esoteric examination of nature.⁸ However, in one of his later works, Boyle used the term in a narrower sense to describe a person who is interested in the investigation of natural science. In *The Christian Virtuoso*, Boyle explains,

But now, the Virtuosi I speak of, and by whom, in this whole Discourse, I mean those, that Understand and Cultivate Experimental Philosophy, make a much greater and better use of Experience in their Philosophical Researches. ... our *Virtuosi* have a peculiar Right to the distinguishing Title that is often given them, of *Experimental Philosophers*.⁹

Boyle admits that there may indeed be individuals who pass for Virtuosi, yet are atheists (i.e., those who are "Denyers of God"). These people, however, are few in number because the study of science leads a person to "Sentiments of Religion." The Christian Virtuoso is one who is "dispos'd to make use of the knowledge of the Creatures to confirm his Belief, and encrease his Veneration, of the Creator."¹⁰ For Boyle, a scientist must approach his work as a Christian; for Christian Virtuosi, science and theology must not be separated.

Throughout his life Boyle was involved in the Royal Society. Beginning in 1645 at Gresham College, Oxford, and chartered in 1660, it involved those who were "inquisitive into natural philosophy, and other parts of human learning; and particularly of what hath been called the New Philosophy or Experimental Philosophy ..."¹¹ John Wallis, a mathematician and theologian, comments on the initial meetings in 1645 by reporting that

our business was (precluding matters of theology and state affairs) to discourse and consider of Philosophical Enquiries, and such as related thereunto; as Physic, Anatomy, Geometry, Astronomy, Navigation, Statics, Magneticks, Chymicks, Mechanicks, and Natural Experiments ...¹²

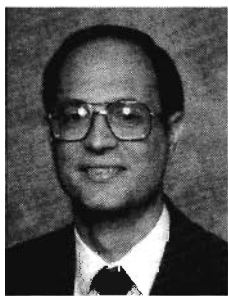
Although their primary goal was not the discussion of theology, we must not conclude that their scientific dialogue was separated from their Christian convictions. Thomas Hobbes was not a part of the Society, and Westfall describes the religious works of the Virtuosi as "one long disapproving footnote to Hobbes' philosophy."¹³ They firmly believed that their scientific endeavors did not jeopardize their Christianity. The two were harmonious.

Boyle as a scientist was on the cutting edge of scientific change and may be properly called "a leader of a scientific revolution."¹⁴ However, as a Virtuoso and member of the Royal Society, he remained firmly committed to his Christian convictions.

Robert Boyle the Theologian

The religious affiliations of Boyle are difficult to determine. He has been described as a lifelong Calvinist,¹⁵ a Puritan at heart,¹⁶ and an Anglican.¹⁷ Our goal in this section will be to identify Boyle's views on the purpose and authority of the Bible.

The Bible had long been viewed as a source of scientific information. John Wilkins, a major influence on Boyle, lamented that interpreters often missed the intent of a passage because they believed that "there is not a demonstration in Geometry, or rule in Arithmetic ... but it may be found out in the Pentateuch."¹⁸ Specific statements concerning the stability of the earth and the motion of the sun were embraced as evidence for a geocentric model of the universe. "The world is firmly established, it cannot be moved" (Ps. 93:1); "the sun knows when to go down" (Ps. 104:19); "the earth remains forever, the sun rises and the sun sets" (Eccl. 1:4-5). The invention of the telescope and the collection of observed data eventually led to a different conception of the purpose of the Bible. Galileo, Kepler, and the Virtuosi began to articulate the view that the Bible was *not* a textbook on science. The statement of Cardinal Baronius that "the intention of the Holy Ghost



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is to teach us how one goes to heaven, not how heaven goes" is quoted with approval by Galileo.¹⁹ Kepler maintained that "you receive no instruction in physical matters [from the Bible]. The message is a moral one ..."²⁰ Boyle also realized that the Bible did not address such things as the mathematical relationship between the pressure and volume of a gas. In contrast to Helmont, a contemporary chemist who propagated a divine Chemistry which was derived solely from the Bible, Boyle maintained that the Bible was "design'd to teach us rather Divinity than Philosophy."²¹ Many of those involved in the new age of scientific experimentation believed that the purpose of the Bible was *not* to give a quantitative analysis of the natural world. These scientists faced persecution from theologians because they appeared to reject biblical authority by coming to conclusions which were opposed to the statements about the physical world quoted above.

A survey of Boyle's writings reveals that he had a high regard for the text of the Bible.

This persecution was unfounded. A survey of Boyle's writings reveals that he had a high regard for the text of the Bible. He refers to "the Truth and Authority of the Scripture" which atheists and antiscripturists allege to overthrow,²² the Bible "whose prerogative it is to teach nothing but Truth,"²³ the "inspired Philosopher" who wrote Prov. 13:19-20,²⁴ and the inspired poet of Psalm 5.²⁵ He interprets the *pasa graphe* ("all" or "every Scripture") of 2 Tim. 3:16 as a reference to the whole Scripture and thus concludes that nothing in the acknowledged canonical books lacks the designation of inspiration.²⁶

His position on the text of Scripture is developed in his publication of *Some Considerations Touching the Style of the Holy Scriptures*.²⁷ His knowledge of the original biblical languages (in addition to Latin, Aramaic, Syriac, French, and Italian) resulted in a great concern for a proper English translation. He argued that some English translations may be obscure because of their misplacement of parentheses (none are found in Hebrew or Greek texts);²⁸ wrong chapter and verse distinctions;²⁹ their mistranslation of the Hebrew conjunction *waw*;³⁰ difficulty in understanding the various *hapaxlegomenon*;³¹ lack of information necessary to acquaint people with the historical particulars of topography, history, rites, opinions, and customs, etc.;³² misinterpretation of the figurative language used by Eastern people;³³

and misunderstanding of the context and intended audience of a particular passage.³⁴ As a result, Boyle argues for a freer translation which will deal with the above issues and result in a proper communication of the sense of the Hebrew and Greek texts. This in turn will encourage people to study the text for themselves.³⁵

Boyle was aware of textual problems concerning the *Qere* and the *Ketib* of textual criticism,³⁶ the *Tiqqune Sopherim* (or emendations of the scribes),³⁷ the various Greek lectionaries, and the differences between the Old Testament texts and their citations in the New Testament.³⁸ Although Boyle was not opposed to textual criticism which seeks to identify the original text through the comparison of extant varying manuscripts, he objected to the deliberate changing of words in order to justify the theology of the interpreter. He criticized those who adjust passages to "countenance their Prejudices, and serve their Ends, though they make the Texts never so fiercely fall out with one another."³⁹ This was the tactic of "Modern Critiks" and related rather to "the Truth or the Authority than to the Style of the Scripture."⁴⁰ It appears that Boyle held to a verbal inspiration of the Bible: truth and authority are found in the words of Scripture, not just in the concepts. Scripture must be translated so that the sense of the words is properly communicated. However, it is not appropriate to change the words in order to read a presupposed theology into the text.

Boyle did work with the text in order to ascertain the reading of the original documents. However, there is nothing in the above roster to indicate that Boyle rejected the truthfulness of these documents. Some scholars suggest that he entertained thoughts in this area based on one unusual statement in his discussion of the style of the Scripture. Boyle does say that "we should carefully distinguish betwixt what the Scripture itself says, and what is only said in the Scripture."⁴¹ Louis More interprets this statement to mean that "as regards the authority of the Bible, he was not in accord with the dogmatic authority of the religious teaching of his time."⁴² Likewise, Klaaren suggests that "it was precisely the latter [Boyle's quote] search for the kernel of Scripture, the primitive historical sense, which became so significant in the course of the modern epoch."⁴³ Dillenberger cites this statement as proof that Boyle was not a biblical literalist.⁴⁴ All these statements ignore the following paragraphs in which Boyle explains what he meant in this sentence. Instead of rejecting biblical authority or limiting its truthfulness, he wanted to distinguish between descriptive and prescriptive truth. Descriptive truth accurately presents things as they are whether good

or bad; prescriptive truth reflects God's will on what we should or should not do. The Bible is not entirely like the "English Statute-Book" which always prescribes legislation to people. Instead, it gives the accurate description of the lies of the enemy and ungodly men. He elaborates on his statement by explaining that "... many wicked persons and their perverter Sathan are there introduced, whose Sayings the Holy Ghost does not adopt, but barely registers; nor does the Scripture affirm that what they said was true, but that it is true they said it."⁴⁵ Instead of pioneering a criticism that attacked the authority of the Bible, he desired to counter a specific criticism (vis. the Bible teaches vice because it presents ungodly sayings and examples) by an explanation of the style of Scripture.

Boyle was both a modern scientist and a theologian who held to a conservative view of the accuracy of the entire Bible. Although the Bible was not a scientific textbook, it was still a source of truth. The following section is a study of how Boyle approached the biblical passages which address scientific matters. Did he reject biblical authority altogether, relegate it only to matters of faith and practice (denying authority in areas of science), or did he hold to complete biblical authority?

Robert Boyle on the Relationship between Science and Scripture

It will be our purpose in the following paragraphs to identify Boyle's thoughts on biblical passages which concern science in some way. Specifically, we will examine how he approached texts which seemed to conflict with the new discoveries of science.

In his book, *Some Considerations Touching the Usefulness of Experimental Natural Philosophy*, Boyle defends the study of experimental science against the attack of several Divines who, for noble motives, "deterre men from addicting themselves to serious and thorough Enquiries into Nature, as from a Study unsafe for a Christian, and likely to end in Atheisme."⁴⁶ Although he had a zeal for the advancement of Christianity and "had much rather have men not Philosophers then not Christians,"⁴⁷ he argued that one could engage in modern science and yet be a true Christian. His thesis was that the study of science would cause Christians to glorify God more, aid in the understanding of Scripture, and produce an apologetic for Christianity. Using Scripture to support his position, he argued the following points.

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Christianity.*

- (1) God had two main goals in his work of creation: (a) the manifestation of his glory (Ps. 19:1, Prov. 16:4, Rom. 11:36) and (b) the good of human beings who were to subdue creation (Gen. 1:28-29) and use it for their benefit (Gen. 1:14-16; Isa. 45:28). Therefore, the study of creation should lead to a doxology of praise to God. It draws people to God, not away from him.⁴⁸
- (2) The knowledge of science actually aids in the understanding of the Bible. The study of certain animals will lead to a greater comprehension of the biblical texts which speak of the characteristics of these animals (e.g. the serpent of Genesis, the four beasts of Daniel's prophetic vision, and the allusions of Jesus to serpents and doves).⁴⁹
- (3) Three attributes of God are seen in a scientific study of nature. (a) His greatness is seen in the vastness of creation. Even if one discards the calculations of the Copernicans and prefers the more modest computations of the Ptolomeans, one must conclude with the Psalmist, "Great is the Lord, and greatly to be praised; and his greatness is unsearchable."⁵⁰ (b) His wisdom is also seen in creation.

When with bold telescopes I survey the old
and newly discovered stars and planets ... when
with excellent microscopes I discern ... the un-
imitable subtilty of nature's curious workman-
ship; and when, in a word, by the help of
anatomical knives, and the light of chymical fur-
naces, I study the book of nature ... I find myself
oftentimes reduced to exclaim with the Psalmist,
How manifold are Thy works, O Lord! in wisdom
hast Thou made them all!⁵¹

- (c) The goodness of God is revealed when the means of God's sustaining of humankind is comprehended. His benevolence is observed in the development of medicines from creation.⁵² Therefore, the study of science should be urged upon all Christians because it increases piety and praise for the Creator rather than leading to atheism.

Although the Bible is not a scientific textbook, it occasionally addresses scientific topics. Like a telescope, this information extends man's knowledge of the world around him and does not contradict the knowledge gained in the laboratory.⁵³ When a conflict developed between science and the Bible, Boyle explained it as either a mistake in science or an incorrect interpretation of Scripture.

Even when some revelations are thought not only to transcend reason, but to clash with it, it is to be considered whether such doctrines are really repugnant to any absolute catholic rule of reason, or only to something which ... depends upon the measure of acquired information we enjoy.⁵⁴

Instead of finding error in Scripture based on the discoveries of science, he claimed the "Truth of the History of the Scriptures."⁵⁵ When both are properly understood, there is an absolute harmony between the Bible and science.

If we lay aside all the irrational opinions, that are unreasonably fathered on the Christian religion, and all erroneous conceits repugnant to Christianity, which have been groundlessly fathered upon Philosophy, the seeming contradictions betwixt Divinity and true Philosophy, will be but few, and the real ones none at all.⁵⁶

Because God is the author of both the book of creation and the book of Scripture, there is "no inconsistency between a Man's being an Industrious Virtuoso, and a Good Christian."⁵⁷

The critics of the Bible had raised questions concerning the miracles of the Bible (e.g., the floating of the axe head) and theologians stood behind statements which seemed to contradict Boyle's science (e.g., the sun rising). Boyle responded with two arguments. First, there are times throughout history when "the Author of those Laws of Nature" made

the parts of the Universe forget their Nature, or Act contrary to it; And ha's (in summe) vouchsafed to alter by Miracles the Corse of Nature, for the instruction or reliefe of Man (As when the Fire suspended its destructive Operation, whilst the three resolute Jewes with their Protectour walk'd unharm'd in the mid'st of those flames that destroy'd the Kindlers, and as the heavy Iron emerg'd up to the swimming piece of wood, miraculously by Elisha made Magneticall).⁵⁸

Other miracles acknowledged by Boyle include Peter walking suspended on water, and the perishable manna which lasted twice as long on the Sabbath and remained fresh for ages in the ark.⁵⁹ At times he explained the miracle in terms of a scientific

process (e.g., Elisha's wood became magnetic to attract the iron), and at other times he simply referred to the miracle (e.g., the manna that remained fresh for ages). Concerning the resurrection of the body, he argued that it should be understood in a "more strict and literal sense" in which the omnipotent God watches over the particles of each individual human body and recomposes the same man with the same particles at the resurrection.⁶⁰ Although Boyle believed in the laws of nature which gave a foundation for experimental science, he had no difficulty believing that God could occasionally perform miracles for the instruction of man.

***When a conflict developed
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Secondly, Boyle realized that there are biblical passages which describe physical processes in such a way that they formally contradict the findings of the new science. For example, the statement, "the sun rises" (Eccl. 1:5), could easily be interpreted within a geocentric model of the world. However, when Boyle embraced a heliocentric cosmology, he was constrained to explain how his science harmonized with the authoritative Bible he embraced. He understood the problem and addressed it by explaining that

in most other places of the Scripture, where the Works of Nature are mentioned but incidently, or in order to other purposes, they are spoken of rather in a Popular then Accurate manner, I dare not peremptorily deny, being unwilling to interesse [modern English: "interest" or "to involve the concern of"] the reputation of Holy Writ (design'd to teach us rather Divinity then Philosophy) in the doubtful contentions of Naturalists, about such matters as may (though the History of the Creation cannot) be known by the meer Light of Natural Reason.⁶¹

His thoughts may be summarized in three statements.

- (1) There are certain revelations about the natural world in the Bible which cannot be discovered by experimentation. These include the creation of the world and the various proceedings of the creation days. They are actual events designed to inform us and to challenge us to study them.⁶²

(2) In other places, God reveals things about the natural world which can be known only by experimentation. These include heliocentric cosmology and information about the size of planets and their distance from the earth. Because the Bible is not a scientific textbook, it mentions these concepts only in passing and does not address them with scientific accuracy. Instead, it conveys them in the way people naturally talk about them. Even modern scientists converse about the beautiful sunset and the brilliant moonlight, knowing full well that the earth rotates and the moon reflects light. It is not an error to speak in the language of appearance.⁶³ For Boyle, the fact that the Bible refers to nature in the language of appearance does not imply that the Bible is in error. Scripture speaks authoritatively in all areas, but it is not the source from which to develop precise mathematical relationships.

(3) The fact that the Bible uses the language of accommodation does not mean that the Bible is in error when it refers to matters of science. Accommodation was viewed from two different perspectives during the time of Boyle. Some believed that God accommodated himself to the *wrong* beliefs of the people living in biblical times. This was based on the supposition that there is error in the biblical text. Socinus (1539-1604) held this view. Because he did not believe in a conscious existence after death, he dismissed the teaching found in Luke 16:19-31 because it reflected accommodation.

One should deal cautiously with this matter [the state of the dead before the Last Day], just even as Christ himself and the Apostles accommodated themselves to the level of the people as the parable of Lazarus [Luke 16:20ff.] and the rich man teaches. This was not the time to perturb the Jews, as even now is not the time, although Jesus sometimes speaks thus in order that it be sufficiently clear that he will resuscitate only the faithful, John 6 [38f, 40, 54].⁶⁴

According to Socinus, the people of Jesus' day believed in conscious existence after death, but they were wrong. Jesus went along with their error (this is what Socinus means by accommodation) so that he would not perturb them.

Calvin also found accommodation in the Bible, but he used the term with a different meaning. According to Calvin, the Bible was written in the language of the common people, not in the language of specialists. God accommodated himself to people by using figures of speech, anthropomorphisms, and the language of appearance. Rather than an ac-

knowledge of error, accommodation resulted in an authoritative revelation that was perspicuous.

The Anthropomorphites, also, who imagined a corporeal God from the fact that Scripture often ascribes to him a mouth, ears, eyes, hands, and feet, are easily refuted. For who even of slight intelligence does not understand that, as nurses commonly do with infants, God is wont in a measure to "lisp" in speaking to us? Thus such forms of speaking do not so much express clearly what God is like as accommodate the knowledge of him to our slight capacity. To do this he must descend far beneath his loftiness.⁶⁵

Boyle held to Calvin's view of accommodation which states that because the Bible was given to common people, it often makes statements in the language of appearance.

Boyle held to Calvin's view of accommodation which states that because the Bible was given to common people, it often makes statements in the language of appearance. In contrast to the Socinian concept, this does not imply an error in the text. Against the Naturalists who believed in the sufficiency of science as opposed to revealed religion, Boyle defended the reputation of the Bible as a book of truth in matters of science and history.⁶⁶ There is an absolute harmony between the scientific facts gathered by experimentation and the scientific facts stated in the Bible. The Bible remains authoritative in matters of science.

Conclusion

Boyle was willing to accept changes in the scientific community, yet he steadfastly rejected changes in the area of biblical authority. Although he was aware of the growing higher criticism of his day, he endorsed Calvin's view of accommodation and continued to affirm the truthfulness of Scripture in matters of science. Boyle believed that the initial rise of modern science in seventeenth-century England was promoted by Christianity. We agree with Kenneth Radant who concludes that "it is incorrect to simplistically attribute the decline in biblical authority in the West to the rising status of reason coinciding with the coming of age of the scientific revolution."⁶⁷ May Robert Boyle be an encouragement to Christians today who desire to advance

modern science and yet hold tenaciously to biblical authority. *

$$\frac{P_1}{P_2} = \frac{V_2}{V_1}$$

Notes

- ¹Charles Webster, "Puritanism, Separatism, and Science," in *God and Nature: Historical Essays on the Encounter between Christianity and Science*, ed. David Lindberg and Ronald Numbers (Berkeley: University of California Press, 1986), 213, concludes that "any truly historical account of the Scientific Revolution must pay due attention to the deep interpenetration of scientific and religious ideas."
- ²This "Weltanschauung that religion impeded the rise of modern science, and that modern science liberated the world from the clutches of a monolithic, superstitious, intolerant, anti-scientific, all controlling Church" is documented and attacked by Richard Popkin, "Skepticism, Theology and the Scientific Revolution in the Seventeenth Century," in *Problems in the Philosophy of Science*, Vol. 3, ed. I. Lakatos and Alan Musgrave (Amsterdam: North Holland Publishing Co., 1968), 1-2f. Richard Westfall, *Science and Religion in Seventeenth-Century England* (Ann Arbor: University of Michigan Press, 1958), 11-12, claims that the entrance of Darwinism into Western thought caused such writers as Lecky, Draper, and White in the late nineteenth century and Paul Hazard in the early twentieth century to propagate this view. It has been advanced recently by Lotte Mulligan, "Civil War Politics, Religion and the Royal Society," in *Intellectual Revolution of the Seventeenth Century*, ed. Charles Webster (London: Duckworth, 1975), 317-339.
- ³Robert Boyle, *New Experiments Physical-Mechanical, Touching the Spring of the Air, and its Effects Made, for the most part, in a New Pneumatical Engine*, 1682 (Ann Arbor: University Microfilms International, 707:11, 1981), 22 emphasis his. The spelling, capitalization, and italics of the primary sources are retained in each quotation.
- ⁴Reijer Hooykaas, *Religion and the Rise of Modern Science* (Grand Rapids: Eerdmans, 1972), 17. This concept is discussed in Robert Boyle, *A Free Enquiry into the Vulgarly Receiv'd Notion of Nature*, 1682, completed in part in 1666, (Ann Arbor: University Microfilms International, 15:11, 1981).
- ⁵Louis T. More, *The Life and Works of the Honourable Robert Boyle* (London: Oxford University Press, 1944), 48.
- ⁶Robert Boyle, *The Christian Virtuoso*, 1690 (Ann Arbor: University Microfilms International, 172:8, 1981), 4. By the term "philosophy" (new philosophy, experimental philosophy, etc.), seventeenth century writers mean what we understand by the concept "science" today. By "reason and experience" he means the experience of experimentation and the thinking process involved in the interpretation of the data.
- ⁷Mathematically, the law is stated as $PV=B$ (at constant temperature and amount, the pressure exerted on a gas times its volume is always constant, in other words, as the pressure increases, the volume decreases and vice versa). This relationship allows the scientist to calculate changes in volume or pressure by solving the equation

$$P_1 \times V_1 = P_2 \times V_2$$
or
- ⁸Walter E. Houghton, Jr., "The English Virtuoso in the Seventeenth Century," *Journal of the History of Ideas*, 3 (1942): 51-73, 190-219.
- ⁹Boyle, *Virtuoso*, 5-6.
- ¹⁰Boyle, *Virtuoso*, 7.
- ¹¹Marie Boas, *Robert Boyle and Seventeenth-Century Chemistry* (Cambridge: University Press, 1958), 5.
- ¹²Cited in Boas, *Robert Boyle*, 6.
- ¹³Westfall, *Science and Religion*, 20-21.
- ¹⁴Thomas Kuhn, *The Structure of Scientific Revolutions*, 2d ed. (Chicago: University of Chicago Press, 1970), 143, and "Robert Boyle and Structural Chemistry in the Seventeenth Century," *Isis* 43 (April 1952): 26-29, argues that Boyle changed the chemical significance of an element. Boyle is sometimes referred to as the father of modern chemistry, but it is more appropriate to give this designation to Dalton, Lavoisier or Priestly in the eighteenth century.
- ¹⁵Because of his conversion and education as a youth in Geneva according to J. R. Partington, *A History of Chemistry* (London: Macmillan, 1961), II, 486.
- ¹⁶Hooykaas, *Religion Modern Science*, 143.
- ¹⁷Barbara J. Shapiro, *Probability and Certainty in Seventeenth-Century England* (Princeton: Princeton University Press, 1983), 94-101, places Boyle on the Anglican side of the Anglican/Roman Catholic debate over the certainty of Scripture and the authority of oral tradition.
- ¹⁸John Wilkins work, *A Discourse Concerning Another Planet*. The actual quote was taken from David A. Bass, "Accommodation in A Discourse Concerning Another Planet (1640) of John Wilkins," (master's thesis, Trinity Evangelical Divinity School, 1989), 58.
- ¹⁹Stillman Drake, *Discoveries and Opinions of Galileo* (Garden City, NY: Doubleday Anchor Books, 1957), 186.
- ²⁰Quoted in Robert Westman, "The Copernicans and the Churches," in *God and Nature: Historical Essays on the Encounter between Christianity and Science*, ed. David Lindberg and Ronald Numbers (Berkeley: University of California Press, 1986), 92.
- ²¹Boyle, *Usefulness*, 30. For a discussion of his controversy with Helmont, see Eugene Klaaren, *Religious Origins of Modern Science* (Grand Rapids: Eerdmans, 1977), 116, 119, 147.
- ²²Boyle, *Style*, 4.
- ²³Boyle, *Usefulness*, 31.
- ²⁴Boyle, *Usefulness* 36.
- ²⁵Boyle, *Usefulness* 25.
- ²⁶Boyle, *Style*, 78. Boyle would have preferred the NASB translation "All Scripture is inspired by God and profitable" rather than the NASB footnote possibility "Every Scripture inspired by God is also profitable ..." (2 Tim. 3:16) which suggests that a passage may be in the Bible and yet lack inspiration.
- ²⁷Boyle, *Style*. The subtitle explains that these considerations were "extracted from several parts of a discourse (concerning divers particulars belonging to the Bible) written divers years since to a friend." The preface clarifies that the discourse was composed 9-10 years earlier (1653-54) while he was still a "green youth" (of about 26-27). There is no indication that he ever changed his mind on any of these points throughout his lifetime. The title page also quotes Ps. 119:103 in Hebrew and 2 Tim. 3:16 in Greek.

The Relationship between Science and Scripture in the Thought of Robert Boyle

- ²⁸Boyle, *Style*, 59-60, 65.
- ²⁹Boyle, *Style*, 60.
- ³⁰Boyle, *Style*, 64-65. Instead of "and," the sense may often be conveyed more accurately by "but, or, so, when, therefore, yet, then, because, now, as, and though."
- ³¹Boyle, *Style*, 11. These are words which occur only once in the Old Testament or New Testament as a whole.
- ³²Boyle, *Style*, 14.
- ³³Boyle, *Style*, 63.
- ³⁴Boyle, *Style*, 21-29. For example, the laws of the first five books of Moses (Boyle does not deny Mosaic authorship of the Pentateuch) must first be viewed as a message for people of a past age.
- ³⁵Boyle, *Style*, 8.
- ³⁶The distinction is between the actual wording (*Ketib*) of the Hebrew text and the corrected reading (*Qere*) of the margin designed to be read in place of the *Ketib*.
- ³⁷The *Tiqqune Sopherim* are the eighteen decrees of the scribes which often altered the text to eliminate anthropomorphisms, cf. Gleason Archer, *A Survey of Old Testament Introduction* (Chicago: Moody Press, 1964), 61.
- ³⁸Boyle, *Style*, 93-94.
- ³⁹Boyle, *Style*, 95.
- ⁴⁰Boyle, *Style*, 94.
- ⁴¹Boyle, *Style*, 16.
- ⁴²*More, Life and Works*, 47.
- ⁴³Klaaren, *Religious Origins*, 107.
- ⁴⁴John Dillengerger, *Protestant Thought and Natural Science* (London: Collins, 1961), 117.
- ⁴⁵Boyle, *Style*, 19.
- ⁴⁶Boyle, *Usefulness*, 22.
- ⁴⁷Boyle, *Usefulness*, 22.
- ⁴⁸Boyle, *Usefulness*, 23-25.
- ⁴⁹Boyle, *Usefulness*, 30-31.
- ⁵⁰Boyle, *Usefulness*, 32-34. Jack Rogers and Donald McKim, *The Authority and Interpretation of the Bible: An Historical Approach* (New York: Harper and Row, 1979), 228, criticize Boyle because of his lack of references to Christ. "The Bible was seen less as a record of God's relationship to people than as a further and higher revelation of His power." Statistically this may be true. However, his references to the power of God stem from the nature of his writings. When addressing matters of science and the Bible, one speaks more about God than Christ. This does not imply that Boyle replaced "the loving God of redemption" with an "omnipotent Creator."
- ⁵¹Robert Boyle, *Seraphick Love*, 1959 (Ann Arbor: University Microfilms International, 1981).
- ⁵²Boyle, *Usefulness*, 43-51, especially 47 on the medicinal use of creation.
- ⁵³Boyle, *Style*, 45. Boyle, *Usefulness*, 124-25.
- ⁵⁴Robert Boyle, *Reflections on a Theological Distinction*, 1690 (Ann Arbor: University Microfilms International, 1981), 20. Intellectual reasoning was certainly a part of Boyle's epistemology in both scientific and biblical studies. However, in *A Discourse on Things Above Reason*, 1681 (Ann Arbor: University Microfilms International, 1981), 19, 28-29, he stressed that there are limitations to reason. Reason should not be allowed to judge what God's revelation could or could not do.
- ⁵⁵Robert Boyle *Some Pyhsico-Theological Considerations about the Possibility of the Resurrection*, 1675 (Ann Arbor: University Microfilms International, 15:15, 1981), 36, in a context which considers miracles in nature.
- ⁵⁶Cited in Dillengerger, *Protestant Thought*, 113.
- ⁵⁷Boyle, *Virtuoso*, 1.
- ⁵⁸Boyle, *Usefulness*, 25-26.
- ⁵⁹Boyle, *Resurrection*, 36-37.
- ⁶⁰Boyle, *Resurrection*, 34.
- ⁶¹Boyle, *Usefulness*, 30.
- ⁶²Boyle, *Usefulness*, 30.
- ⁶³The argument that phenomenal language does not imply error is developed by John H. Gerstner, "The View of the Bible Held by the Church: Calvin and the Westminster Divines," in *Inerrancy*, ed. Norman L. Geisler (Grand Rapids: Zondervan, 1979), 388, 393-94. He quotes A. H. Strong, *Systematic Theology* (Valley Forge, PA: Judson Press, 1907), 223, who asks, "Would it be preferable, in the Old Testament, if we should read: 'When the revolution of the earth upon its axis caused the rays of the solar luminary to impinge horizontally upon the retina, Isaac went out to meditate' (Gen. 24:63)?"
- ⁶⁴Socinus in his work "Epitome of a Colloquium Held in Racow in the Year 1601," as quoted with comment by Glenn Sunshine, *Accommodation in Calvin and Socinus: A Study in Contrasts* (master's thesis, Trinity Evangelical Divinity School, 1985), 68.
- ⁶⁵John Calvin, *Institutes of the Christian Religion*, Library of Christian Classics, Vol. 20, ed. John T. McNeill, translated by Ford Lewis Battles (Philadelphia: Westminster Press, 1960), 121.
- ⁶⁶For a definition of the Naturalist position see William Craig, *The Historical Argument for the Resurrection of Jesus during the Deist Controversy* (Lewiston: The Edwin Mellen Press, 1983), 359-60.
- ⁶⁷Kenneth Radant, "Truth Discovered — Truth Revealed: A Theological-Historical Study of the Integration of Revelation and Changing Human Science in Selected English Natural Histories of the Earth; 1680-1700" (master's thesis, Trinity Evangelical Divinity School, 1987), 123.

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Eternity and the Personal God

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The Bible reveals that God is eternal and personal. Theologians and philosophical-minded scientists have suggested that this carries a conflict. If eternity is interpreted as having the property of timelessness, God cannot be personal because a real relationship between God and the world would require a temporal medium. The conflict can be resolved by reasoning that there are two types of time: One is linked to an idea (abstract time) and the other one to human experience (real time). Both times are related by the principle of complementarity, i.e., their concepts are simultaneously exclusive and yet tied together at a higher level of complexity. God as an eternal being would then combine the idea as well as the experience of time in his essence.

Any Christian theology must enunciate a concept of God which is compatible with the text of the Bible. Such a concept can be thought of as a set of attributes of the divine being. Ever since the Gospel of John conceived God as Spirit, Light, and Love, Christian theology has offered various concepts which, though based on Scripture, reflect the different views and interpretations of their times. The most notable set of attributes was established by scholasticism and later became dominant in theism which presumes that there is an absolute, personal God who created the world *ex nihilo*, maintains it, and is omnipotent, immutable, eternal, etc.

According to Herbert Vorgrimler, more recent debates stress that theism has failed because it does not conform with human experience and cannot withstand scrutiny by logical reasoning. But he sees no reason to either integrate the results of the debates into the concept of a revised theism or reject theism altogether unless the *aporiae*¹ which have emerged, have been properly reflected upon or dealt with. He points out that, in particular, one must take special hermeneutical care when discussing the attributes of God.²

The Bible reveals God as a personal *and* eternal being. Though we find nothing which describes God directly as a person except passages intimating the Trinity, Scripture gives us enough examples of God

as an individual who acts in history, is responsive to the needs of finite beings, and is approachable in prayer. Eternity is linked to the physical world by its association with either timelessness and/or time-related qualities and quantities. The question of what a person or a personal being is has been intensely debated since antiquity; it lies at the root of identity, the ultimate goal of a person's struggle for the inner self.³ In comparison with other attributes, these relate more clearly to the physical world and are, therefore, of more immediate interest to philosophy and science.

The concept of an eternal *and* a personal God is alleged by some to carry a conflict. After an incipient interpretation of God's eternity as having the property of timelessness, theology gradually found out that this is incompatible with the idea of a personal God. A real relationship between a personal God and the world would require a temporal medium for his actions. Those in the scientific community, who comment or elaborate on God or his nature, have uttered a similar line of reasoning. Many of them belong to the school of Bertrand Russell, the outspoken opponent of Christianity.

The conflict between the two attributes induced theologians to search for an interpretation of eternity which would allow them to reconcile their hermeneutical goals with the biblical pronouncement of God as a person. Correspondingly a number of

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philosophical-minded scientists also have come to an understanding of eternity which does not exclude the existence of a personal God.

Timeless and Personal?

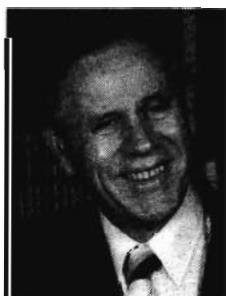
St. Augustine opens the eleventh book in his *Confessions* with the words: "Lord, since eternity is yours ..." and continues in Chapter 11 with "... In eternity nothing passes by; everything is present, whereas time cannot be present all at once."⁴ God's immutable substance exists complete in the indivisible, perfect, and ever complete present of eternity⁵ and is conceived Platonically as immutable timelessness.⁶ A century later Boethius defines eternity as "*interminabilis possessio vitae simul tota et perfecta*." Here nothing is said about time. Eternity is timeless. St. Thomas states similarly that God's eternity has no connection with time. For him time is a quantity which can be divided into infinite intervals or expressed as "now," whereas eternity is not divisible and therefore is a quality unrelated to time.⁷

About the turn of the thirteenth century, the timelessness doctrine was challenged by the two powerful critics of scholasticism, Duns Scotus and William of Occam. They prefer to speak of an everlasting God and deem it a mistake to divorce God completely from the process of time.⁸ Among contemporary theologians, Nelson Pike discusses in detail how timelessness relates to the idea of a person.⁹ He observes that the mental activities of a person can be described by the temporal processes of reflecting, deliberating, anticipating, intending, and remembering. A timeless being neither could engage in these mental activities nor could it act purposefully, i.e., intentionally. Pike notes furthermore, that a timeless being could not be affected or prompted by another and its actions could not be interpreted as a *response* to something else. "Responses are located in *time* after that to which they are responses." He concludes that the concept of a timeless being contradicts the definition of a person. God also could hardly be understood as being om-

nipotent. Pike makes this clear when he writes that he has found "reason to think that a timeless being could not create or preserve a temporally extended universe."¹⁰ Brunner outrightly rejects the divinity of Platonism and proposes that God's eternity be a "sovereign rule over Time and the temporal sphere, the freedom of Him who creates and gives us Time" and that, accordingly, God takes part in temporal happenings; indeed reveals himself in historical time as man.¹¹

It is not surprising that contemporary philosophers and scientists who reflect on man's fundamental religious apprehensions are joining the debates about the concept of God. After World War I, Alfred North Whitehead developed his metaphysical system of ideas "which brings the aesthetic, moral, and religious interests into relation with those concepts of the world which have their origin in natural science."¹² The impact of his work on philosophy, theology, and the theory of science is still growing. Whitehead postulates that time and locations are a necessary part of every metaphysical situation. Therefore any reality, including the divine reality, must be related to at least one point somewhere in space and time. This relationship offers an understanding of God's action in the world but it also implies the ideas of a changing and developing God. The idea does not negate his perfection. His perfection is relative in the sense that *he* only can surpass himself at every stage of his development and can become more perfect than every other actuality, whose absolute perfection is compromised by temporalities.¹³ Whitehead's approach to the concept of God enables theologians to use personalistic language which expresses mutual communication and God's influence in the world, thus confirming the theistic principle of an individual God who is with us in time and space.¹⁴ The principle of immutability, however, can no longer be maintained.

It is important to mention Paul Davies whose books have found worldwide attention and have been referred to by many prominent authors who



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yoke science and religion. In his book, *God and the New Physics*, Davies examines all the traditional arguments for God's existence and attributes, and criticizes them for their inconsistency with the insights of modern physics. He concludes that an eternal God is timeless and cannot be personal.¹⁵ This would mean that we cannot approach God in prayer and that "... a number of important traditional attributes of God lose coherence and meaning ..."¹⁶

To say that this book is a challenge to conservative Christianity and Bible literalism is to be guilty of gross understatement. It could be more easily dismissed if its author were just another carping critic of Christianity ... and if he were using, say, geology or biology as a platform for launching his attack. But Davies cannot be categorized as an atheist or as anti-religious, and his platform is the foundation of all other sciences ...¹⁷

Time and Events

The concept of time seems to be simple, but closer examination reveals that from antiquity to the present attempts to define it have been intricate and tedious.¹⁸ For the following discussion, we select the concepts presented by David Park and Carl Friedrich von Weizsäcker. Park distinguishes between two types of time. He calls the time of physical theory which appears in the equations of dynamics and is registered by a clock, Time 1, and the time of human consciousness, Time 2.¹⁹ Time 1 is not tense-related. The equation $x = vt$, for example, where x is the distance a body having constant velocity v travels during time t , does not convey any information about the past, present, or future of the temporal process. It just tells us what the specific traveling distance *is*, when t is a certain number.²⁰

Consciousness is the total content of our direct experiences. The latter give us a sense of temporal awareness which in turn leads to the abstract notion of Time 2. "We have no sensory apparatus which provides knowledge of temporal relationships as we do have senses which provide knowledge of spatial relationships. Our experience is always within the ... 'present' and even our memories are present phenomena."²¹ Normally we don't even notice our state of self-absorption, characterized by the unawareness of moments. Only when we self-consciously examine our current sense impressions (direct experience) and our state of mind do we find that our *memory* "enables us to compare that *which is* to that *which was*." This discrimination, based on our memory, implies a "sense" of what we call past and constitutes a temporal awareness "or construction of time."²² Another element in this construction is anticipation and the awareness of a change within the

present (as the moving hand of a clock). Park in particular looks at the process by which sense impressions are organized into a perception of objects and situations.

The kind of consciousness to which this leads is what I have called Time 2, the sense that objects move and situations develop: The flow of *events*, viewed always from the perspective "I, here, [presently]" ... In this state of consciousness we are not conscious of time at all; in fact, as soon as we focus attention on the experience of time, we begin to see events against a linear scale, marked off with hours or dates, on which the consciousness of a particular moment is registered as a point.²³

Von Weizsäcker's approach to the nature of time is identical. He distinguishes between a time concept which is void of the "modes," present, past, and future, and a time concept which is characterized by modes. He notes that physicists prefer the use of the first concept for an "objective" description of nature over the use of the second concept for a "subjective" description of nature. There are circumstances, however, where the first time concept is not sufficient for the depiction of certain temporal relationships in physics. Probability, for example, implies a prediction or a statement about the future.²⁴ Quantum theory can be thought of as a general theory of probability *predictions* for empirically determinable alternatives.²⁵ We know today that the second law of thermodynamics tells us that everywhere in the *past*, where a reliable evaluation by humans took place, the entropy of a closed system either increased with time or stayed constant.²⁶ We find here, that mind-dependent concepts (future, past) are involved in the formulation of two fundamental findings of physics.

... it is the perception of external or internal events by our consciousness which leads to what we call experience. It is therefore primarily the event which conveys the notion of time.

It was noted earlier that *direct* experiences lead to temporal awareness. A more specific interpretation would state that it is the perception of external or *internal* events by our consciousness which leads to what we call experience. It is therefore primarily the event which conveys the notion of time. Von Weizsäcker defines an event as the cognizance of a

contingent attribute of an object at a certain time.²⁷ On the other hand, according to Einstein's preferred definition, an event is a point representing a specific set of values of the three dimensions of space and the time. It can also be, in a wider sense, something that occurs at such a point. Accepted terminology defines an occurrence at a given point in the space-time continuum as a "physical event." From the viewpoint of an observer, a physical event can either be experienced presently or be said (in good conscience) to have taken or going to take place.²⁸ A physical event thus may be perceived as having the attributes, "simultaneous with," "earlier than," or "later than," and may be characterized by a time coordinate in the present, the past, or the future. This is obviously Park's Time 2. Synonymous with Park's Time 1 and Time 2 are von Weizsäcker's objective and subjective time respectively.

In March 1954, Einstein wrote in a letter: "For us believing physicists the distinction between past, present, and future is only an illusion, even if a stubborn one."²⁹ Frank Tipler's Omega Point theory advances a similar thought. Tipler suggests that

in effect all the different instants of universal history are collapsed into the Omega point; "duration" for the Omega point can be regarded as equivalent to the collection of all experience of all life that did, does, and will exist in the whole of universal history, together with all non-living instants. This duration is very close to the idea of *aeternitas* of Thomist philosophy.³⁰

Both quotations above are different versions of Augustine's thought at the beginning of "Timeless and Personal?" on page 2. God knows things "timelessly," all at once. For him the past, present, and future of the world are known instantly.

Eternity and Complementarity

In the section, "Timeless and Personal?" eternity was assumed to be "timeless." Closer examination shows that this characterization is problematic. The Platonic eternity of God (The Living Being) appears at first sight to be devoid of Time 2:

... He set out to make the universe resemble it in this way too as far as was possible. The nature of the living Being was eternal, and it was not possible to bestow this attribute fully on the created universe; but he determined to make a moving image of eternity, and so when he ordered the heavens he made in that which we call time an eternal moving image of the eternity which remains forever at one.³¹

It appears equally difficult to relate Augustine's concept of eternity to Time 2 because

we think of eternity in a temporal way, despite the fact that the perfect and immutable substance of God, whose duration is eternal, has no succession in itself and exists complete in the indivisible, perfect, and ever complete present of eternity. We can say that although eternity does not precede time in a temporal way, it is prior to time as its cause, and unless eternity existed, there would be no time, ...³²

*God knows things "timelessly,"
all at once. For him the past,
present, and future of the world
are known instantly.*

The reason for the difficulty is that Augustine thinks of Time 2 in psychological terms and is not aware "of the dynamical laws [of physics] that find their natural expression in terms of Time 1 ..."³³ Boethius' definition of eternity suggests timelessness but he also concludes with Plato

that God ought not to be considered as older than the created world in extent of time, but rather in the property of the immediacy of his nature. The infinite changing of things in time is an attempt to imitate this state of the presence of unchanging life, but since it cannot portray or equal that state it falls from sameness into change, from the immediacy of the present into the infinite extent of past and future.³⁴

These quotations suggest that (created) Time 2 proceeds from an eternity which is "timeless." How can this be understood? The question can be answered in two parts. First, we suggest that eternity, as comprehended by the ancient philosophers, is "timeless" in the sense of not comprising Time 2. "Timeless" is a word used by some writers to interpret eternity in the sense (as they think) of Plato's definition. Actually Plato "seems to have been the first to realize that there are two times and attempts to define the relations between them. ... [However] there is no *obvious* place for time in the theory of Ideas, since the Ideas ... are themselves as timeless as a mathematical theorem" (italics by this author).³⁵ Because the equations of dynamics contain time as devoid of modes, the "timelessness" of eternity may be pictured alternatively as the idea of Time 1.

Secondly, we ask by what could *created* time be manifested? Plato's answer is that God can be the

only eternal, perfect being but that the physical world strives to participate in and demonstrate God's perfection. The most perfect *physical* being

is the outermost heaven, i.e., the sphere of the fixed stars ... [which] is in a state of perpetual uniform rotation, since *uniform rotation*, inasmuch as it has no intrinsic beginning or end and no variation, is the nearest approach to an eternal activity which can characterize any created thing. Plato identified the rotation of this first heaven with time, which he called, [as we already know], the moving image of eternity.³⁶

Park thinks that this train of thought bears implicitly the idea of two times. He refers to an analysis of Plato's text by Proclus and quotes the latter as follows:

As we have often remarked, things have a twofold nature: the one invisible, unique, simple, and unworldly, and the other visible, multiple, varied, and distributed throughout the world. ... If this is so, then time is also two fold. There is a time for heaven and one for earth. The one remains and at the same time proceeds; the other is borne along in motion, ... the revolution of the planets ...³⁷

The discussion above implies that eternity itself embraces the idea of Time 1, and relates in some way to Time 2. At this point it is obvious to ask: What lies at the root of the assumption that Time 2 of the physical world has its roots in eternity? From an abstract viewpoint, the question relates the idea of Time 1 to the experience of Time 2. What logic could tie the two together?

Classical physics uses ordinary logic and concludes, that particles and waves have mutually exclusive properties indeed. Quantum theory gives us logical permission to accept the contradictions by means of an inherent principle, called complementarity.

For an answer we note that, according to the above, Time 1 — which unlocks the mystery of physical processes for us and belongs to God's eternity — cannot be used (let alone explain) the experience or *passage* of time. If, on the other hand, we were to communicate the nature of Time 2, we can-

not consider God in his *eternal* aspect. We have here a pair of ideas, each of which contributes to the understanding of the attributes of God, but both of which cannot be held at the same time.³⁸ "Ordinary" logic, which goes back to Aristotle, does not suffice to link the ideas, because it assumes that any proposition has a unique negation and that either the negation or the proposition is wrong. There is no *tertium quid*. In our case, Aristotelian logic would permit the following statements only: God is eternal and impersonal. God is not eternal and personal. It seems, however, that a special type of logic provides a hint for a more resourceful handling of our problem.

Werner Heisenberg notes that according to von Weizsäcker "ordinary" logic can be expanded by "quantum logic" under the following presuppositions:

1. The content of a proposition is expressed by two complex numbers.
2. The logical conclusion is expressed by truth-values according to the scheme:

0	<—Truth-Values—>	1
0	1/2	1
Conclusion is wrong	Conclusion is complementary	Conclusion is right

3. Conclusions with truth values between 0 and 1 neither can be said to be right or wrong nor can they be expressed in terms of ordinary language.

This logic is adapted to the mathematical scheme of quantum theory which, among its many other successes, enables us to describe the smallest parts of matter by mutually contradicting models. Depending on the choice of the experiment, light or electrons, for example, manifest themselves either as particles or as waves. Actually the two models are indeterminate analogies and are used to describe the real world of light or atoms by a "word-picture." A precise statement can be obtained by the use of mathematical language only. Classical physics uses ordinary logic and concludes that particles and waves have mutually exclusive properties indeed. Quantum theory gives us logical permission to accept the contradictions by means of an inherent principle, called complementarity. Quantum logic thus is a means to interpret complementary conclusions free from the ambiguities of ordinary language, and is an example of reasoning which does not aim at the exclusive possibility of true or false, yes or no, etc.³⁹

The principle of complementarity was articulated by Niels Bohr in 1927 when he and Heisenberg agreed that matter and light per se are neither particle nor wave. The principle appeared in many of Bohr's discussions. A favorite of his "was the definition of a 'great truth' as a 'truth whose opposite is also a great truth.'"⁴⁰ This thought widens the scope of complementarity from scientific insight to a useful concept beyond the domain of physics. The generalization is illustrated by the remark that complementary aspects are often found in human situations: "... The nature of most human problems is such that universally valid answers do not exist, because there is more than one aspect to each of these problems."⁴¹ Park applies this principle to establish a relationship between the two times. He suggests that *Time 1 and Time 2 are of complementary nature* "which will be understood at a higher level of complexity, ..." ⁴²

God's "timeless" eternity and his temporal relationship to the world [are] part of his essence.

We advance now the propositions that the biblical God is eternal and assumedly timeless (or better, in Time 1) and that the biblical God is personal and in Time 2. If Time 1 and Time 2 are complementary the two statements above can logically exist simultaneously. God's "timeless" eternity and his temporal relationship to the world would then be part of his essence.

Paul Tillich suggests that "eternity is neither timelessness nor the endlessness of time."⁴³ Plato called time the moving image of eternity.

It would have been foolish to imply that time is the image of timelessness. ... And eternity is not the endlessness of time [from infinity to infinity because this would mean] the endless reiteration of temporality. To elevate the dissected moments of time to infinite significance by demanding their endless reduplication is idolatry in the most refined sense.⁴⁴

Eternity also includes the quality of temporality. Tillich justifies this by observing that the meaning of *olam* in Hebrew and *aiones* in Greek "means the power of embracing all periods of time." But then one is still confronted with the question: How does eternity relate to "real" time and its modes?

An answer demands use of the only analogy to eternity found in human experience, that is, the unity

of *remembered* past and *anticipated* future in an *experienced* present. Such an analogy implies a symbolic approach to the meaning of eternity. In accord with the *predominance of the present* in temporal experience, eternity must first be symbolized as an *eternal present (nunc eternum)*. But this *nunc eternum* is not simultaneity or the negation of an independent meaning of past and future. The eternal present is moving from past to future but without ceasing to be present.⁴⁵

Eternal and Personal!

The problem with the idea of God becoming personally involved with history or individuals, and thus with Time 2, arose from the assumption that his eternity is timeless or, more specifically, that his eternal presence does not embrace Time 2. "Time in Heaven is marked by numbers; that is Time 1."⁴⁶ Compared to Time 2, Time 1 is without modes. Since human consciousness experiences time through its modes, an eternity without them is discerned psychologically as "timeless." The complementarity of the two times with Tillich's discourse permits the conclusion that God can be eternal and personal.

God is Being itself and as such is ultimate reality. When we say this we must note that any *concrete*

assertion about God must be symbolic, for a concrete assertion is one which uses a segment of our finite experience in order to say something about him. It transcends the content of this segment, although it includes it. ...[But] can a segment of finite reality become the basis for an assertion about that which is infinite? The answer is that it can, because that which is infinite is Being itself, and because everything *participates* in Being itself (*italics by this author*).⁴⁷

It is this analogy which enables us to make an assertion and which "gives us our only justification of speaking at all about God. It is based on the fact that God must be understood as being-itself."⁴⁸

The premise that Time 1 and Time 2 are complementary and the permissibility of inferring by an analogy that the (revelatory) eternity of God can be conceptualized based on our finite interpretation of his eternity allows us to develop the following thoughts:

1. There are attributes of God, eternal or personal, which are related to time implicitly or directly and thus correspond with Time 1 and Time 2. Therefore one must exercise caution if, for example, one were to undertake qualifying statements about omniscience or immutability. The situation is aptly articulated by Pike who writes:

that the interpretation one assigns to the predicate "eternal" has an important bearing on the doctrine of divine omniscience. Some traditional theologians have thought that if God is everlasting (rather than timeless), the doctrine of divine omniscience entails determinism. On the other hand, some contemporary philosophers have argued that if God is timeless (rather than everlasting), he cannot be omniscient at all. A corresponding set of problems and issues arises with respect to the logical relations between eternal and omnipotent and ... between eternal and [personal]. In short the predicate "eternal" occupies something of a pivotal position within the logical-geography of traditional Christian thinking about the nature of God.⁴⁹

A similar notion about the significance of eternity for faith in the biblical God has been given by Wolfhart Pannenberg:

... the fourth question refers to the relation between time and eternity: Is there any positive relation conceivable of the concept of eternity to the spatiotemporal structure of the physical universe? This is one of the most important questions in this dialogue between theology and science. It is unavoidable if the reality of God is to be related in a positive way to the mathematical structure of the spatiotemporal world of nature.⁵⁰

2. To act as a person in Time 2 does not necessarily mean that God becomes tied to space in the sense that he is now "caught up in the operation of the universe" and suffers loss of his omnipotence. God's reality can neither be totally comprehended nor be partially limited by human cognition or reasoning. Ilya Prigogine and Isabelle Stengers contend that for many systems or objects there are languages and points of view which may be complementary.

They all deal with the same reality, but it is impossible to reduce them to one single description. The irreducible plurality of perspectives on the same reality expresses the impossibility [for man to get hold] of a divine point of view from which the whole of reality is visible. ... The real lesson to be learned from [this] ... consists in emphasizing the wealth of reality, which overflows any single language, any single logical structure.⁵¹

Such wealth may suggest an ultimate reality which is personal and yet remains eternal.

3. There is no compelling reason to deny the idea that an eternal God can also be personal. God transcends the two times and combines them in his ultimate reality.

Davies' arguments about God's attributes are persuasive when we view eternity as "timeless" or void of time. But with a different understanding of time, we may say that God's personal involvement with the physical world does not necessarily pose the problems Davies has with some of God's attributes. To postulate that God is "timeless" and therefore unable to be personal reduces him to the God of a single description by physics. Yet, it must be granted that such an idea is more open-minded than the adamant atheism of say Friedrich Nietzsche or Karl Marx. Both identify eternity with "endless time." Their philosophies are untenable today because, according to Einstein, time appeared together with space when the universe came into being.

*Since human consciousness
experiences time through its
modes, an eternity without them
is discerned psychologically as
"timeless."*

4. The problem with a personal God entering into a relationship with finite beings, who do not match his actual being, has been highlighted in two recent publications. Raniero Cantalamessa contends that faith in the personal character of God as expressed within the realm of early monotheism is later replaced by faith in a triune God whose being comprises personal *and* impersonal aspects.⁵² Hans Küng expresses a similar view by suggesting that God is more than a person, but nothing less than a person. He notes that a physicist with all his creative intellect is not able to explain the totality of reality.⁵³ But this is what the Bible says: The ultimate reality is more than a universal reason, more than a large anonymous conscience, more than the highest ideas, more than the beauty of the universe. The ultimate reality is something that is not indifferent to us or leaves us unmoved. God is not a neuter or "it" but a God who lets human beings decide to accept or reject him. He is spirit of creative freedom, the primary identity of justice and love. "But the wording is not determinate here. One also could possibly say according to the complementary principle of the physicist Niels Bohr: In the same way as it depends in quantum mechanics on the query whether upon an experiment the answer is wave or particle, so it depends in a philosophical/theological discussion on the query whether

upon a definite question God is called personal or impersonal. It pertains to God's unbounded essence which transcends all categories that he is neither personal nor impersonal but both simultaneously. He is *transpersonal*.⁵⁴

5. This paper is an apologetic answer to the reasoned denial of a personal God and not an attempt to describe him in terms of quantum theorems. There is a large inventory of revelatory insights which, for the faithful, constitutes an untouchable *a priori*. "Looking at God, we see that we do not have Him as an object of our knowledge, but that He has us as the subject of our existence."⁵⁵ *

Acknowledgments

The author is grateful for the editorial help by J. W. Haas, Jr., Lyn Berg, and Don Ruegg. Also much appreciated are the constructive comments of the reviewers of this manuscript and the communications by Gerhard Weibel.

Notes

- ¹*Aporia*, n. doubt, raising questions and objections without necessarily providing answers.
- ²Herbert Vorgrimler, "Neuere Kritik des Theismus," *Concilium* 13 (March 1977): 142, 147.
- ³The personal and impersonal attributes of God have been thoroughly discussed in the March 1977 issue of the international journal *Concilium*.
- ⁴St. Augustine, *The Confessions of St. Augustine*, Trans. Rex Warner (New York: NY/Penguin Inc., 1963), 257.
- ⁵John F. Callahan, *Four Views of Time in Ancient Philosophy* (New York: Greenwood Press, 1968), 183.
- ⁶Howard A. Slaatte, *Time and its End* (New York: Vantage Press, 1962), 104.
- ⁷Joseph Meurers, *Metaphysik und Naturwissenschaft* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1976), 28.
- ⁸Ronald H. Nash, *The Concept of God* (Grand Rapids: Zondervan Publishing House, 1983), 73.
- ⁹Nelson Pike, *God and Timelessness* (New York: Schocken Books, 1970), chapters 5 and 7.
- ¹⁰*Ibid.*, 118.
- ¹¹Emil Brunner, *The Christian Doctrine of God* (Philadelphia: Westminster, 1950), 268-70.
- ¹²Allison Hartz Johnson, *Whitehead's Theory of Reality* (New York: Dover Publications, Inc., 1962), 5.
- ¹³Robert Mellert, "Die Prozesstheologie und das personale Sein Gottes," *Concilium* 13 (March 1977): 196-99.
- ¹⁴*Ibid.*, 198.
- ¹⁵Paul Davies, *God and the New Physics* (New York: Simon & Schuster, 1984). Davies notes that Christians believe in an eternal God. If "eternal means everlasting or existing without beginning or end for an infinite duration," God is in time and subject to change. "But what causes that change?" If, according to Genesis, God is the cause of all existing

things, it does not make much sense to speak of an ultimate cause which itself changes. The special theory of relativity postulates that time is not independent, but forms with space an entity, the space-time continuum. Time and space are inseparably intertwined. A God who is in time is then tied to space and thus "in some sense caught up in the operation of the physical universe. ... Clearly, God cannot be omnipotent if he is subject to the physics of time, nor can he be considered the creator of the universe if he did not create time" (p. 133).

Davies concedes that the universe had a beginning because he sees "many strands of evidence to support this astonishing theory" (p. 10). But he is critical of the "cosmological argument" which states that the universe must have a cause, and that this cause is God. He deems this argument to be self-contradictory because it is founded on the assumption that everything has a cause "yet ends in the conclusion that at least one thing (God) does not require a cause." Davies notes also that cause and effect are "concepts that are firmly embedded in the notion of time" and that "causation is a temporal activity." But since time did not exist before creation, causation in the above sense could not apply and the idea of God existing "before" the universe came into being is meaningless because there was no "before" (pp. 37-39).

But how can the existence of the universe be explained if time did not exist before its materialization? Interpreting the word eternal as *timeless*, Davies thinks that Boethius' idea of a God who is free of temporal constraints allows for an acceptable concept of creation. A timeless God could "create" the universe in the "sense of holding it in being at every instant. Instead of God simply starting the universe off ... a timeless God acts at all moments" (p. 45). But such God "could not be considered a 'person' or individual in any sense that we know." Davies then continues "Misgivings on this score have led a number of modern theologians to review this view of an eternal God. Paul Tillich writes: 'If we call God a living God, we affirm that he includes temporality and with this a relation to the modes of time.' The same sentiment is echoed by Karl Barth: 'Without God's complete temporality the content of the Christian message has no shape'" (p. 134).

- ¹⁶Arthur Peacocke, "Science and God the Creator," *Zygon: Journal of Religion and Science* 28 (1993): 481.

- ¹⁷Robert L. Shaklett, "God and the New Physics," Book Review in *Journal of the American Scientific Affiliation* (December 1984): 254-55.

- ¹⁸A few examples may serve as an illustration. Plato thinks of time as the moving image of eternity. For St. Augustine "time at best is something impermanent and its being, composed as it is of a series of indivisible moments, remains foreign, by definition, to the permanent immobility of the divine eternity" (Etienne Gilson, *The Christian Philosophy of Saint Augustine*, Transl. L. E. M. Lynch [New York: Random House, 1960], 193). Isaac Newton says that "absolute, true and mathematical time of itself, and from its own nature, flows equably without relation to anything eternal," whereas Albert Einstein postulates that time and space are interrelated. Richard Morris, who elaborates lucidly on the concept of time, discriminates even between five arrows of time (Richard Morris, *Time's Arrows* [New York: Simon & Schuster, [1958] 1986], chap. 8). And K. G. Denbigh's definitions for three types of time are rooted in

theoretical physics, thermodynamics, and human consciousness (K. G. Denbigh, *Three Concepts of Time* [New York: Springer-Verlag, 1981], 168).

One cannot ignore Stephen Hawking's ideas on time (Stephen W. Hawking, *A Brief History of Time* [New York: Bantam Books, 1988], Chap. 9). But his views are criticized by Robert Deltete who holds that Hawking's concept of an imaginary and a real time "has no ontological import" (Robert J. Deltete, "Hawking on God and Creation," *Zygon: Journal of Religion and Science* 28 [December 1993]: 501). Ilya Prigogine and Isabelle Stengers devote an entire chapter of their book to various aspects of time (Ilya Prigogine and Isabelle Stengers, *Order out of Chaos* [Boulder: New Science Library, Shambala Publications, 1984], Chap. VII). They discuss the static time of classical physics vs. existential time, Bergson's time in nature and subjective time, and Frazer's time understood and time felt (p. 214). For systems presenting an unidirectional process, they define an "arrow" of time, for example, the cosmological arrow (p. 259) and the intrinsic arrow of a "new" distribution function (p. 289).

The discussion above offers quite a variety of ideas about time. The question is: Which concept lends itself best to achieve the objective of this article? Its author concludes that the multiplicity of the definitions for time can be sufficiently reduced in the context of other explanations if one accepts the concepts of David Park and Carl Friedrich von Weizsäcker. Both identify two times only and do not define an arrow of time. Von Weizsäcker (Carl Friedrich von Weizsäcker, *Aufbau der Physik* [München: Deutscher Taschenbuch Verlag, 1988], 49) thinks that it is difficult to find a clear description for the meaning of an "arrow of time" because the natural direction of the definition has been reversed, which leads to a circular argumentation.

¹⁹David Park, *The Image of Eternity: Roots of Time in the Physical World* (Amherst: The University of Massachusetts Press, 1980), 100.

²⁰Let us assume that an observer inspects a set of photographs spread out before him on a table. The pictures depict the position of a ball on a billiard table after one, two ... and 10 seconds. The pictures also show a measuring stick which allows for an identification of the momentary ball position. If we ask the person how the pictures could possibly be related to each other he may say, that the position x of the ball can be expressed, say, by the product of a constant v times a variable t or by $x = vt$. Here t is an abstract quantity whose meaning so far has yet to be determined. Some time later the person attends a pool game and becomes conscious of the fact that t identifies with the time he can measure with a clock and that v is the velocity of the ball. It is therefore, reasonable to apply to t the predicate "time."

There are other equations where t appears as a variable which can be measured by a clock. Mathematically many laws of physics can be formulated mostly by hyperbolic differential equations with respect to t where the "time point" of a state or event is described by the value of the parameter t . Variation principles use time as an integration variable. In conservation laws the derivative with respect to time is assumed to be zero. All these equations do not carry any message about the passage of time as conceived by the mind. All values of t enter there at the same footing. Any value of t is always "now." There are no physical

events in the realm of ideas. t is only marked by numbers. This is Time 1.

When watching the pool game the observer experiences a temporal awareness of presence and past or a consciousness of time. This is Time 2. The pictures do not convey any message about the passage of time; the pool game does. "The physical world is such that it can be described by the equations of dynamics" (Ibid., 110).

²¹K. G. Denbigh, *Three Concepts of Time* (New York: Springer-Verlag, 1981), 11.

²²Ibid., 16-17.

²³David Park, *The Image of Eternity*, 111-12.

²⁴Carl Friedrich von Weizsäcker, *Aufbau der Physik* (München: Deutscher Taschenbuch Verlag, 1988), 47-52.

²⁵Ibid., 24.

²⁶Ibid., 137.

²⁷Ibid., 335.

²⁸Ibid., 370.

²⁹Banesh Hoffmann and Helen Dukas, *Albert Einstein: Creator and Rebel*. (New York: The Viking Press, [1972] 1973), 258.

³⁰Frank J. Tipler, "The Omega Point as Eschaton: Answers to Pannenberg's Questions for Scientists," *Zygon: Journal of Religion and Science* 24 (1989): 229. Tipler's Omega Point theory plays a central role in his recent book *The Physics of Immortality*. The reactions of commentators range from outrage to incredulity. Yet prominent reviewers such as Wolfhart Pannenberg (Wolfhart Pannenberg, "Breaking a Taboo: Frank Tipler's Physics of Immortality," *Zygon: Journal of Religion and Science* 30 [June 1995]: 309-14) and Frank Birtel (Frank T. Birtel, "Contributions to Tipler's Omega Point Theory," *Zygon* 30 [June 1995]: 315-27) conclude that his ideas are worthy of further exploration.

³¹Park, *The Image of Eternity*, 101. Park's version of Plato's discourse on time and eternity is supplemented by Cornford's translation and comments regarding Plato's original text (Cornford, *Plato's Cosmology*, 3rd printing. [New York: Bobbs-Merrill Co.], 97-98).

³²John F. Callahan, *Four Views of Time in Ancient Philosophy*, 101.

³³Park, *The Image of Eternity*, 103.

³⁴Boethius, *The Consolation of Philosophy*, Transl. V. E. Watts (London: Penguin Books, 1969), 165.

³⁵Park, *The Image of Eternity*, 100-01

³⁶J. L. Russell, in *The Voices of Time*. Ed. J. T. Frazer. (Amherst: The University of Massachusetts Press, 1981), 67.

³⁷Park, *The Image of Eternity*, 103.

³⁸See Park, *The Image of Eternity*, 112.

³⁹Werner Heisenberg, *Schritte über Grenzen* (München: R. Piper & Co., 1971), 171-77.

⁴⁰John Archibald Wheeler, "Niels Bohr, the Man." *Physics Today* 38 (October 1985): 67.

⁴¹V. F. Weisskopf, *Physics in the Twentieth Century* (Chicago: The University of Chicago Press, 1972), 351.

⁴²Park, *The Image of Eternity*, 113-14.

⁴³Paul Tillich, *Systematic Theology*, Vol. 1 (Chicago: The University of Chicago Press, 1967), 274.

⁴⁴Ibid., 274-75.

⁴⁵Ibid., 275. A nice allegory about the *nunc eternum* is the "eternal flash" (communication by William Russell, First Presbyterian Church of Deerfield).

⁴⁶Park, *The Image of Eternity*, 107.

⁴⁷Tillich, *Systematic Theology*, Vol. 1, 239-40.

⁴⁸Ibid., 240.

⁴⁹Nelson Pike, *God and Timelessness*, x.

⁵⁰Wolfhart Pannenberg, "Theological Questions to Scientists," *Zygon: Journal of Religion and Science* 16 (March 1981): 60-77.

⁵¹Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos*, 225.

⁵²Raniero Cantalamessa, "Die Entwicklung des persönlichen Gottesbegriffs in der Christlichen Spiritualität," *Concilium: Internationale Zeitschrift für Theologie* 13 (March 1977): 165.

⁵³Hans Küng, *24 Thesen zur Gottesfrage* (München: Piper, 1986), 81-82.

⁵⁴*Ibid.*, 83.

⁵⁵Paul Tillich, *The New Being* (New York: Charles Scribner's Sons, 1955), 77.

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SCIENCE K-2 Kathy Lambert, *Supervising Ed.* and **SCIENCE 3-6** Karin Admiraal, *Supervising Ed.* (Grand Rapids, MI: Christian Schools International, 1994). Hardcover; \$49.15, Teacher's Guide; \$27.30, Student Textbook.

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Here are some quotes from *Science 6*, the sixth-grade textbook, on topics of special interest to members of ASA. *Science 6* has no mention of evolution.

Animals in God's Plan

God's creation is full of animals.... But God didn't just make animals and leave them to fend for themselves. Every day, he is taking care of all the animals that he made. He provides them with food, shelter, water, and sunlight ... Animals are important to other animals in the food chain. Some animals are herbivores ... carnivores ... decomposers.... so animals are important to plants, too! People also use animals for food.... Besides being useful, animals are also beautiful and fascinating to study. When God finished making animals, he said that they were good. From the animals, we can also learn about God's care for all his creation. If you study how God cares for the animals, you can learn more about how he cares for you and how you can care for the animals that he made (pp. 71-72).

What is Ecology?

God was the world's first gardener. He planted the Garden of Eden and caused it to grow. Today you can see God's work every time a flower pushes through the earth or a baby mouse is born. He cares for the world that he made and the plants and the animals in it.

After God created the garden, he put people in it to tend it and take care of it. We are God's gardeners on his earth. This earth is our home. We share it with plants, animals and all of God's creatures. Our job is to help keep the world as a good place for God's creatures to live.

An important part of our role as God's gardeners is to study the living things of the earth and the relationships between them. The study of living things and their relationships with one another and with nonliving things is called *ecology*. As we learn more about how God made the world, we can better understand how to take care of it (p. 145).

What is in the Universe?

"In the beginning God created the heavens and the earth" (Gen. 1:1). Everything that God created in the beginning — everything on Earth, in our solar system, and beyond — is part of the universe. The universe is made up of all the matter and energy that there is.... It is important for Christians to study the universe, because it is God's handiwork (p. 324).

God did not just create all the stars and leave them alone. Instead, he is continually moving stars from main sequence to red giant to white dwarf or supernova. He creates new stars from gas and dust in the universe. Our God is always active; you can see his hand in the life of stars (p. 333).

*ASA Fellow

The Origin of the Universe

The Bible tells us that God created the universe from nothing.... But the Bible doesn't tell us exactly *how* he did this. One current theory about the beginning of the universe is called the "Big Bang theory." This theory says that at the first moment, the whole universe was incredibly small ... Then the tiny universe began to expand rapidly into a very hot, dense ball of particles that contained all the ingredients for planets, stars, moons, and energy. ... The particles formed clouds, which gravity pulled together into stars, galaxies, and planets.

Most scientists today accept the Big Bang theory as a reasonable explanation for the origin of the universe because it fits the evidence that they have. ... the universe still seems to be expanding ... Does the Big Bang theory fit the with the Bible's account of creation? The important thing to remember is that God created the universe from nothing by his word.

Could God have used the Big Bang as the process by which he brought the universe into existence? Many Christians think so. In fact, anyone who accepts the Big Bang theory must accept the idea that the universe did have a specific beginning. However,

... the Big Bang theory ... is still a theory. We do not actually know how God chose to create the universe.... As Christians, we affirm that God is the Creator of the universe who continues to care for creation through his providence.

Another question that many people wonder about is, When did the universe begin? Most astronomers think that the universe is between 12 and 20 billion years old.... Many Christians also believe that the universe is billions of years old.

However, many other Christians think that the universe is only about 6-10 thousand years old. They believe that when the Bible talks about God creating everything in six days, it means six normal, 24-hour days.

The first chapter of Genesis tells us that God made everything in six days. Some Christians believe that these are six, 24-hour days. Others think that the six days stand for six longer periods of time. But *all* Christians agree on one thing: the heavens and the earth were not created by chance or accident. God created them and he cares about them and controls them still (pp. 353-356).

*

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Video Review

The Deep Waters of Evolution

Produced by: Media Production Amigos Ltd., Finland, 1996, 20 min.

Pattle Pun*
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This video criticizes four aspects of Darwinian evolution:

(1) The paradigm or world view of evolution:

As summarized succinctly by Matti Leisola, Dr. of Technology and Biochemistry and senior lecturer at the Helsinki University of Technology, evolution is an overarching world view that explains the origin, meaning, and goal of human life. Ever since Thomas Kuhn first proposed the concept of paradigmatic shifts in 1962, the philosophical underpinning of the discussion on evolution has become apparent to most philosophers and some scientists.

Darwin had changed his world view before he promulgated the evolutionary origins of man. The dominant naturalistic world view among evolutionary scientists is also largely responsible for the blind faith and restricted interpretation, that given more time, all of the enigmatic data will be accommodated by new findings that can be explained by the evolutionary paradigm. This bias against any alternative explanation is at the root of the evolutionary debate. A challenge to such a world view will go beyond scientific objectivity, as exemplified by hostile reactions against scholars who do not conform to the dominant world view. The video gives examples of possible discrimination in scientific careers, academic freedom, and even personal and property safety.

*ASA Fellow

(2) The improbability and lack of mechanism of the abiogenesis of the first cell.

Dean Kenyon, Professor of Biology at San Francisco State University, wrote a book entitled *Biochemical Predestination* which promulgated the evolutionary origins of life before he changed his world view. Now he believes that the biochemical evidence for abiogenesis of the first cell is meager and abiogenesis is thermodynamically improbable. Siegfried Scherer, Professor of Microbiology at Munich University of Technology, also points out that the backbone of the evolution paradigm, natural selection, cannot be applied to a nonliving system. Since empirical data always documents that life comes from pre-existing life, the abiogenesis of the first cell will always remain a philosophical conjecture that cannot be verified empirically.

(3) The limit of microevolutionary processes in generating biological diversity.

Siegfried Scherer concludes from his empirical studies on bacterial mutation and evolution that the concept in speciation that mutations are selected by changes in the environment has limitations. Trans-specific evolution requires many beneficial mutations favorably selected by the appropriate environmental factors to build up complexities in genotypes and phenotypes. As he succinctly states, "the more mutations that have to happen at the same time, the lower the probability that such an event occurs."

There are also other molecular patterns among organisms that distinguish them as separate and independent lineages.

(4) The lack of intermediate fossils amongst major groups of organisms.

Lastly, the video points out the fact that the gaps existing in Darwin's time in the fossil record remain largely intact after more than 100 years of paleontological studies and despite countless researchers' intensive efforts to fill them. The only so called transitional form between birds and reptiles, *Archaeopteryx*, has been largely discounted because it exhibited mature features of birds and reptiles and it was contemporaneous with other mature birds. Other fossil finds such as *Protoavis* ("first bird") which lived 75 million years before *Archaeopteryx* also lend credence to this interpretation. The monophyletic evolutionary tree linking all extant organisms to a common ancestor is more an imagination than a paleontologically demonstrated fact.

Based on these criticisms, the video concludes that evolution is indeed in "Deep Waters." More and more, open-minded scholars are questioning the interpretation of the available scientific data. I believe the video did a credible job of presenting the major arguments against the evolutionary paradigm. For any ASAers that are not willing to totally adopt the naturalistic world view in the evolutionary paradigm, the video should be a good introduction to deeper discussion on science and faith. Even for those who adopt methodological naturalism in this discussion, the video also presents strong arguments using empirical data. I highly recommend this video for ASA circulation and promotion. *

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

Natalie Angier, *The Beauty of the Beastly*, Houghton Mifflin, 1995
 Deborah Blum, *The Monkey Wars*, Oxford University Press, 1995
 J. M. Bochenksi, *The Road to Understanding: More Than Dreamt of in Your Philosophy*, Genesis Publishing Company, 1995
 Walter Burkert, *Creation of the Sacred: Tracks of Biology in Early Religions*, Harvard, 1996
 C. M. Carmichael, *The Story of Creation: Its Origin and Its Interpretation in Philo and the Fourth Gospel*, Cornell University Press, 1996
 R. Clifford, *Leading Lawyers' Case For The Resurrection*, Canadian Institute, 1996
 C. E. B. Cranfield, et al., *Christians in the Public Square*, Canadian Institute, 1996
 Paul Edwards, *Reincarnation: A Critical Examination*, Prometheus Books, 1996
 Norman Geisler & Ralph MacKenzie, *Roman Catholics and Evangelicals: Agreements and Differences*, Baker Books, 1996
 Paul Haffner, *Mystery of Creation*, Morehouse Publishing Group, 1995
 John Templeton Foundation, *Who's Who in Theology and Science*, Continuum, 1996

Gina Maranto, *Quest for Perfection*, Scribner, 1996
 Don Nardo, *The Scopes Trial*, Lucent Books, 1997
 Seyyed Hossein Nasr, *Religion and the Order of Nature*, Oxford University Press, 1996
 Larry L. Rasmussen, *Earth Community Earth Ethics*, Orbis, 1996
 Daniel Robinson, *An Intellectual History of Psychology*, Wisconsin University Press, 1995
 J. W. Skillen, *The Shattered Voice*, Canadian Institute, 1996
 Steven Shapin, *The Scientific Revolution*, University of Chicago Press, 1996
 Ninian Smart, *Dimensions of the Sacred: An Anatomy of the World's Beliefs*, California University Press, 1996
 Zdenek V. Spinar, *Life Before Man*, Thames and Hudson, 1995
 M. R. Steele, *Christianity, Tragedy, and Holocaust Literature*, Greenwood, 1995
 Gerrit L. Verschuur, *Impact: The Threat of Comets and Asteroids*, Oxford University Press, 1996
 Keith Ward, *God, Chance and Necessity*, One World Publications, 1996
 Arne Wyller, *The Planetary Mind*, MacMurray and Beck, 1996

Video Review

The Deep Waters of Evolution

Produced by: Media Production Amigos Ltd., Finland, 1996, 20 min.

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This 20-minute video seeks to portray evolutionary theory as based on philosophy alone and wholly unsupported by evidence. It primarily features the comments of Matti Leisola, Siegfried Scherer, and Dean Kenyon. Unfortunately, it tries to make its case with accusations of scientific censorship, unsupported assertions, and the repetition of well-worn but false arguments.

The most troubling aspect of the video was the consistent attempt to present a picture of the scientific community as closed to, and even hostile toward criticism and alternative hypotheses. It further implies that evolutionists are either naively blind, or willfully suppressing evidence against their position. The charge that critical discussion of evolutionary theory is not permitted within the scientific community is simply false. Various aspects of evolutionary theory are widely and vigorously debated in scientific literature.

Evolutionary theory is criticized primarily by raising doubts, based not on conflicting scientific evidence, but on assertions that evolution lacks a factual foundation. At several points the simple existence of unresolved problems is equated with evidence against evolution. Science thrives on questions, for they focus the direction of research. The questions generated by evolutionary theory have resulted in extraordinarily fruitful research, providing explanations for a wide range of biological and historical phenomena.

*ASA Member

An underlying premise of the video is that "evolution has become a modern religion." For some it has, and for others capitalism, nationalism, or even "evangelicalism" has become the center of religious devotion. The issue is not whether an idea or cause can usurp God's place as the focus of our worship, but whether evolutionary theory is compatible with a biblical understanding of God's work and character. Evangelical scholars from the time of Darwin have concluded that evolution and Christian faith are fully compatible.¹

The video first raises the scientific issue of the origin of life. Although the validity of biological evolution is not dependent on the resolution of this question, the video seeks to use uncertainties about chemical evolution as evidence against neodarwinism. Darwin's theory is not about the origin of life. Furthermore, the video's discussion of the origin of life misrepresents the present state of research and ignores the significant developments of recent years. No mention is made of the many areas of active and productive research (self replication of RNA, autocatalytic processes, evolution of RNA in cell-free media by random mutation, synthesis of membrane-bounded vesicles, studies on chirality, etc.).² Recent discoveries, such as the association of thermophilic chemosynthetic organisms with hydrothermal systems, have also opened up whole new possible scenarios for the evolution of life.³ The video emphasizes that no definitive conclusions have been reached, and that there is no consensus on the pathway to the first living cell even after

"thousands of research projects." There are many scientific frontiers, and this is one of them. I personally think God's creation is complex and multifaceted enough that we will not resolve this problem for many more years.

The second part of the video is introduced with the question, "What evidence do we have for the evolution from species to species?" But the evidence for speciation itself is never subsequently discussed. None of the overwhelming data from species distributions, population biology, environmental adaptation, and genetics are even mentioned. That leaves the false impression that there is no evidence for species change. Rather than discussing speciation, the video attempts to show that random mutation cannot generate "totally new information." However, what constitutes "new information" in the context of the genetic code is never stated. Contrary to the claims of the video, random processes can produce new functional units in a selective environment. Highly functional and surprisingly long RNA ribozymes have been generated experimentally from random sequences.⁴ In the nonbiological realm, functional computer programs have been generated by random combinations of commands using a technique that mimics natural selection.⁵

The section dealing with transitional fossils consists of the repetition of false assertions and faulty arguments. The two authorities used to comment on the topic lack appropriate credentials — one is a physicist and the other a soil geographer. The claim is made that connecting links between "basic types" are absent and that evidence from the fossil record has not changed since Darwin! The true situation is that there are numerous examples of fossils with transitional morphologies crossing every taxonomic category from species to phyla.⁶ Major discoveries of transitional fossils have been made within the last few years, most notable being the "walking whales"⁷ of Pakistan. Faced with the undeniable existence of fossils with transitional morphologies, the video seeks to exclude them by definition. "Claimed links" are thus dismissed because they are "complete organisms" that are "fully formed." Such terms are meaningless because they can be applied to any organism however transitional. The transitional status of *Archaeopteryx* is denied because it possesses a mosaic of bird and reptile features! The dinosaur/bird transition is actually another good example of the impact of recent discoveries. A completely new group of primitive fossil birds called the *Enantiornithes* has been discovered that retain many primitive features. Interestingly this new group includes several fossils previously identified as theropod dinosaurs!⁸

The video closes with statements that attempt to minimize the significance of historical evidence. Scherer states that there are "... no data from the past. We have no direct observations of the things which happened a thousand, ten thousands, or millions of years ago." Even the hard sciences utilize data from events in the past that cannot be directly observed. Science works by inferring past processes and causes from their preserved or recorded products and effects. Once the value of historical data is denied, then the only difference of substance between theories is the worldview of the scientists. If the video's approach to historical science was widely accepted, theories could be held and taught regardless of the supporting evidence. The result would be the elimination of science itself. *

Notes

- ¹Livingstone, David N., *Darwin's Forgotten Defenders: The Encounter Between Evangelical Theology and Evolutionary Thought* (Grand Rapids: William B. Eerdmans Publishing Company, 1987).
- ²Joyce, G. F., "Directed Molecular Evolution," *Scientific American* 267, no.6 (1992): 90-97. Ponnampertuma, C., and Chela-Flores, J. (eds.), *Chemical Evolution: Origin of Life* (A. Deepak Publishing, 1992). Morowitz, H.J., *Beginning of Cellular Life: Metabolism Recapitulates Biogenesis* (Yale University Press, 1992).
- ³Holm, N.G. (ed.), *Marine Hydrothermal Systems and the Origin of Life* (Dordrecht: Kluwer Academic Publishers, 1992).
- ⁴Eklund, E. H., Szostak, J. W., and Bartel, D. P., "Structurally Complex and Highly Active RNA Ligases Derived from Random RNA Sequences," *Science* 269 (1995): 364-370.
- ⁵Wayt, W., "Programming with Primordial Ooze," *Scientific American* 275, no.4 (1996): 48-50.
- ⁶Gingerich, P. D., "Paleontology and Phylogeny: Patterns of Evolution at the Species Level in Early Tertiary Mammals," *American Journal of Science* 276 (1976): 1-28. Schultze, H. P. and Trued, L. (eds.), *Origins of the Higher Groups of Tetrapods: Controversy and Consensus* (Ithaca: Comstock Publishing Associates, 1991). Ahlberg, P. E. and Milner, A. R., "The Origin and Early Diversification of Tetrapods," *Nature* 368 (1994): 507-514.
- ⁷Thewissen, J. G. M., Hussain, S. T., and Arif, M., "Fossil Evidence for the Origin of Aquatic Locomotion in Archaeocete Whales," *Science* 263 (1994): 210-212.
- ⁸Chiappe, L. M., 1995, "The First 85 Million Years of Avian Evolution," *Nature* 378 (1995): 349-355.

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Book Reviews

SCIENCE AND THE NEW AGE CHALLENGE by Ernest Lucas. Leicester, England: Apollos (an imprint of InterVarsity Press), 1996. 190 pages, notes, bibliography, index. Paperback; \$17.00.

This is an excellent book by a scientist and biblical scholar, written in easily understood language and with an avoidance of every common misunderstanding or misuse of terms. Lucas, a former research chemist, knows what authentic science is. Currently a tutor in biblical studies at Bristol Baptist College, Lucas also knows what authentic Christian theology is. Formerly he was Education Director of Christian Impact in London. This book consists of an introduction, eleven chapters (each about 13 pages long), and a chapter on conclusions. The specific topics dealt with include a description of the New Age movement and its relationship to science and knowledge, the impact of modern physics and its attempted correlation with Eastern mysticism, the thought of Pierre Teilhard de Chardin and his book entitled *The Phenomenon of Man*, biology and the life sciences, the Gaia hypothesis, and ecological awareness in New Age and Christianity.

Lucas summarizes his attitude toward the interaction between science and New Age thought in three convictions: (1) the appeal made to science by many New Agers is sincere but superficial; (2) the arguments used by New Age scientists are on the whole muddled and mistaken; and (3) an orthodox Christian world view provides the most satisfactory framework for doing science and integrating "physics" with metaphysics. The present book concentrates on the first two of these convictions.

The book starts with a useful summary of the New Age movement, describing it as an outgrowth of the counterculture movements of the '60s, with roots in the religions of the East but influenced also by western secular humanism, and frequently incorporating an occult element. Its dominant themes are summarized by four words: monism, pantheism, autonomy, and relativism. It is fundamentally critical of rationalism and its distinction between subject and object; in the area of New Age spirituality, in particular, rationality has no place. "It is claimed that there is a 'new science' which also puts us in touch with reality-as-it-is and that there is in fact a coming-together of eastern mysticism and modern science." In each of the chapters, the consequences of these New Age premises is described, together with a critique that points out the errors and failures in New Age thought.

The book provides many examples of distinguishing between often confused terminologies: (1) the difference between doing authentic science and attempting to draw philosophical, religious, or metaphysical implications from science; (2) the difference between acceptance of the whole world view of the New Age, and involvement in inter-

national peace or ecological movements endorsed by New Agers; (3) the difference between many of the New Age criticisms of "science," and criticisms of that world view known as "scientism"; (4) the difference between a rejection of reductionism as a metaphysical stance, and a rejection of the reductionist methodology of the physical sciences; (5) the difference between seeing such properties as human consciousness as illusions, and their development in terms of "emergent properties" of the whole in a natural word consisting of "a hierarchy of organized systems at various levels of complexity"; (6) the difference between the concept of Gaia as a scientific hypothesis, and the concept of Gaia as a myth.

This is a valuable book and one admirably suited for group discussions as well as for personal reading.

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

RELIGION AND THE NATURAL SCIENCES: The Range of Engagement by James E. Huchingson, (Ed.). Fort Worth: Harcourt Brace Jovanovich, 1993. ix + 422 pages, glossary, index. Paperback; \$34.91.

We are now in the midst of a proliferation of college, university, and seminary courses on religion and science, partly (I know) owing to a bold initiative from the John M. Templeton Foundation and partly (I suspect) owing to the increasing conviction among academics that higher education has too long neglected the synthetic disciplines (such as religion) in favor of the more analytic (such as science). This book is an attempt to meet the needs of students and faculty who are part of this commendable trend, by publishing under one cover a collection of short readings on a variety of topics related to the religion/science interface. The first half of the book deals with global concerns: ways to approach the whole subject; reflections on models and metaphors; and arguments about nature, supernature, and miracles. The second half contains essays about cosmology, quantum theory, evolution, socio-biology, and ecology. As the title implies, essays on the social sciences are not included.

An anthology such as this, aimed at students and faculty in a highly interdisciplinary field, should be judged by its balance, comprehensiveness, and clarity. On all three counts, Huchingson passes easily, though not always with flying colors. Two of my favorite essays are: Richard Bube on "The Failure of the God-of-the-Gaps" and Ian Barbour on "Ways of Relating Science and Religion." There are also some very good essays by major thinkers like Langdon Gilkey, Mary Midgley, and John Polkinghorne; selections from important literary figures like C. S. Lewis, Annie

Dillard, and John Updike; and lesser pieces by famous scientists like Albert Einstein and Isaac Asimov, nearly fifty items in all.

Conspicuous by their absence, however, are examples of the many fundamental contributions that historians and sociologists have made to understanding the complex interactions of religion and science. To that extent, this is a philosopher's book: Huchingson has chosen most readings based on their contribution to ongoing discussions of interest to people working in the field now. Though some selections are historically significant, such as those by Richard Niebuhr and Pierre Teilhard de Chardin, none in my opinion could be called genuinely historical or sociological in approach. Certainly philosophy plays a crucial role in mediating the conversation between religion and science, but the role of history in explaining how we got to this pass is surely no less important. This is particularly puzzling in a book so deeply committed to the dialogue model for relating science and religion, since it is from historians of science more than anyone else (and not ordinarily from philosophers or scientists) that we learn how rich the interactions have actually been and how poorly the conflict model represents them.

Casting aside my own disciplinary bias, in other ways this is a well-balanced book. The section on "Cosmology and Creation," for example, includes a very clear and fair analysis of the structure and limitations of the cosmological argument for the existence of God by philosopher Douglas Lackey; a famous selection in which the agnostic astronomer Robert Jastrow doubts his religious doubts (taken from his book, *God and the Astronomers*); an argument for the legitimacy of "origins science" by theologian Norman Geisler and creation scientist J. Kerby Anderson; and a previously unpublished essay on "Cosmology and Theology," by physicist and theologian Robert J. Russell, who knows this particular cluster of issues as well as anyone. Other sections of the volume evidence a similar "range of engagement" between religious and nonreligious persons.

Overall, the success of this book will likely be determined by how many instructors choose it for their courses, as it is clearly intended for that purpose. It is more comprehensive in scope and more inclusive of various theological and disciplinary perspectives than most other books on religion and science, which suggests a favorable prognosis. Recommended strongly for academic libraries and individual readers interested in the religion/science interface.

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

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COSMIC WITNESS: Commentaries on Science/Technology Themes by George L. Murphy, LaVonne Althouse, and Russell Willis. Lima, OH: CSS Publishing Co., 1996. 183 pages, 5 Appendices. Paperback; \$15.95.

It is the purpose of this book to help "preachers to discern ways in which Scripture provides resources to address scientific and technological concerns." Principal author George L. Murphy has a Ph.D. in physics, an M. Div. degree, has taught at several Christian colleges, is the recipient of two awards from the Templeton Foundation for his papers on science and religion, and is currently pastor of St. Mark Lutheran Church in Tallmadge, Ohio. He has been active in the ASA, and includes in comments on Heb. 1:3 that "Upholding the universe by his word of power" has been "used as a motto by the American Scientific Affiliation, an organization of Christians in various areas of scientific work." The book is intended as a contribution by the Evangelical Lutheran Church in America's Work Group on Science and Technology, the Working Group on Science and Technology of the United Church of Christ's Board of Homeland Ministries, and the Ecumenical Roundtable on Science and Technology to the Church's ministry of proclamation. The book calls attention to over 150 texts currently used regularly in church three-year lectionaries to mark periods of the church year, and suggests applications of these texts to issues in the areas of science and technology.

A common theme in many of the comments deals with environmental and ecological concerns. In a listing of 31 scientific metaphors, analogies, or explanations referred to in the text, 13 relate to evolution and others refer, for example, to cosmology, light, nuclear processes, the anthropic principle, relativity, and the nature of science. Appendices at the end of the book give an Index of Texts by season; Index of Texts by Books of the Bible; Major Topics in Preaching about Science and Technology from the Lectionary, Technology, and Justice; and two "Story Sermons" intended "to suggest an imaginative way of preaching."

Many of the suggested commentaries are helpful. In dealing with Gen. 1:1-2:4, for example, it is suggested that "it is possible that the entire development of the material universe, back to the first instant of the big bang, can be explained scientifically in terms of natural processes, while it remains a work of divine creation." In connection with Ps. 96, it is suggested that "We should ask about any of our activities, 'Does this contribute to the praise of God?'" In considering Ps. 139:1-17, it is pointed out that "there is no need to think that God is eliminated by the discovery of scientific explanations for phenomena or that God is necessary as an element of scientific explanation." It would have been helpful in these cases to discriminate between "explain" and "describe."

In connection with Jer. 1:4-10, "Technology of redemption and renewal is technology which promotes justice, sustainability, and participation." Or in connection with Col. 2:6-15, "The proper object of concern is the elevation of any philosophical or scientific system to a religious level," or Ps. 121, "The popularity of some New Age

thought, and especially of astrology, threatens to return people to that ancient bondage."

Other of the commentaries are more problematic. On Is. 44:6-8, for example, it is stated that "Teilhard reminds us that we also have the opportunity to speak about the evolutionary process as one of the means through which God will bring about his ultimate future, Omega - Christ." Or again in treating Rom. 12:1-8, "Teilhard de Chardin suggested that the Body of Christ is the next stage in evolution." In treating some texts, Murphy suggests that the preacher consider the possibility of developing a science fiction story with a time-travel theme. The fifth Appendix offers two examples for such stories, but I must confess that a science-fiction story in which the temptation of Christ is cast into the mode of a prehistoric creature being tempted by a dinosaur does not do much for me.

One representation of effective preaching describes it as preaching with the Bible in one hand to provide the basis of exegesis, and the newspaper in the other hand to provide the application to life today. This book can be helpful in suggesting to the preacher insights or illustrations to make the exegesis come alive for the person in the pew.

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

GOD AND THE PHILOSOPHERS by Thomas Morris, (Ed.). New York: Oxford University Press, 1994. 285 pages, no index. Paperback; \$13.95.

This book is a collection of essays by philosophers who are also believers. In our secular, postmodern age this kind of book has great significance. It is a reminder that many intellectuals embrace religious faith. There are still those who affirm that anyone embracing God is intellectually uninformed. This book will serve as a corrective to that biased position.

This is a difficult book to summarize because of its nature as a collection of essays. While I resonated with some of the essays, there were others which made me wonder about the reality of the faith being claimed. Most of the contributors claimed to be Christian; some were Jewish. I appreciated the authors' willingness to share their own personal struggles with the great questions of life, and how they finally came to embrace Christianity, or "God." Some had religious backgrounds while others came from atheistic homes. I was amused by one writer who grew up in a Unitarian Church but then became an atheist. He says the move was an easy one in that he did not have to give up any cherished beliefs because Unitarianism doesn't contain much in the way of "cherished beliefs." He finally ended up in a more orthodox church.

The authors come from a variety of religious backgrounds. One moved from fundamentalism to Pentecostalism; another from Protestantism to Catholicism; others

from low church to Episcopalianism. They came to Jesus Christ (or God) in different ways, landing in different churches or religious traditions. All in all I found the book interesting. Most of us have struggled with the issues described by the authors, and to see how these intellectual philosophers came to faith was quite fascinating.

The book points out the importance of intellectual Christians writing about the faith. The names of C. S. Lewis and Francis Schaeffer came up several times, along with other intellectual Christian writers. There is tendency on the part of some within the church to exalt experience over reason. Christianity is imminently reasonable, and the authors of this type of book serve to underscore that fact.

This might be a good book to give a young intellectual struggling with the great metaphysical questions. However, it should be understood that it is not a specifically Christian book. It would at least serve to remind young people that not all philosophers are atheists, and might encourage some to continue the quest for faith.

Reviewed by Richard M. Bowman, Director of Research and Publications, Disciple Heritage Fellowship, Box 109, Lovington, IL 61937

THEISM, ATHEISM AND BIG BANG COSMOLOGY by William Lane Craig and Quentin Smith. New York: Clarendon Press-Oxford, 1993 (Paperback edition, 1995). 337 pages, index. Paperback; \$19.95.

The two authors are both philosophers, Craig at the Catholic University of Louvain and Smith at Western Michigan University. The book is a debate concerned with the origin of the universe, especially whether the "Big Bang" theory tends to support atheism or theism.

There are three main sections in the book. In Part 1, theist Craig argues for a finite universe which implies a Creator. Smith, an atheist, seeks to refute Craig's arguments. In Part 2, Smith argues that the Big Bang has no cause, making the idea of God unnecessary. Craig responds with his theistic counter-arguments. In Part 3, both authors react to Stephen Hawking's quantum cosmology, and how it relates to theism.

I found this to be a fascinating book. There is much wisdom in preparing a book in which two scholars interact from differing points of view. It allows for a quick comparison without having to hop around between several books in order to determine if one side is fairly reflecting the views of the other side.

There are really two main discussions in the book. Craig argues that an actual infinite cannot exist in space and time. Infinity is a theoretical concept which cannot be actualized in history. He uses many helpful illustrations to make his point. If an actual infinite cannot exist in history, then our universe cannot be an actual infinite; therefore, it had a beginning point, and thus it must have

been created by God. The second argument has to do with the question of whether a finite universe must have a cause. Craig argues that everything which began to exist must have a cause. The universe began to exist, and therefore it must have a cause adequate to explain reality as we experience it. That cause is God. Craig interacts with Kant, Hume, and others in making his case.

Smith seeks to refute Craig's arguments, and presents his case for an uncaused universe. Both authors seem to agree that the Big Bang probably took place as the event which brought our universe into existence. Smith argues that the Big Bang was a singular event which has no cause. He used some rather complex mathematical arguments to support his argument.

The much shorter third section is a reaction to Steven Hawking. Craig argues that Hawking's theories are compatible with theism, and that Hawking himself does not rule out theism as a possible explanation for reality. Again, Smith argues that atheism is more compatible with Hawking's quantum cosmology.

While I am admittedly biased, it seemed to me that Craig's arguments were much more cogent. I found his arguments concerning an actual infinite to be compelling, and I must admit to being somewhat surprised to read Smith's argument for an uncaused universe. To speak of the universe as uncaused strikes me as absurd, and I did not realize that some atheists were trying to make such an argument. An eternal universe is a somewhat rational idea, but Craig destroyed it with his arguments concerning an actual infinite. Smith, however, was not arguing for an eternal universe, but an uncaused finite universe. To say that something began to be, yet there was no cause, appears to me to be irrational. I simply cannot conceive of anything beginning to be without a cause.

Craig was careful not to say (as we did in the past) that every event must have a cause. If that is so, then God must have a cause. His argument is that God is an eternal being who thus never began to be. Therefore, one cannot speak of God as having a cause.

The main arguments of the book are rather easy to follow even though there are difficult sections. I highly recommend this book to intelligent readers interested in the origin of the universe.

Reviewed by Richard M. Bowman, Director of Field Services, Disciple Heritage Fellowship, Lovington, IL 61937.

THINKING CLEARLY ABOUT GOD AND SCIENCE
by David Wilkinson and Rob Frost. East Sussex, UK: Monarch Publications, 1996. 209 pages, index. Paperback; £10.00.

This book is part of a series that is designed to help Christians gain a better understanding of their faith and show how Christian truths can shed light on a variety of

matters that are of crucial importance to society. In this instance, a scientist (Wilkinson) and a theologian (Frost) come together to reflect on the apparent concordism between religion (Christianity) and science. Following a brief introductory chapter in which the authors state that all truth is God's truth, the book consists of six chapters. Each chapter addresses a different issue through which the authors demonstrate how religion and science can and should work together to address the larger questions of existence and meaning.

Chapter two (Frost) examines the question of whether God's existence can be proven scientifically. Various historical proofs for the existence of God are presented along with an examination of some underlying assumptions made by scientists, as they seek to explain the universe. At the heart of both religion and science is a quest for meaning that reflects the apparent order of creation. While neither can prove the existence of God, both avenues of investigation point to some creative intelligence behind the world and some overriding purpose in all that we see.

The third chapter (Wilkinson) deals with the dichotomy: science is about proof; Christianity is about faith. The key issue here is methodology. Therefore, much space is devoted to examining rationalism, empiricism, and the success of science. While science and theology may ask different questions of the world, both rely on evidence and interpretation in their attempts to make sense of the world. At the same time, both approaches have limits. Consequently, there is much to be gained through cooperative interaction between scientists and theologians that would replace isolated examinations of the world from conflicting standpoints.

The next chapter (Frost) examines whether science can provide a foundation for morals. Ethical issues have arisen around research in areas like energy, ecology, and medicine, and the issue of whether scientists, politicians, or the public are to be held responsible and accountable for the social impact of those developments is largely unanswered. Frost suggests that the answers may be found in the Bible and the development of a Christian mind. The adoption of an attitude towards wholeness and the betterment of human life by all concerned parties will bring Christians and scientists together to ensure a better future.

Chapter five (Wilkinson) examines whether advances in the scientific understanding of the origin of the universe eliminates the need for a creator. The author emphasizes the central place of Jesus Christ in God's creation, as a key to understanding the purpose of creation. At the same time, we should be clear about what the biblical account of creation actually says and what scientific theories like the Big Bang actually claim to explain. Part of the success of science is that it limits its range of questions. Through Christianity, as a complement to science, we can gain insight into why there is a universe at all, where scientific laws come from, why the universe is intelligible, and what our significance in the universe is.

The sixth chapter (Wilkinson) deals with the question of whether science rules out miracles. Whether we exam-

ine the biblical accounts of miraculous events or look at some of the unanswered questions around scientific oddities like quantum mechanics or chaos theory, there are many things that we just cannot explain. To extract these unknown elements from the context of the larger message of which they are a part is to misrepresent them and invite misunderstanding. Many aspects of religion and science appear equally as miraculous. The author concludes that scientific objections against miracles are weak and that a scientist studying the resurrection may find strong evidence for its truth.

The final chapter (Frost) deals with whether a scientist can also be a Christian. Both scientists and Christians are seekers after truth, who at various times in their lives grapple with ultimate questions of meaning and existence. Many big names in the history of science (Kepler, Boyle, Newton) have held a strong faith, and in more modern times continued seekership may be best expressed by astronaut James Irwin's observation that there may be more significance in the fact that God walked upon the earth, than that man walked upon the moon.

This book is not intended for the specialist, or for those who have devoted sustained attention to the issues raised. It is designed for the faithful Christian who may be wondering whether the relationship between religion and science is in any way problematic for them. The major strength of this book is that it exposes the reader to the personal thought processes of a scientist and a theologian as they try to grapple with the world view of the other. Apart from some sloppy editing, for example, there is a section on Paraclesus (sic), this book is a very readable and engaging introduction to the debate between religion and science.

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

THE ARTFUL UNIVERSE by John D. Barrow. Oxford: Clarendon Press-Oxford, 1995. 274 pages.

Barrow, an astronomer at the University of Sussex, has written several books, perhaps the best-known is *The Anthropic Cosmological Principle*, with F. J. Tipler. Apparently not one to shun grandiose subjects, he has written this book to explore how the universe has influenced the existence of the arts in humans.

I suppose that the usual Christian answer to the question of why the arts exist is that humans are in the image of God. Since God is creative, humans are too. Barrow doesn't explicitly reject that view (or consider it), although he seems aware of some Judeo-Christian viewpoints, and has a certain sympathy for them. Basically, his reason for the existence of the arts is that the perception of things artistic is adaptive.

The book is fascinating. Barrow touches on many subjects, including the origin of language, why humans re-

spond as they do to different types of landscapes, why there are years, months, and weeks in the current human calendar, the question of whether mathematics is man-made or not, why we perceive constellations, and what makes certain patterns of sounds music.

Not surprisingly, he doesn't know everything about his subjects. For example (although I am not a linguist, either), it is my understanding that Noam Chomsky's belief in a universal grammar isn't as universally accepted as Barrow thinks it is, and Barrow's argument is fairly dependent on this view. Also not surprisingly, Barrow has been selective in his explanation of the arts. There is very little about dance or sculpture, and no explanation for why poetry exists, or what (if anything) makes it different from prose.

Though Barrow doesn't explain everything, he does explain some things. He has given an explanation for why we can only see about one octave of the electromagnetic spectrum, but can hear several octaves, namely, that it is dark almost half the time, so we have been selected for greater aural sensitivity than visual. (That doesn't explain why we can't see infrared, which could be seen in the dark.)

Perhaps the most important thing Barrow doesn't explain is why, if the capacities that lead to art are so important to survival under current terrestrial conditions, other organisms have so little artistic expression, and we so much. Certainly Barrow is at least partly right — humans who can make fine distinctions in the appearance and sounds of their surroundings would be expected to have more offspring than those who can't, but explaining perception isn't the same as explaining creativity. I think that the image of God explanation is even better.

All educated persons, and those seeking an education, would profit from this book. There are a number of illustrations at appropriate places throughout the text, and several plates. The book includes notes, an adequate bibliography, and an index.

Reviewed by Martin LaBar, Southern Wesleyan University, Central, SC 29630.

TIME'S ARROW AND ARCHIMEDES' POINT: New Directions for the Physics of Time by Huw Price. New York: Oxford University Press, 1996. 306 and xiii pages, notes, bibliography, and index. Hardcover; \$25.00.

Price is a philosopher at the University of Sydney in Australia. He started his undergraduate studies in mathematics in Australia but later switched to philosophy. While a graduate student in Cambridge, Price was challenged by Paul C. W. Davies, writer of *Space and Time in the Modern Universe* (Cambridge University Press, 1977). Davies states in that book (p. 70) that molecular theory based on Newtonian mechanics alone cannot provide proof that the entropy of an isolated system will always increase, because

Newtonian physics is symmetric in time. In *Time's Arrow and Archimedes' Point*, Price follows Davies' argument, looking at the consequences of symmetry in time, specifically, the fact that science does not know how to handle negative movements in time. Price talks about this possibility, which he calls the block view of time, in the first chapter before he talks about specific problems.

In chapter two, Price discusses the Second Law of Thermodynamics. He claims that low entropy at the beginning of the universe needs explaining more than the high entropy at the end. Laws, he argues, should work the same in both directions. Price goes on to describe the difficulties in radiation, cosmology, and micro physics which result from thinking that time only works in one direction. He also spends a chapter on "The Puzzle of Contemporary Quantum Theory." The author claims that many difficulties in our theories disappear when we assume that the future can influence the present.

On the dust jacket, we read that Price became known as the philosopher who took on Stephen Hawking on the "arrow of time" in *Scientific American*, Oct. 1989. Stephen Hawking claimed in *A Brief History of Time* (p. 174) that God had no freedom to choose the initial conditions. There were only a few possibilities for physical theories which God could use. Price writes in this book under review that, though a quantum mechanical description may seem complete to the observer, it is always incomplete to God. He argues that the perspective we have as creatures in time is incomplete. In classical theories, observation makes us gods (p. 259).

The book is easy to read. Philosophers and physicists should read it. For many it will give fresh insights. I heartily recommend this book for thorough study and discussion. The last chapter is particularly helpful, as it gives a short chapter by chapter overview of the book.

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

BLACK HOLES: A Traveler's Guide by Clifford A. Pickover. New York: John Wiley & Sons, Inc., 1996. 210 pages, index, bibliography. Hardcover; \$24.95.

Pickover does research at the IBM T. J. Watson Research Center with a special interest in computer graphics. His writing is quick and pungent. He has composed a short story journey of explorers approaching a black hole. His purpose is not character development, but to put a human face on the mathematics of black hole dynamics. Actually, not all faces in this story are human.

The description of a black hole is developed as a story of a fictitious, diamond-bodied explorer who is sent on a series of approaches to a black hole's event horizon. The style of the book is reminiscent of George Gamow's *Mr. Thompkin's in Wonderland or Stories of c, G and h* (1940).

Gamow created fictionalized experiences with relativity and quantum effects by giving various values to the universal constants c , G and h . Edwin Abbot also took a similar approach in *Flatland, a Romance of Many Dimensions*, written near the turn of the twentieth century. Pickover's story has mystery, intrigue, even sexual innuendo — an unexpected element in physics literature.

The story line is weak. It is blatantly contrived to house the mathematics being illustrated, but that is the author's goal. The reader is encouraged to have a calculator at hand. Each chapter develops a particular equation.

The book also lends itself to being read at a computer. Basic and C code for solving all the equations are provided in an appendix. No disk is provided, but the program listings are short and easy to enter. Some generate graphics. Full color computer graphic prints of many of the relationships are provided in the center of the book. All in all it is an entertaining and clever book which is readable for anyone curious about such astrophysical phenomena, especially computer enthusiasts. The book offers entertainment and intrigue for more advanced students of black holes looking for ways to share ideas with a broader audience.

The author has no moral agenda, apart from the fact that framing science as amoral is an agenda. The only theological allusion is silence.

Mr. Pickover has written other popular science books. His home page with personal and professional information as well as other examples of computer graphics he has created is at: <http://sprott.physics.wisc.edu/pickover/home.htm>

Reviewed by Douglas Franks, Physics, Christopher Dock Mennonite High School, Lansdale, PA 19446.

CONJURING SCIENCE: Scientific Symbols and Cultural Meanings in American Life by Christopher P. Toumey. New Brunswick, NJ: Rutgers University Press, 1996. 197 pages, endnotes, index. Paperback; \$16.95.

About a decade ago, a popular advertisement ran in which an actor promoted a drugstore product by saying "I'm not a doctor but I play one on TV." In this advertisement, the authority of science was "conjured" to promote consumer interest in a product. How is it that such a vacuous, blatant, and insulting charade can be accepted by contemporary American consumers? In *Conjuring Science*, University of North Carolina anthropologist Chris Toumey explains what it is about American culture that would permit such an intellectual travesty to not only occur but actually to be representative of the cultural role often played by science.

In Part One of *Conjuring Science*, Toumey outlines the way that science co-exists with American culture and how it came to be that way. Science in American culture is like God in the Old Testament — revered, worshipped,

feared, understood very poorly and known primarily through “gee whiz” theatrics — burning bushes, plagues, pillars of fire, etc. Science, like the God of the Old Testament, is known primarily through symbols quite far removed from the reality thus symbolized.

Tourney argues that this separation is the result of a mismatch between the values of contemporary science — primarily its moral autonomy — and traditional American cultural values. Science was initially understood in America in terms of a “Protestant Model” which had three epistemological bases — Scottish Common Sense, Baconian empiricism, and Princetonian Theology — all of which suggested that science was practical, easy, non-specialized, open to all and, like the fundamentalists’ view of Scripture, not in need of explication by experts. This view was supplemented by a widespread belief that science would make our lives better by providing useful products. Thus understood, science flourished in nineteenth- and early twentieth-century America.

The separation occurred as science became dominated by “The European Research Ethos,” which embraced the Enlightenment values of secularism, rationalism, and explanatory naturalism and believed fervently in the value of science for science’s sake. This science was self policing, self validating, morally autonomous and completely out of sync with traditional American values. The separation was exacerbated by the failure of scientific popularizers to do anything more than get people excited about the razzle dazzle of science without contributing materially to their scientific literacy.

In Part Two, Toumey identifies himself as a “postmodernist” and presents a technical anthropological model of how the symbols of modern American culture have become so separated from the reality they symbolize that an actor *qua* actor can stand in for the authority of science. Implicated in this epistemological disaster are television, a failed school system, and the general drift of postmodern thought.

Part Three is a masterful, succinct survey of several cases where science was “conjured” to serve some cultural purpose: (1) the fluoridation controversy, in which the large scientific organizations advocating the addition of fluoride to drinking water were turned into sinister bureaucracies out to rob people of their individuality; (2) Lyndon LaRouche’s pseudoscientific AIDS propaganda to support Proposition 64 in California; (3) the “Cold Fusion” fiasco where a public embraced an ill-supported scientific breakthrough because of the “hope” it offered, despite articulate warnings from competent scientific authorities; (4) the equation of evolution and secular humanism by religious fundamentalists eager to find a scapegoat for the moral deterioration of society; and (5) the morally-lopsided, simplistic, antiscientific tenor of movies about “Mad Scientists” — Drs. Jekyll, Frankenstein, Strangelove, and Moreau.

The book concludes with a provocative chapter entitled “A Manual for Conjurers” in which Toumey offers nine observations about conjuring, using his previous five case

studies as background. His conclusions are disconcerting: in the name of “fairness,” our media gives equal time to both sides in a scientific debate, even though the dissenting voice may be negligibly represented in the scientific community. In this way, creationism has made its way into our schools; fluoride has been kept out of our water. Our cultural demand for certainty in matters that affect us has allowed us for decades to be hoodwinked by tobacco scientists who constantly remind us that the link between cancer and smoking was “only statistically probable” and not “certain.” Readers of this review might recall the way that very recent scientific breakthroughs have been handled in the media — say in the synthetic fat controversy or the “life from Mars” question. How often have we heard a “minority” voice given “equal time” to contest the conclusions of the scientific establishment with no indication of the constituency represented by the minority voice?

Conjuring Science is in many ways an overlapping sequel to Toumey’s previous book, *God’s Own Scientists: Creationists in a Secular Worm* (Rutgers University Press, 1994), with which it shares considerable discussion of both historical American attitudes towards science and the anthropology of creationism. Indeed portions of *Conjuring Science* reads like a barely disguised plagiarization of *God’s Own Scientists*: chapters two and eight of the former are basically identical to chapters two and five of the latter. This should have received some acknowledgement.

Given the problematic role played by science in the evangelical sub-culture, Toumey’s general conclusions about the way that science and its symbols function in our world is very helpful. If, as Toumey suggests in both of his books, the creation-evolution controversy is really a highly symbolic critique of a declining traditional morality, then perhaps Christians who foray into this battle are seriously mistaken if they arm themselves with only the weapons of science.

Reviewed by Karl Giberson, Professor of Physics, Eastern Nazarene College, 23 East Elm Ave, Quincy, MA 02170.

GENESIS UNBOUND: A Provocative New Look at the Creation Account by John H. Sailhamer. Sisters, OR: Multnomah Books, 1996. 257 pages, index.

One will probably not find a more text-sensitive (some may think *oversensitive*!) Old Testament scholar than John Sailhamer, who teaches concurrently at Western Seminary and Northwestern College. Ever since I had him as a professor, I have been impressed with his scholarship and his fresh, innovative understanding of Scripture — especially Genesis 1-2 — which deserves a significant hearing. Sailhamer believes that his approach to Genesis 1-2 fits remarkably well with “current scientific models of the universe” (p. 15).

Sailhamer challenges three common but unexamined assumptions (implicit in our English translations) which

most people bring to Gen. 1:1-2:4a and offers the following theses: (1) The primary purpose of the early chapters of Genesis is not to describe how God made the world but to describe *two acts*: (a) the creation of the universe in Gen. 1:1 (which could have spanned billions of years) and (b) the preparation of "the land" for God's people in Gen. 1:2-2:4a (which took a much shorter period of time); (2) Gen. 1:2 does not refer to some formless mass which God shaped into the world as we know it today (a misperception which can be traced to the influence of Hellenistic thought on the Septuagint's translation, which affected the Vulgate — all the way to the King James and modern versions); (3) Gen. 1:2-2:4a does not describe the creation of "the earth/world" made in six days but rather *the land* which God eventually promised to Abraham and his descendants. (Much of this argument has been elaborated upon in his excellent monograph, *The Pentateuch as Narrative*.)

Sailhamer calls his view "Historical (or Textual) Creationism," which begins with the biblical text rather than current science and points to creation as literal history (pp. 44-45) and straightforward narrative (p. 233). The focus of his book is on the biblical text itself (p. 24). Diverging from the stream of traditional interpretation on Gen. 1-2, Sailhamer follows the medieval Jewish exegetes like Ibn Ezra and Rashi, who dissented from the Hellenistic "global reading" of Gen. 1:2ff. Sailhamer rightly insists that Genesis 1-2 be read in the broader context of Genesis itself and also the entire Pentateuch (p. 225).

After introducing the issues in Part I, "Genesis in Controversy," Sailhamer examines important concepts and phrases in Part II, "Genesis Reconsidered": "In the beginning," "the land and the sky" (a merism expressing "totality"), "formless and void," "the land" (i.e., Eden) and the like. In Part III, "Genesis Unbound," Sailhamer walks the reader through the text of Genesis 1-2. Part IV, "The Roots of the Problem," summarizes a history of cosmology and of interpretations of Genesis 1-2, whose assumptions may interfere with reading the text as intended.

Given the new ideas Sailhamer presents, I'll make mention of some of the highlights. (1) The "beginning" of Gen. 1:1 (a word which in Scripture *never* refers to a point in time, but to an "extended, yet indeterminate duration of time" [p. 38]) could well imply billions of years (which includes geological ages/ice ages and the extinction of dinosaurs), which fits nicely with current science. God's creation, then, was *not* instantaneous. (2) When God prepares the desolate land for human habitation, he says, "Let there be light," which hardly needs to be understood as the creation of the sun or some primeval light source (God had already created the sun, moon, and stars in Gen. 1:1). (3) God brings rain clouds to water the land (even though they existed before — just as rainbows existed before Noah's time but took on a covenantal significance in Genesis 9). (4) In this "land," God places *fruit* trees (not *every* kind of tree) for humans to enjoy. (5) The "seas"/"pools of water" God forms turn out to be the Great (Mediterranean) Sea, the Dead Sea, and the Sea of Galilee. (6) He then filled the land with birds and crawling creatures which need not have been created instantane-

ously; they could have already existed "in the beginning." In all of this, Sailhamer's interpretation of the Genesis text, although provocative, hardly seems strained.

Any critical comments of mine are fairly minor. First, Sailhamer appears to confuse relativity theory with relativism (pp. 185-86). While at a popular level (in the early 1920s) relativism had been wrongly *inferred* from Einstein's relativity theory, relativity itself still assumes certain fixed absolutes such as the speed of light and the locations of events in space-time. Second, Sailhamer laudably desires to begin with Scripture rather than science when interpreting Genesis 1-2, but can it not be the case that scientific findings may well contribute to a clearer and much-needed revised understanding of Scripture *without* compromising biblical authority? Third, Sailhamer sees the "days" of preparing and filling the land to be six literal days (p. 244), but it seems that "day" (*yom*) can be used more flexibly than 24-hour periods within Genesis 1-2 itself (e.g., it seems there was far too much activity to squeeze into the sixth day; in Gen. 2:4, *yom* has a more elastic usage). Furthermore, although Sailhamer's focus is on Genesis 1-2, it would be interesting to see if he would equate this localized sense of "land" with the region affected by the Noachian deluge.

Sailhamer offers us a new paradigm on Genesis 1-2, furnishing us with a carefully-argued model that is far less-contrived than many contemporary ones. Whatever minor disagreements one might have with his approach, Sailhamer's perspective ought to be taken seriously. I highly recommend it.

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THE WORLD AS CREATION by Emily Birns. Wilmington, DE: Michael Glazier, 1990. 104 pages, index. Paperback.

This book is subtitled *Creation in Christ in an Evolutionary World View*. Burns, a professor of systematic theology at Villanova University, is one of the foremost authorities on Teilhard de Chardin. In some ways, the subtitle summarizes the whole book. It is a thoroughgoing view of the world through the eyes of a follower of Teilhard, a pan-en-theistic approach. It is thrust into a biblical framework by virtue of the fact that it is part of a theological series that requires that it begin with biblical material. But that material is not taken very seriously. For example, as one would expect from this perspective, the view of sin is weak. The author calls it multiplicity and fragmentation (p. 38).

The volume is divided into four main sections: the Framework, in which the biblical material is presented along with an historic overview of its interpretation; the Question (seven pages in length) in which the human dyad is seen as a co-creator with God in a process kind of way; the Challenge, in which the current problems of ecology, hunger, and the poor are approached; and fi-

nally, the last chapter, "The Word and Hope: The Christological Dimension."

The author does have some good insights into biblical feminism, effectively arguing that men and women are *not* the same: and that if only one sex were needed, it *could* be men. "Women deserve and need equality because they share a common humanity, lived out in a highly differentiated mode of being" (p. 46). This is tied in with the theme of liberation which is related, I think correctly, to responsibility. We become more humanized as we become aware of our individualness and are found in harmony in union relationships. Effective reasons are also given for a strong ecological perspective on the world.

The book suffers from three main weaknesses. The first is the style. No attempt is made to present the ideas of Teilhard in a clear, simple way. The author assumes both a philosophical and a Teilhardian background on the part of the reader. Some paragraphs run over a page in length (pp. 54, 55). In this way, it reminds one of a German philosophical treatise. Perhaps if it were written in simple English, one might discover that not much was being said.

Another weakness is the wholesale reinterpretation of Christianity. To illustrate: "'The Christ,' a title we have been using, is extended far beyond its most obvious connection of continuity with the historical Jesus to a discontinuous, radically transformed, spiritual presence filling the cosmos" (p. 40). In some ways, Teilhard's views are seen as more important than the Bible or at least as the key to biblical interpretation. While many of us accept some process views, we do so in scientific ways, rather than Teilhardian ways.

The author sees, correctly, that science has changed the way we perceive the world. But the author is a humanist-theologian and not a scientist and, consequently, tries to make her science fit her world view. For example, she sees evolution as moving towards ever greater complexity, seemingly unaware that we have parasites and other degenerative organisms that indicate otherwise.

I think that ASA readers who wish a Catholic perspective are better served by thinkers such as Denis Edwards in his *Jesus and the Cosmos*.

Reviewed by Fred Jappe, Professor of Chemistry, Mesa College, San Diego, CA 91911.

IN THE BEGINNING GOD: Modern Science and the Christian Doctrine of Creation by John David Weaver. Macon, GA: Smyth & Helwys Publishing, Inc., 1994.

The author has an apologetic interest in helping people outside Christianity who find science to be a stumbling block to faith in Christ, as well as an interest in helping Christians who are afraid of the implications of scientific discoveries. His stimulating chapters on physics, biology, and geology will be helpful to people who want a greater

understanding. His discussions on the possible evidence for purpose and design in each field and the proper use of the "anthropic principle" are excellent. These are followed by chapters on understanding Genesis, natural theology, the relationship of science and faith, and the role of apologetics in preaching. Weaver's background is apposite to the task: he was Senior Lecturer in geology at Derby College for many years; he held the pastorate of a Baptist church for ten years; he is currently Fellow and Tutor in Pastoral Theology at Regent's Park College, Oxford.

Weaver's other apologetic concern is to grapple with the problem of suffering in creation. He properly notes the limitation of natural theology when he says: "If natural theology on its own is limited in what it says about the nature and destiny of human beings, it is even more limited in what it can tell us about God" (p. 147). Yet he goes on to maintain that the suffering caused by the mutations and extinctions of evolution can be seen as evidence that, because God is intimately involved with creation, he suffers with creation as he travels with us along the evolutionary path.

I think he would be on safer ground to emphasize the love of God in connection with the cross. To read out of the ravages of nature that God suffers seems no more valid than to conclude that God is a cruel sadist. While Weaver argues well in emphasizing that "the suffering of the world is a demonstration of God's self-giving love that takes risks in giving freedom to creation," nonetheless some relevant questions will remain unanswered for some readers.

In discussions of God's relationship with creation, in trying to hold together the concepts and doctrines of God's transcendence and God's immanence, the author evinces much interaction with process theology. Yet he properly (and importantly) rejects a central tenet of process thought when he rejects Paul Fiddes's belief that God is changed in his inner being by creation (p. 173).

In a couple of places, the author's stated conclusions were not necessarily invalid, but lacked the needed support of tight argumentation. They appeared to be assertions, especially where other conclusions are not logically impossible. For example, after stating that "the fundamentalist Christian reaction against evolution does not have a scriptural warrant," the author goes on to say, "and behind a view of the separate creation of humanity there are two fallacies in particular . . . Firstly, it implies that God does not use the whole of his creation for his purpose. Secondly, it requires our relationship with God to be controlled genetically, as genes must be created to enable response to God; but the Bible excludes such a possibility, affirming the freedom of human response and the gift of sonship from God that follows that response" (p. 98).

Why would humanity be free to respond to God if we evolved as part of the evolution of the world, but not if God specially created us? Does Weaver really mean to argue that God created humanity with genetic content yet no prior genetic history, that for all time in the future

there could be no spiritual relationship with God and no free will? Such does not follow logically. Also, while the author is quite aware that fundamentalists do not accept the theory of evolution, he does not address important books that critique evolutionary theory (Michael Denton's *Evolution: a Theory In Crisis* or Philip Johnson's *Darwin On Trial* come to mind). There is almost an either/or mentality: either you accept evolution or you believe the world was created in six literal days. But the author's purpose is not to debate evolutionary theory, but to propose ways in which it can be integrated with Christian theology and proclamation. His working understanding of Genesis is that it was written or compiled during the time of the Jewish exile in Babylon, which is a widely held position. Yet there is much evidence that Genesis belongs to an earlier time (see R. N. Whybray's *The Making of the Pentateuch*, Kenneth A. Kitchen's *Ancient Orient and Old Testament* and *The Bible in its World*). For those readers who hold to an earlier dating of Genesis, Weaver's discussion of the theology of the creation accounts may still provide much food for thought.

In conclusion, Weaver's *In the Beginning God* is both insightful and stimulating. It exhibits the strength that comes from years of work as a scientist and as a theologian, as well as the profound importance of relating the two enterprises. The book is not too technical for the non-scientist, and I recommend it for scientists, pastors, and students as worthwhile reading.

Reviewed by Mark Koonz, First Lutheran Church, Opheim, MT 59250.

RATIONALITY IN SCIENCE, RELIGION, AND EVERYDAY LIFE: A Critical Evaluation of Four Models of Rationality by Mikael Stenmark. Notre Dame: University of Notre Dame Press, 1995. 392 and ix pages, notes and bibliography. Hardcover, \$32.95.

Stenmark is Lecturer in Philosophy of Religion at Uppsala University, Sweden. In this book, he studies rationality in analytic philosophy only and limits himself to the three areas mentioned in the title. He could have considered many more areas, but the more serious shortcoming, he confesses, is that he did not discuss "continental" philosophy in this book (p. 361).

In my view, the greatest shortcoming is that the author does not want to discuss the Christian view. Stenmark rejects this view too quickly. Basically, he does not want to discuss the God-centered option, since the central place he gives rationality as the judge of our actions would disappear.

In the Introduction, the author claims people can only be fully rational in their beliefs or actions if the ends or aims they try to achieve are in their real interest. He does not define interest. In analytic philosophy, Stenmark distinguishes three approaches: Formal, Contextual and Practice-Oriented (p. 11). Later he adds Presumptionism, the model Stenmark himself considers the most appropriate.

Under the heading Religion, Stenmark discusses not so much religion as theology. He should have used the word theology instead of religion in the book's title. We can discuss theology rationally. Stenmark's objection would probably be that not every believer is a theologian, but everyone has religious concepts. However, finding rational connections between religious concepts is theology, whether done professionally or by a layman.

This reviewer did not find the reading easy, mainly because the book is unnecessarily repetitive. The lack of an index makes checking difficult. Some notes are missing, for example, on p. 72 the writer refers to note 66 and 67, but the notes of this chapter end at 65. The book may interest philosophers.

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

GENESIS TODAY: Genesis and the Questions of Science by Ernest Lucas. London: Christian Impact, 1995. 160 pages, bibliography.

This book is easy to read. Lucas, a biblical scholar who held research fellowships in chemistry at North Carolina and Oxford Universities, currently teaches at Bristol Baptist College. His intention in this book is to clarify Genesis 1-11 and its connection with science, the theory of evolution, and the second law of thermodynamics. He wants to "disperse the fog that surrounds science in many people's minds." On the other hand, he says, some people are confused about the nature of the Bible and its interpretation (p. 6).

Lucas points out that scientists are always selective in the data they collect. He claims that they are becoming more aware that the line between facts and theory is fuzzy (p. 25). Still, every scientist must have faith in the "rationality" of creation and his own rationality, says the author. Religious faith is not irrational, as the writer correctly points out. The question is: how do we connect religious faith and rational science?

My only strong objection to the book is the way Lucas talks about human nature. Lucas claims, that the "image of God" is the "spiritual" side of man, and that "dust" is the earthly nature of man. I do not think that we can draw that conclusion from Genesis. Lucas' reasons are insufficient. We are not a mixture of the earthly and the heavenly. Though created from dust, we are images of God.

The book makes two valid points. First, it shows that science is not as unbiased as scientists want us to believe. Second, it argues that many people read the Bible as if everything should be understood literally. Lucas wants us to read each part of the Bible realizing its literary character. The beginning of Genesis is more a rejection of pagan religion and thinking than a historical record. Lucas

shows that well. I recommend this well-written book for the general reader. ASA members may not find anything new in the book.

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

ECOLOGIES OF KNOWLEDGE: Work and Politics in Science and Technology by Susan L. Star, (Ed.). Albany, NY: State University of New York Press, 1995. 421 pages, index. Paperback; \$21.95.

This book aims to show how social influences affect science. The book is a collection of nine essays by social scientists intent on "examining science as a radically contextual, problematic venture with a very complicated social mandate, if any" (p. 1). Individual essays are collected in three parts that focus on the effects of politics, research materials, and the workplace on science. The essays are preceded by an extended editorial introduction (complete with a three-page poem) that moves through the difficulties that social scientists face in performing "science and technology studies (STS)" to a rallying call for feminists to critique STS.

Part 1 opens with "Essays on the Tyranny of Science" that identifies the social problems in science and the tyrants responsible: "Because women and nature are associated historically, the domination of nature demanded by science mirrors, justifies, and reinforces the domination of women" (p. 73). In the opinion of Croissant and Restivo the problem is the male majority in science who need to be rescued by progressive ideologies (feminists, anarchists, and Marxists). "In fact, Science, Reason, Logic, Truth, and Objectivity, along with Obligation, Duty, Morality, and God are all tyrannical abstractions that have been used singly and collectively to intimidate and restrict humans, and to attack the foundations for liberating human and cultural development" (p. 68).

In contrast to the first chapter, Star's second chapter is excellent and deftly illustrates the complexity of nature and how science uses "formalisms" to simplify real life situations. Formalisms appear in many forms, from "recipes" to expert systems, and while these are useful, there are invariably situations where the formalisms do not work. Star explores how "wizards" or "gurus" are able to cope with these deficiencies through work-around routines based on a knowledge of what is left out of the formalisms when they were created. Particularly interesting are the ethics of selecting what to include and leave out of a formalism and who is responsible for ethical decisions made by expert *systems* (pp. 112-17).

The third chapter examines computerization as an ideological movement. Kling and Iacono explore five assumptions of the movement, such as "More computing is better than less" (p. 137) and poignantly observe that few indi-

viduals go back to check that installing the latest computer system did in fact provide the benefits that were expected.

Part 2 examines how even inanimate objects (research material, laboratory space, and a door) can influence science. The first of these essays best illustrates the relationship with a history of mammalian reproduction (1910-1940) that chronicles how research was limited by the availability of animal tissue. Clarke recounts a gripping tale of scientists' search for research material; buying pigs for uterine samples and then selling them to slaughter houses minus a few pieces; and zealous scientists scouring for human embryos in collaboration with local surgeons. Many of the collections involved ethical decisions situations that are similar to those faced in fetal tissue research, adding to the interest of this essay.

Part 3 of the book examines how the workplace affects science. The first essay describes how the British Royal Air Force came to develop the TSR 2 aircraft largely to protect the air force from budget cuts. The author's point is that engineers "are typically involved in designing and building projects that have *both* technical and social content and implications" (p. 282). The essay weaves a story of intrigue with examples of political favoritism that leave the individual scientists struggling to develop the best science possible. The final essay examines how the discovery of oncogenes caused major technical and theoretical changes that were rapidly adopted by all scientists who wanted to remain "relevant" and funded. The question raised is whether the scientists' rush to join the bandwagon fuels the switch to an emerging technology or whether changes are based solely on scientific merit.

The value of this book lies in showing how social influences effect science. Being cognizant of these influences will help scientists in their own areas of research. However, the polemic of some sections, and the jargon used by writers in the social sciences, will preclude this book from gaining popularity in the physical and life sciences. Many of the essays are written from philosophical perspectives foreign to ASAers, making this book difficult to wade through, though the reader who perseveres will find some insights.

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

THE ORIGINS SOLUTION: An Answer in the Creation-Evolution Debate by Dick Fischer. Lima, OH: Fairway Press, 1996. 382 pages. Paperback; \$19.95.

Fischer received a BS from the University of Missouri, went into the Air Force (164 combat missions in Viet Nam), and upon return earned an MA in theology. Each of these defining experiences is manifest in this book.

There are 18 chapters which Fischer says are actually two parts, though this division is not evident in the table

of contents. There is no overall bibliography, and all references are contained in notes following each chapter.

Fischer's main point is that the "warfare" between science and religion is basically stupid, characterized by mutual, willful misunderstanding and largely due to inaccurate transcription by Medieval scribes and the improper translation of some Hebrew words in the Old Testament. For example, 'adam is translated "human" when it should be "son of Adam" and 'erets is translated "earth" when it should be "land." Fischer takes the position that "If the revelations of the Bible appear to contradict the revelations of science, it is due to error that has crept in someplace" — a position that should find strong support in the ASA. These mistranslations produce three main themes in Part II: Adam was the first man under a covenant with God and was inserted into a populated world about 5000 B.C.; Eden was at Eridu; reduced life expectancy is the result of cross breeding of the Adamites with their neighbors; the Flood, which was local, occurred between 3128 B.C. and 2978 B.C. Each of these statements, and many others, is strongly supported by both biblical and scientific references, not to mention rigorous argument.

Fischer unequivocally rejects "creation science," which he considers an oxymoron, for "the science is dreadful, even the biblical exegesis is unsound." He devotes considerable effort to a critical examination of all (that I have heard of plus some) their arguments. He is concerned about them for they bring discredit to the Bible among secular scientists. The science is sound, for example, with regard to the age of the earth being greater than 10,000 years old. Continuing to maintain this patently absurd argument invites ridicule from all nonbelievers, but especially, and justifiably, from the nonbelieving scientists.

This is an important book due, not in the least part, to Fischer's ability to focus directly and clearly on specific issues and not entertain distractions. Certainly some will argue that his focus is wrong, but to me that is less important at this point than having issues presented in a manner simple enough that anyone can grasp them. For example, one of the reasons I drifted away from faith had to do with the interpretation that Adam was the first human. This was understood to mean that not only our spiritual but our physical being derived directly from Adam. This had come to have no sense. However, I was caught up in other things and never tried to think it through. Had I done so, I would not have succeeded for I simply do not have the necessary background in biblical scholarship. But it was clear that not only did Adam have neighbors but, upon leaving Eden, he had access to cultural implements (metal tools) and practices (agriculture) not present at the inception of bipedalism or at the beginning of the expansion of the brain or (probably) at the time of the origin of language. (Each of these attributes has been taken at one time or another to mark the line between Hominid and human.)

The writing of this book required extraordinary scholarship, clarity of thought, and courage. Fischer, being a unique blend of scientist, warrior, and biblical scholar is eminently qualified to have produced it. He wants to

make biblical interpretation available to scientists as well as philosophers, theologians, logicians, etc. and argue that it does not contradict established scientific results. This seems a vitally important objective, and for my money he succeeded in spades. His writing is powerful, at times passionate, clear, and his arguments totally devoid of "hair splitting."

There are some trivial problems — a couple of typographical errors, the tables are not numbered or discussed adequately, and there is no index. Everyone will find something to disagree with; for example, I am not nearly as sanguine as Fischer about the rational status of macro-evolutionary theory. However, with an open mind, there is great reward and challenge. Without qualification or hesitation, I highly recommend this book.

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

GETTING HERE: The Story of Human Evolution by William Howells. Washington, DC: The Compass Press, 1993. 261 pages, endnotes, glossary, index, 69 figures, 4 photographs. Paperback. \$19.95.

Howells is one of the world's leading authorities on evolution. He has written seven books on anthropology and evolution, including one entitled, *Evolution of the Genus Homo*. The book under present review is his latest.

Getting Here provides a comprehensive presentation of fossil, genetic, and behavioral evidences and their interpretations for evolution of the animals in general and human beings in particular. It is a very useful reference on human evolution.

The book is well written and well organized. The text is full of technical terms of animal classification, anatomical parts, and geological ages. Fortunately, there is a glossary at the end of the text to help readers who are not familiar with those terms. The many illustrations in the book are also beneficial. There are humorous moments throughout the book.

To members of the American Scientific Affiliation, the last chapter should be most interesting. It presents the author's philosophical reflections on human evolution and covers subjects such as sociology and human behavior. There is even a short section on religion. One particularly interesting point he poses is that, as the fittest will survive the best and species evolve in the direction of the most offspring, what if the best survivals choose not to reproduce, or choose to reproduce only a few offspring? In some parts of the world, the most intelligent and highly educated people bear no or very few children. This is something we may like to ponder if we want the *homo sapiens* species to be extant.

Reviewed by James Wing, 15107 Interlachen Drive, Unit 1014, Silver Spring, MD 20906-5635.

Letters

Don't Tar Van Till: A Response to Anderson and Mills

In their letter (December 1996, pp. 282-4) Anderson and Mills compare Van Till to Polkinhorne, Peacocke and Corey, and suggest that Mills' view at least partly coincides with those of the trio. But they give no indication of understanding the gulf between Van Till and the others.

Peacocke espouses a view which has become popular among contemporary "theistic" philosophers. Basic to this view is the belief that God is not omniscient, that he does not (or cannot) understand all the consequences of his acts, that he is engaged in an ongoing experiment whose end cannot be predicted accurately. Proponents of this general view usually believe that God has the power to correct matters before they go catastrophically awry, that he will always muddle through.¹ This deity is a scientist enlarged, with theories that alter as new data becomes available. Since he is thus limited, he *must* tinker with the universe from time to time.

Underlying this view is the assumption that God is restricted in time. He lives in the same "now" as we — with necessary relativistic corrections, of course. Unless someone can explain how to disentangle the phenomena, it seems necessary that a time-bound entity be also space-bound and matter-bound. In other words, the deity must be within the universe.

In radical contrast, Van Till follows Augustine and Calvin rather than modern views. For him, God is the omnipotent and omniscient Creator, with whom there is neither before nor after. The temporal universe we know is in his eternal care and control. He does not have to tinker at any point because the beginning was perfectly, comprehensively and eternally right. However, he is not precluded from what we see as miraculous intervention, for he is sovereign. But miracles, apart from creative origins, seem almost always to be a divine exclamation point to make us pay attention. Signs and wonders underscore the message of his prophets and his Son.

Mills denies that all required directions could have been placed in the universe at its inception. For him, life began only by direct divine intervention,² and the development of life required the introduction of genetic information from outside many times.³ The cryptic foundation of this view is that he understands fully all the principles that can inhere in matter and all the natural laws governing its development, or at least the ultimate limits of these. I am confident that he will deny this. But the denial springs from his lack of insight into the ultimate foun-

datations of his outlook. This is not reprehensible, merely the normal state of human beings, for it is extremely difficult to recognize one's most basic commitments. Certainly nothing in the normal training of scientists even suggests that there are first principles.

Unrecognized commitments have their consequences. The modern philosophers noted earlier do not recognize that they are transferring to their deity their own time-bound experience, thus making a God in their own image. This is idolatry as surely as casting a silver Diana or carving a statue of Athena, though more subtle.⁴ Mills and Anderson, by adopting their covert principle (God can initially do only what I understand to be possible), similarly unwittingly construct their own version of the deity. This deity produced a universe with many information gaps which had to be filled later by direct divine interventions. Despite Mills' vigorous denials and strong protests,⁵ this is a version of God-of-the-gaps. What is obvious to onlookers is not seen by him from within. The pair have also created a new Van Till in their own image by their attempt to tie him to the authors they note. This is further evidence that they do not understand the theological and philosophical commitments involved.

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Notes

¹One might be hard-pressed to explain this to those who perished in the Flood. Further, I do not see how to base this assurance within this view. Were I to espouse it, I would expect to act somewhat like the Victorian lady who dropped a curtsy whenever Satan was mentioned. Her explanation was that politeness costs little, never hurts, and "you never can tell."

²Genesis 1 does not support this claim. Heaven and earth (v. 1), aquatic and aerial life (v. 21) and the human pair (v. 27) are the sole entities specified created. Plant life (vv. 11f) and terrestrial entities (vv. 24f) were not, according to the sacred text, created.

³See, for example, Gordon C. Mills, "The Evolutionary Significance of the Species Variation in Cytochrome c Structure," *JASA [PSCF]*, 20:52-4 (June 1968); *ibid.*, "Structure of Cytochrome c and c-like Modifications and Origin of Genes," *PSCF* 46:236-45 (December 1992).

⁴Note Rom. 1:23, 25.

⁵Mills, "A Response to David Siemens, Jr.," *PSCF*, 48:138 (June 1996).

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Science has brought about enormous changes in our world. Christians have often reacted as though science threatened the very foundations of Christian faith. ASA's unique mission is to integrate, communicate, and facilitate properly researched science and biblical theology in service to the Church and the scientific community. ASA members have confidence that such integration is not only possible but necessary to an adequate understanding of God and His creation. Our total allegiance is to our Creator. We acknowledge our debt to Him for the whole natural order and for the development of science as a way of knowing that order in detail. We also acknowledge our debt to Him for the Scriptures, which give us "the wisdom that leads to salvation through faith in Jesus Christ." We believe that honest and open study of God's dual revelation, in nature and in the Bible, must eventually lead to understanding of its inherent harmony.

The ASA is also committed to the equally important task of providing advice and direction to the Church and society in how best to use the results of science and technology while preserving the integrity of God's creation. It is the only American evangelical organization where scientists, social scientists, philosophers, and theologians can interact together and help shape Christian views of science. The vision of the ASA is to have science and theology interacting and affecting one another in a positive light.

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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.

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Canadian Scientific & Christian Affiliation

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

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Local Sections

of the ASA and the CSCA have been organized to hold meetings and provide an interchange of ideas at the regional level. Membership application forms, publications, and other information may be obtained by writing to: American Scientific Affiliation, P.O. Box 668, Ipswich, MA 01938-0668, USA or Canadian Scientific & Christian Affiliation, P.O. Box 386, Fergus, ONT N1M 3E2, CANADA or by contacting the CSCA website at: <http://avatar.uwaterloo.ca/~mann/cscahome.html>

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