PERSPECTIVES on Science and Christian Faith

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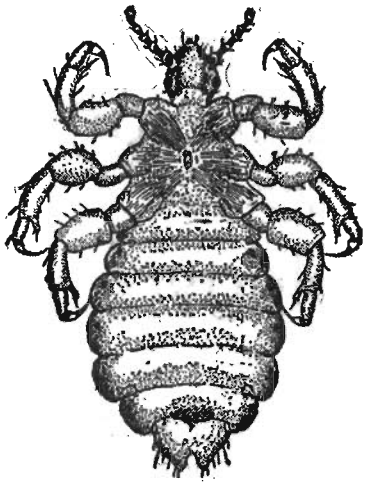


"Seeing Ourselves through Another's Eyes"

When I was in the fifth grade attending a one room country school in rural Kalona, Iowa, our teacher, Hobert Yoder, introduced us to the poetry of Robert Burns. I was especially impressed with Burn's poem, "To a Louse," which describes the creeping advances of a vulgar louse on the dress of a fashionable lady, who is oblivious to the invasion of the eco-parasite. Was the invader a member of *Pediculus humanus* (body lice) or *Pediculus capitis* (head lice)? We can only guess. However, the poet's contrast is striking—an elegant lady infected with pediculosis! Through another's eyes, we discern a vastly different picture than what is perceived by the poet's subject, Jeany! Burns concludes the poem with these words:

> O wad some Power the giftie gie us
> To see oursels as ithers see us!
> It wad frae mony a blunder free us,
> An' foolish notion:
> What airs in dress an' gait wad lea'e us,
> An' ev'n devotion!

The ideas of the poem carry a powerful truth—we frequently miss seeing our personal "lice," when we fail to grasp inadequacies of our theories or gaps in our understandings. When our "lice" are detected by others and are pointed out to us with gentleness, do we defend our foible pretensions and errors or do we gratefully acknowledge the great service another's eyes have done for us?

In the scientific community we frequently dialogue, debate, and exchange contrary ideas. Sometimes the discussions are vigorous as we passionately defend specific ideologies that are dear to us; other times the interactions are more contemplative and tentative. Dialogue can serve a powerful function by helping participants re-examine presuppositions and foundational concepts through other eyes. Occasionally even an "ugly, creepin, blastit wonner" is identified!

This issue contains three dialogues that discuss significant questions: (1) What bridges conversations between physical scientists and theologians? (2) How can big bang cosmology be reconciled with energy conservation? (3) Does Intelligent Design invalidate naturalism? For each of these three questions a dialogue ensues, which is initiated by a proponent, who suggests the presence of specific "lice" within a stated position. A respondent provides an alternative or counter response. And finally, the initial proponent replies by either reaffirming the earlier identification or by conceding that a "crowlin ferlie" may have been misidentified.

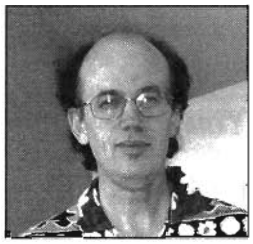
As a reader you are invited to use your magnifying lens to examine the issues in these three dialogues. Maybe "out o' sight, below the fatt'rels, snug and tight" you can identify a hidden member of the order Phtiraptera. Our dialogue writers have generously exposed their potential vulnerabilities to the broader scientific community by participating in an open dialogue. If you identify a specific "louse," you are invited to join one of the dialogues by writing your gentle response and submitting it to the Editor for publication as a Letter in a future issue of our journal.

Happy hunting,
Roman J. Miller, *Editor*

"You are invited to join one of the dialogues by writing your gentle response and submitting it to the Editor for publication as a Letter in a future issue of our journal."

Foundations of the Dialogue between the Physical Sciences and Theology

Ross H. McKenzie



Ross H. McKenzie

A theoretical physicist gives an appreciative but critical review of recent work by Alister McGrath on the dialogue between science and theology. Some of the important areas of dialogue that have been identified include the explicability and rationality of the physical world, the "fine-tuning" of the universe, and the faith involved in going from "inference to the best explanation." Realist perspectives are important (and controversial) in both physical science and theology. An important idea, advanced by Torrance, is the parallel between the constraints imposed by physical reality and revelation, independent of the observer and "common sense." Some concerns are raised about McGrath's treatment of modern physics, the role of postmodernism, the evangelical perspective, and the fidelity to the agenda of Thomas Torrance. Finally, some words of exhortation are given to all writing on the relationship between science and theology.

I will give an extended review of a recent book by Alister E. McGrath entitled The Foundations of Dialogue in Science and Religion.

There is an increasing interest in the relationship between science and theology. Until a few decades ago they were popularly perceived as being "at war" and "contradictory." There are now popular books appearing with titles such as *The Mind of God*, *The God Particle*, and *The Physics of Immortality*. This has been partly fueled by the public success of Stephen Hawking's *A Brief History of Time*. Even atheistic scientists such as Richard Dawkins are writing books that use religious imagery and are full of discussion about God, creation, and design. In universities, the increasing interest is reflected in new undergraduate courses, new journals, new conferences, new research centers, new academic positions, and new scholarly books. This interest is partly being stimulated by the large amount of funds that the Templeton Foundation is injecting into such ventures. The purpose of this article is to give the perspective of an academic who does research in theoretical physics and who approaches theology from an evangelical perspective. To keep the discussion focused, I will give an extended review of a recent book by Alister E. McGrath entitled *The Foundations of Dialogue in Science and Religion*.[1] Most of the issues I raise are relevant to other work in the field.

McGrath has recently made four important contributions to the field: (1) a textbook for introductory courses on the subject,[2] (2) the book under review, (3) a biography of Thomas F. Torrance (one of the most influential writers in the field),[3] and (4) the first two volumes of a trilogy on the subject.[4] The first was used in a new course that I recently taught with five other lecturers at the Bible College of Queensland.[5] McGrath has backgrounds in both science and theology. He is best known as the prolific author of many books on theology (ranging from the popular to the academic; from history to biography to modern evangelicalism). He has an impressive ability to take large amounts of complex material and present an overview that is clear but not superficial or simplistic. He is currently a professor of historical theology at Oxford University and the principal of Wycliffe Hall. Yet, he also has a D.Phil. in molecular biophysics. Furthermore, his contribution to this subject is of particular

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interest because most writing on the subject at the academic level is not written from an evangelical perspective.

Although publishers and authors sometimes claim that their books are meant for almost everyone, I think this book is primarily meant for academics working in theology and the philosophy of science. However, in the interest of promoting real dialogue, I hope that having the response of an active theoretical physicist will be useful.[6] I think the book is a worthwhile and commendable contribution which is significantly better than much writing on the subject. At the end of the book McGrath states: "It might be helpful to think of this volume as an attempt to justify a sustained intellectual engagement between two highly important aspects of human life and thought." I think he has achieved this goal admirably.

Personally, I found the book immensely stimulating, particularly because it motivated me to start reading Torrance, Barth, and Calvin. This has influenced the way I approach my research and teach religious education at the local primary school. Specifically, the areas for dialogue that McGrath has identified are significant and appropriate. Yet, I wish to raise some concerns about the treatment of theoretical physics, the role of postmodernism, and the evangelical perspective and to question whether the book really does advance the agenda of Thomas Torrance, as claimed. I hope the reader will see how these concerns turn out to be interrelated. Before raising them, I will briefly summarize the contents of the book that are relevant to them, taking note of some of the many positive contributions. In striving to be constructive, I will conclude with some suggestions as to the way forward in this complex field.

Overview

McGrath gives three considerations that shape the book: (1) the rise of postmodernism; (2) the growing dissatisfaction with foundationalism in philosophy; and (3) the perpetuation of outdated stereotypes such as the "conflict" model. McGrath suggests that the book develops the agenda set out by Thomas Torrance in *Theological Science* (1969), who emphasized similarities between science and theology at the level of method: the ways in which reality is apprehended, investigated, and represented.

Chapter 2, The Quest for Order, considers the significance of the fact that science finds that the physical world is explicable. Observed regularities can be codified in physical laws that can be described mathematically. This is an amazing thing! However, today it often is taken for granted, and its significance is not contemplated. Exceptions are the popular books written from a secular perspective by the physicists Paul Davies and Heinz Pagels. The universe could have been chaotic and/or incomprehensible to humans. However, when viewed from the perspective of the doctrine of creation, the order, regularity, and explicability of the world is not surprising.

McGrath gives three considerations that shape the book: (1) the rise of postmodernism; (2) the growing dissatisfaction with foundationalism in philosophy; and (3) the perpetuation of outdated stereotypes such as the "conflict" model.

Chapter 3, The Investigation of the World, starts with the view that theology and science are fundamentally divergent in the way they acquire information about the world. Theology does it through revelation; science does it through experimentation. Yet McGrath points out that this is an oversimplification because even if an experiment is inconsistent with a theory, sometimes scientists will keep believing the theory. (A famous example is that from 1920 to 1960, scientists continued to accept Einstein's general theory of relativity despite the fact that the predicted gravitational red shift of light was not observed.) Furthermore, the simplistic model of science solely being a process of designing experiments to test hypotheses is historically wrong. Many significant discoveries were accidents! The relationship between experimentation (experience) and theory is not straightforward:

> The doctrine traditionally, yet misleadingly, known as the "Duhem-Quine thesis" asserts that, if incompatible data and theory are seen to be in conflict, one cannot draw the conclusion that any particular theoretical statement is responsible for this tension, and must therefore be rejected (p. 89).

McGrath is careful to point out that this idea has been inappropriately used by David Bloor and Harry Collins who study the "sociology of scientific knowledge" to justify relativism in science. Nevertheless, McGrath suggests that this principle is of fundamental importance to both science and theology. He suggests that experience often has relatively little impact on our world views.

Objections to natural theology (trying to obtain information about God directly from his creation, rather than from revelation) are considered from theological, philosophical, and historical perspectives. John Calvin's view was that a general knowledge of God can be obtained from the creation by anyone, not just Christians. However, this knowledge is marred by sin, and a knowledge of God the

Dialogue I: Theology & Physical Science

Foundations of the Dialogue between the Physical Sciences and Theology

Differences over natural theology led to a famous debate between Emil Brunner and Karl Barth. Barth had a very negative view of natural theology, claiming that it suggested that God needed the help of humans to make himself known through revelation. McGrath suggests this debate was influenced by the historical context ...

Redeemer can only be obtained through Christ. Differences over natural theology led to a famous debate between Emil Brunner and Karl Barth. Barth had a very negative view of natural theology, claiming that it suggested that God needed the help of humans to make himself known through revelation. McGrath suggests this debate was influenced by the historical context: it occurred the year that the Nazi party (which emphasized order in creation) seized power in Germany. Torrance was sympathetic to Barth's view but considered that it was focused on a natural theology which was detached from systematic theology based on revelation. Part of Torrance's argument is based on an analogy that just as Einstein brought non-Euclidean geometry into physics, natural theology needs to be brought into the realm of systematic theology.

A fertile area for the dialogue is the anthropic principle, which was considered by the astronomers Carr and Rees in a paper in *Nature* in 1979. They argued that the values of the fundamental physical constants (such as the charge and mass of an electron) are "fine-tuned" so that life can exist. If these constants had values that were slightly different by a few percent, the evolution of the universe would not have produced things such as stable stars, lots of carbon, stable atoms and molecules, and heavy elements that are essential for life. Atheistic scientists argue that this is not evidence for the existence of a Designer because if it were not true, we would not be here to observe it. McGrath clearly presents the objections of William Lane Craig and Richard Swinburne to this argument. Briefly, suppose that you survive facing a firing squad of one hundred expert marksmen. Is your reaction, (1) you are not surprised that you do not observe that you are dead, or (2) you are surprised that you do observe that you are alive?

McGrath then reviews Harman's work on "inference to the best explanation." This is the process of "accepting a hypothesis on the grounds that it provides a better explanation of the evidence than is provided by an alternative hypothesis." He concludes with pointing out the similarity among three imaginary people. The first person was someone who was committed to Einstein's general theory of relativity in the period 1920–1960, despite the fact that the predicted gravitational red shift of light had not been observed. The second is a person today who holds to Darwinian ideas about the origin of species, despite the fact that speciation has never been observed in the laboratory. The third is a Christian who holds onto her faith, despite the fact that she is puzzled by the existence of pain and suffering in the world. McGrath points out the common feature that all "hold on to" their view, "believing that its explanatory ability and coherence are sufficient to justify it, and that the difficulty will one day be resolved."

Chapter 4, The Reality of the World, identifies similarities in debates about realism in the theological and philosophy of science communities. The fact that some scientific theories are remarkably successful at explaining the results of past experiments and predicting the results of new ones suggest that they are describing an underlying reality. Furthermore, much of the modern technology (computers, drugs, radio, airplanes, ...) that we regularly use is based on these theories. Some scientists hold to the view that there is a direct correspondence between the concepts in a theory and the reality to which they relate. Philosophers describe this position as "naive realism." Most scientists, however, would hold to a position of "critical realism": the theoretical concepts that scientists consider in their minds are some approximation (which is continually being improved) to the underlying reality. In contrast, postmodernists reject realism suggesting that these theoretical concepts are really a reflection of the "interpretative community" that produces them. Advocates of the "strong program" of the sociology of knowledge claim that "scientific truth" is purely a social construct. Advocates of philosophically similar positions can be found among those writing about theology. For example, McGrath considers a well-known advocate of such views, Don Cupitt, who asserts:

> We constructed all the world-views, we made all the theories ... They depend on us, not we on them ... the more realistic your God, the more punitive your morality (p. 152).

McGrath's response is:

> It might be argued that it is repressive and uncreative to suggest that the Compton wavelength of an electron is 2.424309×10^{-12} meters, or that DNA

> possesses the structure of a double helix. Each of these could be argued to be intransigent, representing the interests of the western male scientific establishment, and failing to respect creativity. The intense difficulty with such objections is that experimental research, often linked with theoretical considerations, shows that this is the way they are – and further asserts that these conclusions are independent of the gender, social status, religion, and sexual orientation of the observer (p. 158).

In contrast to Cupitt, Torrance advocates critical realism in theology (p. 158). It is constrained by who God is and his revelation in Christ and in the Scriptures.

Given the complexity of many concepts in both science and theology, humans must inevitably build models or analogies that allow them to visualize these concepts.

Chapter 5, The Representation of the World, points out that given the complexity of many concepts in both science and theology, humans must inevitably build models or analogies that allow them to visualize these concepts. This is particularly true if one wants to communicate these concepts to a wider audience that is not used to thinking in highly abstract terms. McGrath considers some of the problems associated with using analogies in science. The use of analogies in theology is explored briefly using the example of Christ's death, being a "ransom." The perspective of Ian Barbour on the similarities and differences between the use of models in science and religion is reviewed. McGrath points out that Barbour overlooks an important difference: whereas formulation and validation of models occurs in science, there is no direct parallel to this in classical Christian thought, such as advocated by Torrance (as in the quotation above). The basic concepts are given in God's revelation. This is in contrast to some liberal theology which develops new models of concepts such as God, sin, and redemption. A detailed discussion is then given of how the idea of "complementarity," advocated by the famous theoretical physicist Niels Bohr, may be relevant to theology. Previously, Torrance as well as Loder and Neidhardt have emphasized the philosophical similarity in the way that Barth approached theology and Bohr approached the description of quantum phenomena. Importantly, both advocated that the phenomena they were trying to understand (God's self-revelation and quantum physics, respectively) must be interpreted on its own terms. Specifically, Bohr tried to come up with a model based on classical thinking that could explain "wave-particle duality": in some experiments, electrons act like particles; whereas in a different class of experiments, electrons act like waves. McGrath discusses how one can draw an analogy to the problem in theology of Jesus having both divine and human character simultaneously.

Some concerns

The Treatment of Modern Physics

I feel it is worthwhile to point out how some theoretical physicists might respond with skepticism to McGrath's discussions of two specific aspects of modern physics, supersymmetry and complementarity. His treatment is not a good example of how to relate science and theology. First, some of the science he is discussing is far from being well established. Second, the connection to theology is forced and debatable. Nevertheless, along the way, some important issues are raised.

Supersymmetry

Chapter 2 contains a section (pp. 69–73) which discusses the fact that symmetry plays a major role in quantum theory. This might be of some theological interest because Aquinas argued that observed symmetries reflect the perfection of God. McGrath suggests that this interest has been offered a "new lease of life" because of the recent current interest in supersymmetry in theoretical physics. All known elementary particles are either fermions or bosons. Fermions have the property that any quantum state can be occupied by at most one particle. In contrast, any number of bosons can occupy a single quantum state. Examples of fermions are electrons, protons, and neutrons. Examples of bosons include photons (light particles and mesons). Supersymmetry theories propose that to each class of elementary particle which is a boson (fermion) there is a corresponding partner which is a fermion (boson). For example, as well as photons there should be "photinos" which are fermions. Later in the book, in the context of the use of analogies in theology, McGrath states:

> It is important to pause here, and note the importance of the way in which the growth of "supersymmetry" theories have posited a fundamental relationship between various aspects of modern physics. The doctrine of creation, puts such relationships on a secure intellectual footing, suggesting that a correlation exists within the created order prior to its being discerned through human investigation (p. 181).[7]

I have several concerns about this discussion of supersymmetry and this last point, in particular. My concerns are given in order of increasing importance.

1. It is not clear to me that this discussion will be understandable to most readers of the book. (The same can be

Trying to lend theological support to superstring theory or supersymmetry is contentious because these theories lack any empirical evidence. Furthermore, it is debatable whether theologians should ever lend support to any specific scientific theory.

said of the present article!) Terminology such as fermions and bosons are not defined.

2. It should have been pointed out that there is currently no experimental evidence for the validity of supersymmetry[8] or superstring theory. In his most recent book, Stephen Hawking states:

> There is no more experimental evidence for some of the theories described in this book than there is for astrology, but we believe them because they are consistent with theories that have survived testing.[9]

Furthermore, it is not at all clear that superstring theories will ever be tested experimentally because they would require particle accelerators bigger than the size of the earth. Hence, we may never know whether superstring theories really describe the created order rather than being just beautiful mathematical constructions. It should be stressed that this is quite different from the situation with general relativity between 1920 and 1960, mentioned earlier. Although the predicted gravitational red shift had not been observed several other predictions had been successfully tested.

3. If supersymmetry really is an underlying symmetry of the physical laws of nature, the universe itself would still have only exhibited perfect supersymmetry (equal numbers of photons and photinos) during some incredibly short time, like the first 10^{-41} seconds, after the beginning of the universe. However, in the world in which we now live the supersymmetry is "broken," i.e., that is far from perfect. There are an "astronomical" number of photons in the universe but so far we have not found a single photino. Will not such imperfection present problems to Aquinas' argument?

4. A statement by a theologian that theories based on symmetry are on a "sound intellectual footing" because of the doctrine of creation can be easily misinterpreted as an endorsement of a specific scientific theory and is problematic. Was that not the source of Galileo's problems?

Let me illustrate the problems with a concrete example from my own field of research. Currently, one of the greatest challenges in theoretical physics is understanding high temperature superconductors. These materials were discovered in 1986 by Bednorz and Muller, who were awarded the Nobel Prize in physics in 1987. (In contrast, some scientists have had to wait as long as thirty years after their initial discovery before they were awarded their prize.)

Over the past fifteen years, thousands of theoretical papers have been written on the subject focusing on two questions: (1) Why can superconductivity occur at such a high temperature? and (2) Why are the properties of the metallic phase so fundamentally different from elemental metals such as lead and copper? Yet despite all of this work by numerous distinguished theorists, including Nobel laureates Phil Anderson, Bob Laughlin, T. D. Lee, and Bob Schrieffer, we do not have clear answers to these questions. It is sometimes stated: "The only consensus is that there is no consensus." Yet in 1997, Shou Cheng Zhang, from Stanford University, published a paper in *Science* proposing that the electronic properties of high temperature superconductors could be understood in terms of an underlying symmetry associated with a set of transformations known as the symmetry group SO(5).[10] McGrath's statements could easily be misinterpreted as an endorsement of this theory over competing theories that are not based on symmetry. Though the SO(5) theory did initially create some interest, partly because of its aesthetic appeal, most theorists now consider that, in the real materials, this symmetry is so approximate that it is not a particularly useful concept.

Maybe the point worth making is just that the major role played in theoretical physics by symmetry is a concrete reflection of underlying order and explicability. A concrete example of this concerns the elementary particles known as quarks and the symmetry group SU(3). In the 1960s, a plethora of new particles were discovered and classifying them was like zoology. However, Gell Mann showed that many of them were related and developed a nice classification scheme in terms of SU(3).

In summary, trying to lend theological support to superstring theory or supersymmetry is contentious because these theories lack any empirical evidence. Furthermore, it is debatable whether theologians should ever lend support to any specific scientific theory.

Complementarity

The last chapter contains an extensive discussion of the concept of "complementarity,"[11] which was introduced by the theoretical physicist Niels Bohr to try to explain some of the puzzling features of quantum theory that emerged in the 1920s and 1930s. Some experiments involving electrons are most easily understood if we think of the electron as a particle. Other experiments are naturally interpreted if the electron is viewed as a wave. Complementarity refers to this ambiguity or "wave-particle duality." This idea was subsequently applied to a wide range of subjects including politics, economics, and religion. As discussed below, it also is used widely today by postmodern and New Age writers. A few points need to be made from the perspective of the theoretical physicist:

1. All physicists seem to agree that quantum theory predicts the outcome of specific experiments. Furthermore, many of its predictions have been tested to incredibly high precision, sometimes to within a factor of one part in a million. Nevertheless, physicists strongly disagree about the *interpretation* and *meaning* of the theory.[12] Besides the Copenhagen school (associated with Bohr), there are the Bohmian, many worlds, consistent histories, "no interpretation," and decoherence interpretations.[13] Complementarity is *not* a key component of quantum physics. Beller points out that several influential textbooks on quantum mechanics do not even mention complementarity.[14]

Complementarity is an ill-defined philosophical concept which has a long history of being abused ... I am skeptical that applying it in theology will be fruitful.

2. Physicists are finally acknowledging that much of Bohr's writing was obscure rather than profound.[15] It was inappropriate of him and his contemporaries, such as Born and Pauli, to try and apply complementarity to a wide range of subjects such as politics and religion. Furthermore, an unfortunate consequence of their lack of intellectual discipline has been that it has helped inspire postmodern writing which misappropriates scientific concepts into the humanities, as discussed in the next section.

3. It is not necessary to invoke Bohr or complementarity to make two worthwhile points that McGrath[16] is concerned with:

a. The physical world must be interpreted on its own terms. It does not matter if the physical world presents us with concepts which we do not like because they are counterintuitive or go against our philosophical world view or favorite scientific theory. That is the way the world is and scientists are sometimes forced to revise their perspectives accordingly. There is a clear parallel to the approach of Barth and Torrance to theology:

> Christian theology arises out of the actual knowledge of God given in and with concrete happenings in space and time. It is knowledge of the God who actively meets us and gives Himself to be known in Jesus Christ—in Israel, in history, on earth. It is essentially positive knowledge, with articulated content, mediated in concrete experience. It is concerned with fact, the fact of God's self revelation; it is concerned with God Himself who just because He really is God always comes first. We do not therefore begin with ourselves or our questions, nor indeed can we choose where to begin; we can only begin with the facts prescribed for us by the actuality of the subject positively known.[17]

b. Even the best scientific theories sometimes present puzzles, paradoxes, and counterintuitive concepts which even the greatest scientific minds find hard to accept and cannot resolve to the satisfaction of most of their colleagues. Nevertheless, they "accept" those theories as the "best explanation" and continue to use them in their everyday scientific life. There is a clear parallel to theology. Despite the coherence of the biblical world view it does present issues such as suffering, free will versus predestination, and the human and divine natures coexisting in the person of Christ. Such issues challenge our preconceptions and our classical forms of reasoning.

In summary, complementarity is an ill-defined philosophical concept which has a long history of being abused. Since it is so contentious, I am skeptical that applying it in theology will be fruitful.

The Role of Postmodernism

I do not think that McGrath's treatment of postmodernism accurately reflects just how skeptical most scientists are about postmodernism. McGrath says one of the reasons for the book is the "inexorable rise of postmodernism." This is important for two reasons:

> Many discussions of the relationship between science and religion remain firmly grounded in a set of presuppositions which can only be described as "modern" ...
>
> The "postmodern" discussion to date of the methods and epistemic achievements of the natural sciences (especially the physical sciences) has seemed to some

I am concerned that McGrath has overlooked a whole body of literature associated with the problem that the ["postmodern" discussion to date of the methods and epistemic achievements of the natural sciences ... has seemed to some to be somewhat hasty and superficial in its analysis]. This weakens some of his arguments and will cause others to be received with skepticism in the scientific community.

> to be somewhat hasty and superficial in its analysis ...

I agree strongly with both these points. Furthermore, at various points, McGrath is critical of postmodern views. However, I am concerned that McGrath has overlooked a whole body of literature associated with the second reason above.[18] This weakens some of his arguments and will cause others to be received with skepticism in the scientific community.

Currently in universities, particularly in the USA, a major conflict sometimes known as "the Science wars" is occurring between natural scientists and postmodernists (mostly in departments of literature and "science studies" and "cultural studies"). This conflict was arguably started by the book, *Higher Superstition: The Academic Left and Its Quarrels with Science* written by Paul Gross (a professor of life sciences at the University of Virginia) and Norman Levitt (a professor of mathematics at Rutgers University).[19] It was a rather vicious attack on postmodern writing about science.[20] In 1996, the "editorial collective" of the postmodern journal *Social Text* produced a special issue dedicated to the "Science Wars." Unwittingly, they included in the issue an article, "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity" written by Alan Sokal, a professor of physics at New York University.[21] Once the article was published, Sokal revealed that it was a hoax:

> For some years I've been troubled by an apparent decline in the standards of intellectual rigor in certain precincts of the American academic humanities. But I'm a mere physicist: if I find myself unable to make head or tail of jouissance and differance, perhaps that just reflects my own inadequacy.
>
> So, to test the prevailing intellectual standards, I decided to try a modest (though admittedly uncontrolled) experiment: Would a leading North American journal of cultural studies – whose editorial collective includes such luminaries as Fredric Jameson and Andrew Ross – publish an article liberally salted with nonsense if (a) it sounded good and (b) it flattered the editors' ideological preconceptions?
>
> The answer, unfortunately, is yes ...[22]

The ensuing controversy was so big that it even was covered on the front page of the *New York Times*. It has stimulated numerous articles, both scholarly and at the popular level, and several books.[23] In particular, Sokal and Jean Bricmont, a professor of theoretical physics in Belgium, wrote a book in French which was a detailed critique of the writing of French philosophers about science.[24]

There has been some debate in the physics community as to what the hoax actually proved.[25] I do not claim to endorse Sokal's act. However, I think there are some important lessons here, especially for those who are interested in the dialogue between science and theology. Let me suggest that from the controversy we can draw the following modest conclusions:

- There are serious communication problems between scholars in the humanities and scientists.
- Many scientists are very skeptical about postmodernism, particularly its support for relativism and antirealism. They are skeptical because science and technology work so well.
- Many scientists consider that some postmodernists are misusing science to make their points. Particularly, concepts from quantum theory, relativity, and chaos theory are taken out of context and used to justify indeterminism and relativism.
- Some of the problems actually began with great theoretical physicists such as Bohr, Born, and Pauli, who wrote large amounts of obscure material containing highly speculative suggestions about the relevance of quantum theory, and especially complementarity to philosophy, politics, and religion.[26] Bohm and Prigogine have continued in a similar vein.

So, why are scientists "realists" who believe in "truth"? One reason is that due to advances in technology over the past few decades it has been possible to make experimental tests with incredibly high precision of the predictions of fundamental theories such as quantum mechanics, special relativity, general relativity, and quantum electrodynamics (QED). For example, QED predicts a value of the magnetic moment anomaly of electrons that agrees with experiment to within a few parts per billion.[27] When Schwinger, Tomonaga, and Feynman devel-

oped the theory of QED, they did not anticipate that it would be tested to such precision. In a similar vein, as emphasized by Weinberg[28] other theories have led to predictions that were not at all anticipated when the theories were originally developed. One hundred years ago, Planck introduced the concept of the quantum in order to explain the spectrum of black body radiation. He did not anticipate that this result would describe the spectrum of the cosmic microwave background, which is the remnant of the big bang, to an accuracy of better than 0.1%. When Einstein wrote down his field equations for gravity (general relativity), he did not realize that they would lead to the prediction of gravitational radiation which was subsequently observed (albeit indirectly) in binary pulsar systems to an accuracy of 0.4%.[29]

McGrath rightly points out that Einstein used his equations for general relativity to predict the gravitational red shift of light, yet experiments in the period 1920–1960 failed to observe the predicted effect. Some sociologists of science have made much of the fact that physicists still accepted the theory, in spite of the fact that it had been "falsified." This may be a just criticism but these sociologists use this problem to suggest that science is irrational and unreliable, neglecting to mention that the predicted effect has now been observed with a precision of seventy parts per million.[30]

Given such spectacular agreement between theory and experiment it is very hard for me to believe that these theories are just a social construct or that the equations developed in the minds of people like Einstein and Feynman do not in some sense represent an underlying reality that is independent of the mind and independent of the social context in which the theory was constructed.

It is rather disappointing that McGrath cites Pickering as having "demonstrated the perhaps unacknowledged significance of communal norms, traditions and approaches in the scientific undertaking" (p. 161). Citing Pickering is provocative to physicists familiar with his work. Although acknowledging the value of some of his contributions, physicists Kurt Gottfried and Ken Wilson have strongly criticized Pickering's work.[31] Their *Nature* article focuses on his unjustified and misleading conclusions that the standard model of elementary particles is just a social construct.

In summary, McGrath's book could have been strengthened by giving the views of scientists on postmodernism. Furthermore, given all of the above problems concerning the relationship of postmodernism to science, I fear McGrath's treatment of complementarity and suggestions that chaos theory "is pregnant with theological significance" (p. 59) will be greeted with skepticism by theoretical physicists because there are some similarities to postmodern writing.[32]

The Evangelical Perspective

McGrath is the author of several books on evangelicalism[33] and is the principal of Wycliffe Hall which has the stated aims of being " biblical, evangelical, Anglican, missionary, and contemporary." Hence, his views on how evangelicals have approached and should approach the dialogue are of particular interest. This appears to be only treated explicitly in the sections "Science as the Enemy of Religion" (pp. 26–27), and "Evangelicalism and the Natural Sciences" (pp. 129–31). In the first section, fundamentalism is defined as originally a cultural movement rather than a theological position. The Scopes trial and the associated fallout are briefly reviewed. The first section concludes with:

> The current attempt within conservative Protestantism to make sense of the biblical creation accounts in the light of evolutionary theories continues (Pinnock 1989; Santmire 1991), despite the polarizion [sic] of the debate through the deployment of "warfare" imagery.

The second section concludes with:

> The views of Packer and Warfield [who did not hold young earth and anti-evolution views] have not met with universal assent. "Creationists" such as Henry Morris have somewhat hastily dismissed the approach adopted by Warfield as a clear case of "pervasive theological apostasy" (Morris 1984, 39).

I think that a much stronger case could have been made by including a more sustained interaction with the extensive evangelical literature that already exists

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I fully endorse the above statements but think that a much stronger case could have been made by including a more sustained interaction with the extensive evangelical literature that already exists on this subject. It is also important to make a distinction between microevolution, macroevolution, and Darwinism (a philosophy or world view). I do not think Clark Pinnock should be viewed as representative of conservative Protestant thought.[34] The past fifty years has seen a wide range of scholarly evangelical writing on science and theology by people such as Bernard Ramm,[35] Richard Bube,[36] Del Ratsch,[37] Malcolm Jeeves,[38] Walter Thorson,[39] Donald MacKay,[40] Howard Van Till,[41] William Dembski,[42] Edward Larson,[43] Phillip Johnson,[44] and Kirsten Birkett.[45] It would be unreasonable

McGrath suggests that the book develops the agenda set out by Thomas Torrance in his book, Theological Science. *However, I think the book differs from Torrance's agenda in two significant respects ... the use of the term "religion" rather than "theology" ... [and] it interacts little with the text of the Bible.*

to expect McGrath to interact with all this literature and I would not necessarily expect him to agree with any of it. (I do not agree with some of it). However, I find it disappointing and strange that none of this work (which is not just concerned with evolution) is even mentioned.

I am concerned that this lack of attention to evangelical views reflects a lost opportunity to undermine two of the "myths" in this field. The first "myth" is that if one takes the results of science seriously, the only intellectually respectable solution is to embrace liberal theology, and even worse process theology. The second "myth" is the one that McGrath is more concerned about: if you accept the authority of the Bible, you must reject significant portions of biology, geology, and astronomy. The evangelical authors cited above and the members of organizations such as Christians in Science in the UK and the American Scientific Affiliation stand in stark contrast to these views.

Fidelity to Torrance's Agenda

McGrath suggests that the book develops the agenda set out by Thomas Torrance in his book, *Theological Science*. However, I think the book differs from Torrance's agenda in two significant respects. The first concerns the use of the term "religion" rather than "theology" in the title and in much of the text. In his textbook, *Science and Religion: An Introduction*, McGrath states:

> Torrance draws a careful and critical distinction between "religion" and "theology." The distinction is important, as many discussions of the interaction of religious and scientific ways of thinking often treat the issues of "science and religion" and "science and theology" as synonymous—different ways of speaking about the same thing. Drawing partly on a Barthian perspective, Torrance insists that this is unacceptable. "Religion" is to be understood as concerning human consciousness and behavior. Religion is essentially a human creation. Theology, on the other hand, has to do with our knowledge of God.

Given the above, it is surprising that McGrath would use the term "religion." Besides this issue of consistency, McGrath's use of "religion" can lead to misinterpretation of what he is saying. For example, Chapter 3 begins with:

> In the previous chapter, we noted a high degree of convergence between the natural sciences and religion in relation to the critically important area of the ordering of the world, and its amenability to investigation and explanation.

This sentence makes sense if "religion" is replaced with "Christian theology." However, it is highly contentious if "religion" is replaced with "Hinduism" or "Buddhism." One of the reasons that many scientists so strongly object to the concept of a dialogue between science and religion is that they equate "religion" with superstition, magic, and mysticism, which reject the rationality and empiricism of science.

The second manner in which the book does not seem to advance Torrance's agenda is actually my biggest concern of all: it interacts little with the text of the Bible. Torrance has stated:

> A realist evangelical theology will go far toward healing the artificial gap that has opened up in modern times between kerygma and dogma, exegesis and dogmatics, and thereby toward restoring to Christian theology rigorous fidelity towards its proper subject matter, the self-communication and self-revelation of God in Jesus Christ his incarnate Word.[46]

Theological science is based on the data we have: the Bible. Furthermore, good theological science will take all of that data into account. I will use three examples to illustrate how McGrath has not done this.

First, Chapter 2 discusses in detail the doctrine of creation without interacting with the text of Genesis, nor how that might relate to New Testament passages such as John 1:1–18 or Col. 1:15–22. I can find no mention of the Fall nor how creation is now "frustrated" and awaiting redemption (Rom. 8:18–23).

Second, natural theology is discussed from a theological, philosophical, and historical perspective (pp. 98–118). I would have liked to see what the implications are of passages such as Gen. 11:19, Psalm 19, Acts 17:16–31,

Rom. 1:16–23, and 1 Cor. 1:18–31. Maybe such passages were some of the reason Barth was so opposed to natural theology; it was not just the rise of Nazism. In discussing Calvin's views on the subject, it would have been helpful to point out how Calvin used passages of the Bible, such as these, to develop his views.[47]

Third, as an example of the use of analogies in theology, McGrath discusses how the word "ransom" was used to illustrate the meaning of Jesus' death, as in Mark 10:45. The views of the early patristic writers on the "ransom" are then discussed (p. 182). This is interesting but I would have thought it best to first discuss how the concept of the ransom from the perspective of the Old Testament.[48] Barth provides a beautiful example of this in his exegesis of the "atonement" in Rom. 3:25.[49] Scripture itself provides the ultimate example of the use of analogies. Furthermore, the analogies of Scripture seem to be designed to be accessible and illuminating to all people, and also reflect the idea of God's accommodation to our limited minds. This is in stark contrast to some of the rather obscure analogies proposed in science and theology articles—a Ph.D. is a prerequisite to understanding them.

McGrath's treatment is in contrast to that of Calvin's discussion of natural theology.[50] Kirsten Birkett has given a nice treatment of how biblical theology can aid an understanding of the relationship between science and Christianity.[51] She explicitly looks at not just Genesis but also passages from Exodus, Job, Ecclesiastes, Proverbs, Matthew, Romans and Colossians. These say much about not just the order in the world but also the frustrated creation, the limitations of wisdom (and hence the limits of science), and Jesus as Wisdom Incarnate.

In concluding, I note that the same criticisms cannot be made of McGrath's latest book, the first volume of *A Scientific Theology*,[52] which is dedicated to Torrance. It contains a devastating critique of trying to relate science to the ill-defined concept of religion (pp. 50–60) and it does discuss natural theology from a biblical perspective (pp. 257–64).

The Way Forward

In a desire to be constructive, I conclude with five exhortations to all those interested in the dialogue between science and theology.

1. Assemble a multidisciplinary research team

While acknowledging the value of McGrath's contribution, I think some of the shortcomings of the book reflect that he has taken on an impossible task for any one individual. The subject is truly interdisciplinary, covering not just theology and several disciplines of science (mostly physics and biology), but also philosophy and history. The literature is vast and difficult to keep up to date with. Furthermore, I hope the above discussion of theoretical physics shows there are subtle issues involved, some of which will only be apparent to people actively doing research in the relevant disciplines. The humanities has a fine tradition of books written by single authors. Although, I think this is quite suitable for writing a biography of Plato, a commentary on Romans, or a survey of the novels of Jane Austen, I do not think it is the appropriate model for doing research in this field. The model of single authorship has now been essentially abandoned in science; people make up for their own lack of expertise by collaborating with others. Even Einstein had to get help from Grossmann with the mathematics of Riemannian geometry. When the biologist James Watson wanted to understand the molecular basis of genetics, he collaborated with a physicist, Crick. Furthermore, crucial to their discovery of the structure of DNA were the interactions that Watson had with chemists and X-ray crystallographers. Some of the most exciting scientific research today is being done in fields such as bioinformatics, materials science, nanotechnology, and quantum computing. It is almost all being done by teams of people comprising individuals from different disciplines.[53] In my own research in theoretical physics, I have found collaboration with experimental physicists, chemists, and mathematicians to be extremely fruitful, once the communication barriers are surmounted.

While acknowledging the value of McGrath's contribution, I think some of the shortcomings of the book reflect that he has taken on an impossible task for any one individual.

Working with a multidisciplinary team will make it much harder to drift from the real data (in this case, the Bible and well-established science) into unsubstantiated speculation. It also will make the research more likely to be accessible to a broader audience and to have a real impact. Michael Fisher was a professor of physics, chemistry, and mathematics at Cornell University. Apparently, he often said: "The problem with a lot of interdiscliplinary research is that it lacks a lot of discipline." Unfortunately, just as such a criticism can be made of the field of "science studies," which was the subject of Sokal's hoax, it also applies to much writing about science and theology.[54]

2. Engage the biblical text

For those such as evangelicals who might support Torrance's agenda, the Bible represents the real data that must be understood. I believe that any discussion

In a desire to be constructive, I conclude with five exhortations to all those interested in the dialogue between science and theology. 1. Assemble a multi-disciplinary research team; 2. Engage the biblical text; 3. Be more critical of what you read and what you write; 4. Write clearly; and 5. Acknowledge the limits and potential dangers of the dialogue.

of natural theology must first wrestle with Rom. 1:17-21:

> For in the gospel a righteousness from God is revealed, a righteousness that is by faith from first to last, just as it is written: "The righteous will live by faith." The wrath of God is being revealed from heaven against all the godlessness and wickedness of men who suppress the truth by their wickedness, since what may be known about God is plain to them, because God has made it plain to them. For since the creation of the world God's invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that men are without excuse. For although they knew God, they neither glorified him as God nor gave thanks to him but their thinking became futile and their foolish hearts were darkened.

This passage suggests to me that something can be learned about God from creation. Yet, it is something that will be evident to all and so cannot be based on modern science which is only accessible to an elite. However, that knowledge will be corrupted by sin and so may only be accessible to those who already know God through revelation and redemption. After all, this passage is arguably the starting point for the Barthian revolution[55] (and the Reformation!). To his credit, in his new book McGrath does discuss verse 18 and Barth's views (and their biblical basis) in more detail.[56]

As always, it should be stressed that it is particularly important to not just consider isolated verses or passages but to consider the major plot lines of the whole Bible.

3. Be more critical of what you read and what you write

Surely this is a lesson from the Sokal hoax. This does not apply just to postmodernism. Writers in the science/theology field also need to be more critical of the evidence for scientific theories, the scientific credentials of those writing on science and theology, and the use of scientific analogies in theology. Richard Feynman was one of the greatest theoretical physicists of the twentieth century. His advice to beginning scientists was basically: "The first principle is that you must not fool yourself, and you are the easiest person to fool."

4. Write clearly

Critiques of the rise of postmodernism (and of Niels Bohr) point out that it seems that sometimes people mistake obscurity for profundity.[57] This does not just happen in philosophy but also in theoretical physics. Sometimes, ideas that at best are trivial or simple (and at worst are wrong) are hidden behind a complicated mathematical formalism that presents a barrier to understanding. I worry that this is also happening in science and theology. Consider, for example, the following sentences:

> Crystalline formations embody a polycentric form of order which does not yield to physico-chemical analysis or logical construction. While we cannot get very far in explaining this kind of order through analytical methods, we are able to create certain conditions within which crystalline formations spontaneously become disposed into a distinctive order. In this event, useful recourse is made to group theory in developing appropriate modes of apprehension in the light of intuitively apprehended clues which press themselves upon us as we work with crystals ...

Some readers may assume that they do not understand these sentences because they know little about crystal structures and group theory. However, I teach undergraduates about crystal structures and do research in theoretical solid state physics. Yet, I have no idea what the author is really trying to say. I would like to tell you that the author is Derrida, Lacan, Foucault, or at worst Bohr. However, I regret to acknowledge that the author is someone that both McGrath and I consider to be one of the best writers on science and theology: Torrance.[58]

5. Acknowledge the limits and potential dangers of the dialogue

Although, I have sometimes been skeptical about the value of a dialogue between the physical sciences and theology, McGrath, more than any other individual, has convinced me that the dialogue is worth pursuing. Yet I think there are potential dangers and pitfalls for theology. This is because at the heart of theology is the Cross. I fear that

too much focus on the dialogue and insights on theological method may not enlighten our theology but distract from, dilute, or obscure the content. For example, there are dangers of a subtle shift of focus from redemption to creation, and from revelation to natural theology. Consequently, it is appropriate to give the last word to Karl Barth:

> Everything shines in the light of His death, and is illuminated by it. No single passage of the Synoptic Gospels is intelligible apart from the death. The kingdom of God has its beginning on the other side of the Cross, beyond all that is called "religion" and "life," beyond conservatism and radicalism, physics and metaphysics ...
>
> Christ died for us. For us—that is, in so far as by His death we recognize the law of our own dying; in so far as in His death the invisible God becomes for us visible; in so far as in His death is the place where atonement with God takes place (iii. 25, v. 9), and where we who have rejected our Creator, return to His love; and in so far as in His death the paradox of the righteousness and the identity of His holy wrath and His forgiving mercy becomes for us—the Truth."[59] ◈

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Notes

[1]Alister E. McGrath, *The Foundations of Dialogue in Science and Religion* (Oxford: Blackwell, 1998).

[2]_____, *Science and Religion: An Introduction* (Oxford: Blackwell, 1998).

[3]_____, *Thomas F. Torrance: An Intellectual Biography* (Edinburgh: T & T Clark, 1999).

[4]_____, *A Scientific Theology*, Volume 1: Nature (Grand Rapids, MI: W. B. Eerdmanns, 2001); and _____, *A Scientific Theology*, Volume 2: Reality (Grand Rapids, MI: W. B. Eerdmanns, 2002).

[5]The course "The Dialogue between Science and Theology: The Search for Meaning" was accredited by the Australian College of Theology. Other lecturers were Dr. Johan Ferreira (Bible scholar), Rev. Dr. Peter Close (pastor with a Ph.D. in microbiology), Dr. Peter Fung (obstetrician), Dr. Peter Ralphs (theologian), and Dr. Richard Brown (environmental engineer). The course received an award from the Templeton foundation.

[6]www.physics.uq.edu.au/people/mckenzie/

[7]The identical sentences also appear on p.151 of Alister E. McGrath, *The Foundations of Dialogue in Science and Religion*.

[8]For the latest experiment which fails to find evidence of supersymmetry see, Affolder, et al., "Search for Gluinos and Scalar Quarks in p–p Collisions at $\sqrt{s}$ = 1.8 TeV Using the Missing Energy plus Multijets Signature," *Physical Review Letters* 28 (2002): 041801. For a less technical description see, www.aip.org/enews/physnews/2002/split/574-1.html

[9]S. W. Hawking, *The Universe in a Nutshell* (London: Bantam, 2001), 103–4.

[10]S. -C. Zhang, "A Unified Theory Based on SO(5) Symmetry of Superconductivity and Antiferromagnetism," *Science* 275 (1997): 1089.

[11]In reviewing previous work that was critical of this, McGrath states: "It is not clear that Austin has understood that 'wave packets' were derived by Schrödinger from linear harmonic oscillator wave functions" (p. 196). This is technically incorrect. In order to discuss the relationship between waves and particles, wave packets should be written as a linear superposition of free-particle wave functions, not harmonic oscillator wave functions (see, for example, S. M. McMurry, *Quantum Mechanics* [Wokingham: Addison Wesley, 1994], 224–6). On one level, this may be a pedantic point since it is not crucial to McGrath's argument. On another level, it may be important because some scientists will react skeptically to theologians who make simple technical mistakes such as this.

[12]There are three things that polite physicists never discuss at dinner parties: politics, religion, and the quantum measurement problem!

[13]For an introduction, see J. Horgan, "Quantum Philosophy," *Scientific American* (July 1992): 94–103.

[14]M. Beller, *Quantum Dialogue: The Making of a Revolution* (Chicago: University of Chicago, 1999).

[15]Ibid.; and _____, "The Sokal Hoax: At Whom Are We Laughing?" *Physics Today* (September 1998).

[16]In a private communication, McGrath has stressed to me that he did not wish to give any priority to Bohr's views but rather "to make the more general point that assigning priority to observational evidence can lead us into thinking about—and representing—reality in ways that run counter to common sense."

[17]T. F. Torrance, *Theological Science* (Oxford: Oxford University Press, 1969), 26–7.

[18]To balance this criticism, I should point out that some of this work is briefly mentioned in McGrath, *A Scientific Theology*, Volume 1: Nature, 112. Sokal's hoax is discussed in McGrath, *A Scientific Theology*, Volume 2: Reality.

[19]P. R. Gross and N. Levitt, *Higher Superstition: The Academic Left and Its Quarrels with Science* (Baltimore: Johns Hopkins University Press, 1994).

[20]For a review, see R. H. McKenzie, "Postmodern Science," *kategoria* 1 (1996): 63–8.

[21]A. D. Sokal, "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity," *Social Text* 46/47 (spring/summer 1996): 217.

[22]_____, "A Physicist Experiments with Cultural Studies," *Lingua Franca* (May/June 1996): 62.

[23]Numerous articles are available at: www.physics.nyu.edu/faculty/sokal/

[24]A. D. Sokal and J. Bricmont, *Intellectual Impostures: Postmodern Philosophers' Abuse of Science* (London: Profile Books, 1998).

[25]S. S. Schweber, "Reflections on the Sokal Affair: What Is at Stake?" *Physics Today* (March 1997): 73; S. Weinberg, "Sokal's Hoax," *The New York Review of Books* XLIII (13) (1996): 11; and Beller, "The Sokal Hoax."

[26]Beller, "The Sokal Hoax."

[27]P. J. Mohr and B. N. Taylor, "CODATA Recommended Values of the Fundamental Physical Constants: 1998," *Reviews Modern Physics* 72 (2000): 351. See appendix B.

[28]Weinberg, "Sokal's Hoax," 11.

[29]J. H. Taylor, Jr., "Binary Pulsars and Relativistic Gravity," *Rev. Modern Physics* 66 (1994): 711.

[30]R. F. C. Vessot, et. al., "Test of Relativistic Gravitation with a Space-Borne Hydrogen Maser," *Physical Review Letters* 45 (1980): 2081.

[31]K. Gottfried and K. G. Wilson, "Science as a Cultural Construct," *Nature* 386 (1997): 545.

[32]For a "classic" example of writing that looks to me just like Sokal's article, see E. L. Simmons, "Toward a Kenotic Pneumatology: Quantum Field Theory and the Theology of the Cross," *The Center for Theology and the Natural Sciences Bulletin* (Spring 1999). [This essay was one of the winners of the Templeton Foundations "Expanding Humanities Vision of God" essay contest in 2000. It is available on the Templeton Foundation Science and Religion Resource CD, 3rd ed.]. The essay reflects a very confused understanding of quantum physics based on reading popular books on

the subject. It mistakenly equates quantum field theory with Bell's theorem. It mistakenly claims that quantum field theory is non-local. The opposite is actually true. That is why the observation of EPR correlations is such a puzzle. As a regular user of quantum field theory, I would agree with Sokal that it provides absolutely no insight into psychology and human relationships. Similarly, I assert Simmons' essay provides no insight into the theology of the Cross, but rather confuses it because the Cross is primarily about interpersonal relationships (as in the relationship between humans and the personhood of God embodied in the Trinity). The essay does not mention sin or the substitutionary atonement. The best analogies for understanding the Cross are to be found in the Old Testament not in popular books about quantum theory.

[33]A. E. McGrath, *Evangelicalism and the Future of Christianity* (Downers Grove, IL: InterVarsity Press, 1995).

[34]See the extensive critique of his pluralist and universalist views by D. A. Carson, *The Gagging of God* (Grand Rapids, MI: Zondervan, 1996).

[35]B. Ramm, *The Christian View of Science and Scripture* (Grand Rapids, MI: Eerdmanns, 1954). This was reprinted in 1987, a testimony to its enduring influence. For a review of Ramm's legacy, see J. L. Spradley, "Changing Views of Science and Scripture: Bernard Ramm and the ASA," *Perspectives on Science and Christian Faith* 44 (1992): 2. Ramm has been highly influential in the USA; sometimes in ways he did not intend. Mark Noll has noted that the publication of Ramm's book was a catalyst to Henry Morris writing his first book on "creation science" (M. Noll, *The Scandal of the Evangelical Mind* [Grand Rapids, MI: Eerdmans, 1994], 188–92).

[36]R. H. Bube, *The Human Quest* (Waco, TX: Word, 1971); *Putting It All Together* (Lanham, MD: University Press of America, 1995). Bube is also the author of many articles in (and former editor of) the journal, *Perspectives on Science and Christian Faith*.

[37]D. Ratsch, *Science and Its Limits: The Natural Sciences in Christian Perspective*, 2d ed. (Downers Grove, IL: InterVarsity Press, 2000) (First published as *Philosophy of Science* [Downers Grove, IL: InterVarsity Press, 1986]); and ——, *The Battle of Beginnings* (Downers Grove, IL: InterVarsity Press, 1996).

[38]M. A. Jeeves, *The Scientific Enterprise and Christian Faith* (London: Tyndale, 1969).

[39]W. R. Thorson, "Realism and Reverence," *Journal of the American Scientific Affiliation* 38 (1986): 75.

[40]D. MacKay, *The Clockwork Image* (Downers Grove, IL: InterVarsity Press, 1974); *Science, Chance, and Providence* (Oxford: Oxford University Press, 1978).

[41]H. J. Van Till, D. A. Young, and C. Menninga, *Science Held Hostage: What's Wrong with Creation Science AND Evolutionism* (Downers Grove, IL: InterVarsity Press, 1988).

[42]W. Dembski, *The Design Inference* (Cambridge: Cambridge University Press, 1998).

[43]E. J. Larson, *Summer for the Gods: The Scopes Trial and America's Continuing Debate Over Science and Religion* (New York: Basic Books, 1997). This book won a Pulitzer Prize in 1998.

[44]P. E. Johnson, *Darwin on Trial* (Downers Grove, IL: InterVarsity Press, 1991); ——, *Reason in the Balance: The Case Against Naturalism In Science, Law, and Education* (Downers Grove, IL: InterVarsity Press, 1995).

[45]K. Birkett, *Unnatural Enemies: An Introduction to Science and Christianity* (Sydney: Matthias Media, 1997).

[46]T. F. Torrance, *Reality and Evangelical Theology: The Realism of Christian Revelation* (Philadelphia: Westminster, 1982; Downers Grove, IL: InterVarsity Press, 1999).

[47]J. Calvin, "The Knowledge of God Conspicuous in the Creation and Continual Government of the World," in *Institutes of the Christian Religion* Book 1, trans. H. Beveridge (Grand Rapids, MI: Eerdmans, 1989), chap. v.

[48]Compare, for example, J. Stott, *The Cross of Christ* 2d ed. (Leceister: InterVarsity Press, 1986), 175–82.

[49]K. Barth, *The Epistle to the Romans*, translated from the 6th ed. by E. C. Hoskyns (London: Oxford University Press, 1933), 104–5.

[50]Calvin, "The Knowledge of God Conspicuous in the Creation and Continual Government of the World."

[51]Birkett, *Unnatural Enemies: An Introduction to Science and Christianity*.

[52]McGrath, *A Scientific Theology*, Volume 1: Nature.

[53]Examples include the recent Bio-X initiative at Stanford University and the Bauer Center for Genomics Research at Harvard *Nature* 416 (2002): 256–7.

[54]See note 32.

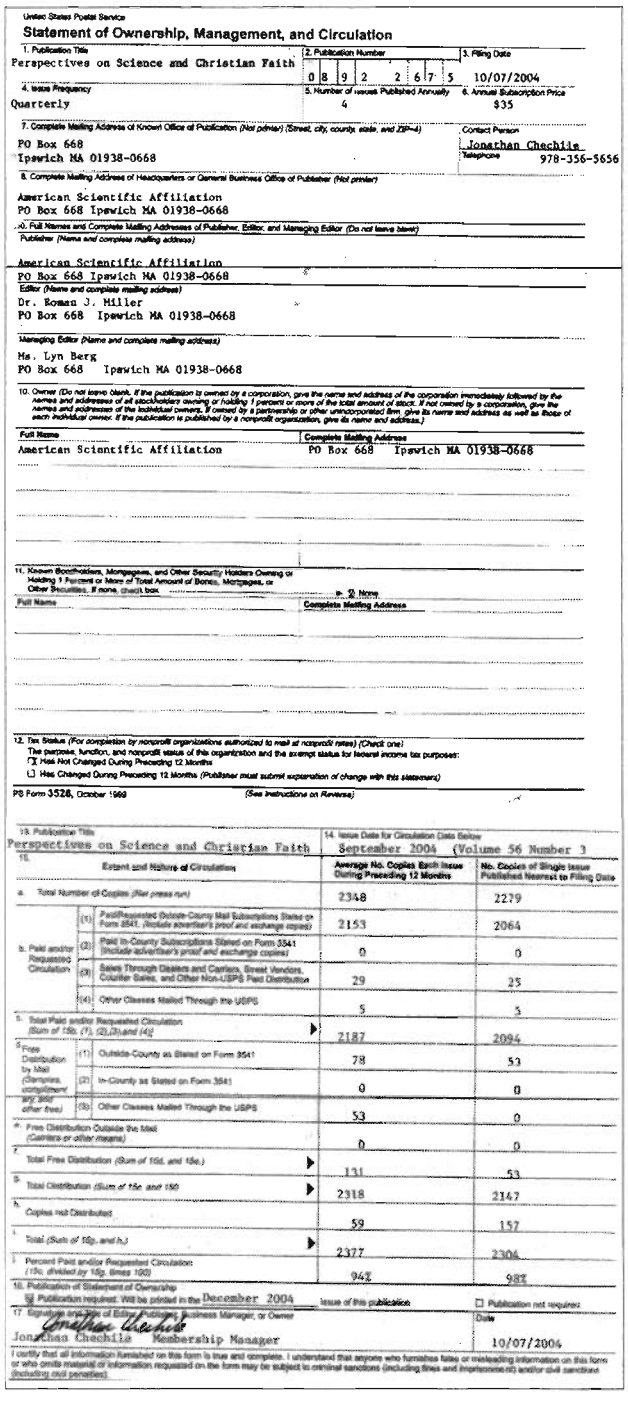
[55]Barth, *The Epistle to the Romans*.

[56]McGrath, *A Scientific Theology*, Volume 1: Nature.

[57]Weinberg, "Sokal's Hoax."

[58]Torrance, *Reality and Evangelical Theology*, 44.

[59]Barth, *The Epistle to the Romans*, 159–60.



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On Writing a Scientific Theology: A Response to Ross H. McKenzie

Alister E. McGrath

Alister McGrath responds to an important recent critique of his exploration of the dialogue between science and theology by the noted Australian theoretical physicist Ross McKenzie. The criticisms concerned relate to the use made of modern physics, the engagement with postmodernism, an evangelical perspective on theology, and fidelity to the thought of T. F. Torrance. A response is offered to these concerns, noting particularly the extended and more developed discussion of these issues in A Scientific Theology *(2001–2003).*

Alister E. McGrath

It is always a great pleasure to welcome new voices in the science and religion field, and there is little doubt that Ross McKenzie is poised to make some seminal contributions in this domain. Based at the Department of Physics of the University of Queensland in Brisbane, Australia, McKenzie has pioneered some exciting new developments in the field of nanotechnology, particularly relating to superconductivity. Yet McKenzie's interests extend far beyond this important field of research. As his recent engagement with my attempt to forge some kind of working relationship between Christian theology and the natural sciences make clear,[1] McKenzie has a deep and highly informed interest in making connections between theoretical physics and theology. I therefore read his assessment of my project with the greatest of interest. In this article, I shall offer a response to McKenzie's assessment, and indicate how my own thinking has developed since the publication of *The Foundations of Dialogue in Science and Religion* back in 1998.

McKenzie makes many kind comments about my work, which I found both generous and encouraging. It is not my intention to deal with these, but to turn to consider the broad areas in which he expresses concern or disagreement with my approach. The points he makes are as fair as they are important, and I must outline how I would respond to them, even if space limits a more detailed answer.

Let me begin by sketching the background to my approach. Over the period 2001–2003, I published a series of three substantial volumes setting out a new approach to Christian theology which offers new possibilities for interdisciplinary interaction. Unlike those approaches to theology which encourage intellectual isolationism—such as those of Karl Barth and the "radical orthodoxy" of John Milbank[2]—the "scientific theology" I develop in those volumes both demands and encourages the exploration of the interfaces between Christian theology and other disciplines—above all, the natural sciences.

The background to this lies in my early interest in the natural sciences, which I continue to regard as being at the cutting edge of human thought. I studied chemistry at Oxford, and went on to do doctoral research at Oxford's Department of Biochemistry on aspects of molecular biophysics, focusing especially on the development of physical techniques to study biological systems. In 1976, I was awarded a fellowship by the European Molecular Biology Organization for advanced study at the University of Utrecht, which

Over the period 2001–2003, I published a series of three substantial volumes setting out a new approach to Christian theology which offers new possibilities for interdisciplinary interaction.

Alister McGrath *is professor of historical theology at Oxford University and the director of the John Templeton Oxford Seminars in Science and Christianity. After his undergraduate degree in chemistry at Oxford, McGrath went on to complete doctoral research in molecular biophysics under the supervision of Professor Sir George Radda and did advanced theological study at Cambridge. He has published extensively on theology and science including the book,* The Science of God: Introduction to Scientific Theology *(Eerdmans, 2004). He is married, with two children, and currently lives in Oxford. McGrath may be contacted by email at: Alister.McGrath@wycliffe.ox.ac.uk.*

was then pioneering a technique for protein isolation of relevance to my research. It was during my time at Utrecht that I decided to try to set about developing a "scientific theology."

As McKenzie points out, it is virtually impossible for one person to master such different fields as the natural sciences and theology. It took me twenty years to get up to speed in both domains, and involved me in going beyond my experience as a working scientist to undertake a detailed engagement with both historical and systematic theology, and the history and philosophy of science. I was asked back to the University of Utrecht in January 1997 to deliver a lecture on "The Relation of the Natural Sciences and Christian Theology." I expanded this lecture in 1998 into the book reviewed by McKenzie, mainly to clear my mind a little in preparation for the larger task that lay ahead.[3]

This project was to write a series of works, setting forth an approach to theology which drew upon the working assumptions and methods of the natural sciences. The project, which has the running title *A Scientific Theology*, sets out to plot a trajectory for Christian theology which maintains its academic and spiritual integrity while encouraging a direct and positive engagement with a scientific culture, understood as both scientific theory *and* practice. The work is marked throughout by a sustained and critical engagement with the history and philosophy of the natural sciences, and a passionate commitment to the legitimacy of theology as an academic discipline in its own right. The work argues for a direct engagement between Christian theology and the natural sciences without the need for surrogates or intermediaries, such as the somewhat baffling school of "process thought" apparently favored by some American theological writers in this field.

As McKenzie rightly notes, my role model here was Thomas F. Torrance, unquestionably the greatest British theologian of the twentieth century, who was for many years professor of Christian Dogmatics at the University of Edinburgh. A happy by-product of my engagement with his ideas was a growing interest in Torrance as a person. Theologians sometimes treat theology as a disembodied intellectual pursuit, and I found it important to affirm that Torrance (like other theologians) was actually a living human being, who connected his theology with his life and work. Researching his biography was one of the more personally fulfilling research projects of recent years.[4] Although I diverge from Torrance at points—for example, he makes little appeal to the biological sciences in his works—there is little doubt that he has provided a decisive stimulus to those wishing to take the interaction of theology and the natural sciences seriously, rather than just play around with vague notions of human religiosity.

The structure of the three volumes of A Scientific Theology *makes it clear that this work is primarily concerned with theological method, rather than with specific theological topics. It is a systematic work of theology, rather than a work of systematic theology.*

The structure of the three volumes of *A Scientific Theology* makes it clear that this work is primarily concerned with theological method, rather than with specific theological topics. It is a systematic work of theology, rather than a work of systematic theology. After an opening section dealing with the distinctive approach to be adopted, the work crystallizes around three specific topics, each of which demanded a full volume to be dealt with properly.

Nature

This opening volume clarifies the general position to be adopted, before moving on to a detailed engagement with the concept of "nature," which is of such decisive importance in any discussion of the relation of the natural sciences and theology.[5] "Nature" is often treated as a fundamental resource for theology, on the basis of the assumption that it is an unmediated and uninterpreted concept. Yet there is a growing and settled view that the concept of "nature" actually represents a socially mediated construct. Nature is thus to be viewed as an interpreted notion, which is unusually vulnerable to the challenge of deconstruction. The implications of this for a "theology of nature" are explored, with especial reference to the Christian understanding of nature as creation.

Reality

The second volume deals with the issue of realism in science and theology, and sets out both a critique of anti- and non-realism, and a positive statement of a realist position.[6] In the light of this, the nature of a scientific theology is explored, with particular emphasis being placed upon theology as an a posteriori discipline which offers an account of reality. This volume develops the theological potential of the program of "critical realism" developed in the writings of the

noted social scientist Roy Bhaskar, which has considerable potential for Christian theology in general, and for the interaction of that theology and the natural sciences in particular.

Theory

The third and final volume in the series addresses the issue of how reality is represented, paying especial attention to the parallels between theological doctrines and scientific theories.[7] This volume considers the origin, development, and reception of such doctrines and theories, and notes the important parallels between the scientific and theological communities in these important matters. Christian doctrines—here treated as the counterparts of scientific theories—are shown to be an essential element of the theological task. All three volumes are now published, and have been supplemented by an introductory volume, which both sets the work against its intellectual background, and explains its leading ideas in a relatively accessible manner.[8]

McKenzie's Concerns

McKenzie's assessment of my project is based largely on the relatively short 1998 volume *The Foundations of Dialogue in Science and Religion*, rather than the much more substantial three volumes published over the period 2001–2003. It is no criticism of McKenzie to suggest that some of the concerns that he expresses are met through the much fuller treatment I was able to offer in these larger volumes. But enough of such preliminaries. Let us turn to the specific topics that he raises.

Modern Physics

I fully concede that my 1998 account of the interaction of science and theology was too dependent on some speculative aspects of supersymmetry. The *Scientific Theology* volumes make no reference to this; I had come to the same conclusion myself. McKenzie is also right to make some critical comments of my use of some concepts developed by Niels Bohr, of which I make further use in the *Scientific Theology* volumes. As McKenzie rightly points out, the concept of "complementarity" and other aspects of quantum theory can be abused in some highly misleading ways. I would certainly concur with his judgment that E. L. Simmon's article "Towards a Kenotic Pneumatology: Quantum Field Theory and the Theology of the Cross" shows a thoroughly superficial knowledge of quantum theory, and consequently makes some spurious theological applications.[9]

My concern at this point, however, was to emphasize that, in attempting to represent reality, we must allow our theorizing to be shaped by that aspect of reality which is under consideration, even when this seems to lead to some counterintuitive results. The general point I try to make is that each aspect of reality must be investigated and represented according to its distinct nature.[10] I appeal to Bohr as an example of someone who was prepared to adjust his conceptualities in the light of his encounter with reality, and argue that theology must also bring its thoughts and ideas into line with the encounter with God we know through revelation. Theology, like the natural sciences, is thus to be seen as an a posteriori discipline, shaped by its distinctive object, rather than predetermined patterns of human thought.

In attempting to represent reality, we must allow our theorizing to be shaped by that aspect of reality which is under consideration, even when this seems to lead to some counterintuitive results.

Postmodernism

As McKenzie points out, while signaling the importance of the issue, my 1998 volume makes surprisingly little reference to postmodernity. My later volumes explore the implications of the Sokal hoax in some detail,[11] and I critique many aspects of postmodern anti-realism at some depth in *Reality*,[12] pointing out some obvious inconsistencies and weaknesses in the anti-realistic writings of philosopher Jacques Derrida and theologian Don Cupitt. This "whole body of literature" was omitted due to reasons of space alone, and is fully treated in this later volume, along with a vigorous defense of scientific realism. I follow this by proposing a specific approach to theological realism, which is firmly grounded in both recent writing in the philosophy of science and contemporary scientific practice. In *Theory*, I also stress that theory must be seen as a response to reality, rather than as a free creation of the postmodern human mind. I hope that these later volumes redress this weakness in the earlier work, and I concur with McKenzie that such expansion and elaboration was necessary.

Evangelicalism

I write theology as an evangelical, and seek to do theology from an evangelical perspective,[13] while at the same time reflecting a responsible scientific outlook. I concede that there are places where I could have engaged with other evangelicals—such as those mentioned by McKenzie—such as those who either ditch science altogether in favor of a highly nuanced biblical hermeneutic, or who adopt a more responsible approach which ought to be com-

What McKenzie rightly discerns as an important task – namely, engaging with the extensive evangelical literature in the field of science and religion – did not seem to me to be of direct importance to the greater task of formulating and articulating a viable way of doing theology.

mended. Yet my concern, both in *The Foundations of Dialogue in Science and Religion* and later in the three volumes of *A Scientific Theology*, was not to settle intra-evangelical disputes, but to map out a coherent, viable and defensible approach to theological method. What McKenzie rightly discerns as an important task – namely, engaging with the extensive evangelical literature in the field of science and religion – did not seem to me to be of direct importance to the greater task of formulating and articulating a viable way of doing theology. Perhaps I shall be able to come back to this; as McKenzie rightly points out, much needs to be done here.

Torrance

A further point of concern relates to my use of Thomas F. Torrance, whom I regard as a pioneer of the approach to scientific theology that I wish to commend. McKenzie – again rightly – points out that my 1998 volume talks about "religion," where Torrance much prefers to talk about "theology." I think that this issue is more than adequately redressed in the three volumes of *A Scientific Theology*, which gives priority to the category of "theology," and rejects any generalized appeal to the vague and somewhat plastic category of "religion" as the basis of theological reflection. This does not represent a change of mind on my part; I have never seen a religion-based approach to theology as being viable, for reasons that I set out in more detail in the later volumes of *A Scientific Theology*, and which are anticipated in earlier writings of mine dating from the early and mid-1990s.[14]

McKenzie also expresses concern about the absence of a detailed engagement with the Bible, comparable to that found in some of Torrance's writings. This actually had more to do with limitations on space than any theological deficiencies on my part. It is true that in 1998 I talked rather broadly about "creation" without interacting seriously with the Bible; readers will note an extensive and more spacious engagement with Scripture in *Nature*.[15] This reflects the publisher's generous allocation of space, which allowed me much greater freedom to engage with the Bible than the more narrow confines of the earlier work. McKenzie also is worried that my 1998 discussion of natural theology is somewhat lightweight; I correct this in 2001–2002 with a major historical and systematic exposition of this notion, and demonstrate how it can function as a "trans-traditional device" in facilitating interdisciplinary dialogue on the one hand, and Christian apologetics on the other.[16] I shall be returning to the place and significance of a Christian natural theology in a major monograph to be published in 2006 or so, with the provisional title *The Glory of the Lord: A New Vision of Natural Theology*.

And Finally ...

I am immensely grateful to McKenzie for his constructive, rigorous, and insightful critique of the 1998 volume *The Foundations of Dialogue in Science and Religion*. I hope that he will find the discussion in *A Scientific Theology* to be more satisfactory. I think he will. I learned a lot in the intervening years, not least by listening to my critics, both scientific and theological. But readers may be wondering where I shall be going next. For the "scientific theology" volumes are not really a work of systematic theology, but a work of theological method – in other words, an attempt to develop a viable way of doing theology. It now remains for me to *apply* this method – something that I hope to do in four or five years time, in a three-volume work provisionally and somewhat tentatively entitled *A Scientific Dogmatics*. I have no doubt that I will learn much from writers such as McKenzie along the way, and will always welcome their criticisms and comments, just as I have valued his encouragement and more positive comments in his article, to which this represents a short response. I also look forward to seeing more from his own pen in this field: he clearly has much to contribute, and I look forward to hearing (and learning) more from him in the future. ◈

Notes

[1]R. H. McKenzie, "Foundations of the Dialogue Between the Physical Sciences and Theology," *Perspectives on Science and Christian Faith* 56, no. 4 (2004): 242–54.

[2]See, for example, John Milbank, *Theology and Social Theory: Beyond Secular Reason* (Oxford: Blackwell, 1993).

[3]Alister E. McGrath, *The Foundations of Dialogue in Science and Religion* (Oxford: Blackwell, 1998). I was asked back to Utrecht to speak on "a scientific theology" in April 2003, once that project was completed.

[4]___, *T. F. Torrance: An Intellectual Biography* (Edinburgh: T & T Clark, 1999).
[5]___, *A Scientific Theology: 1 – Nature* (Edinburgh: T&T Clark and Grand Rapids: Eerdmans, 2001).
[6]___, *A Scientific Theology: 2 – Reality* (Edinburgh: T&T Clark and Grand Rapids: Eerdmans, 2002).
[7]___, *A Scientific Theology: 3 – Theory* (Edinburgh: T&T Clark and Grand Rapids: Eerdmans, 2003).
[8]___, *The Science of God: An Introduction to a Scientific Theology* (Edinburgh: T&T Clark and Grand Rapids: Eerdmans, 2004).
[9]McKenzie, "Foundations of the Dialogue Between the Physical Sciences and Theology," note 32.
[10]See my use of Heisenberg at McGrath, *Reality*, 283–5.
[11]McGrath, *Reality*, 188–91. The discussion ranges beyond the accounts McKenzie notes.
[12]Ibid., 177–93.
[13]For my attempts to contribute to a wider discussion, see Alister McGrath, *Evangelicalism and the Future of Christianity* (Downers Grove, IL: InterVarsity Press, 1995); ___, *A Passion for Truth: The Intellectual Coherence of Evangelicalism* (Downers Grove, IL: InterVarsity Press, 1999). More specifically, see Alister McGrath, "Engaging the Great Tradition: Evangelical Theology and the Role of Tradition" in John G. Stackhouse, ed., *Evangelical Futures: A Conversation on Theological Method* (Grand Rapids, MI: Baker, 2000), 139–58.
[14]For example, see McGrath, *A Passion for Truth*, 201–28.
[15]McGrath, *Nature*, 141–59.
[16]McGrath, *Nature*, 241–305; ___, *Reality*, 55–120.

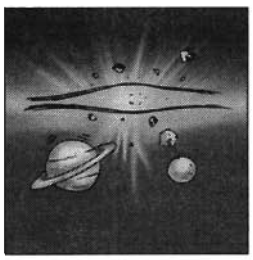
Dialogue I: Theology & Physical Science
A Closing Remark

A Closing Remark

Ross McKenzie

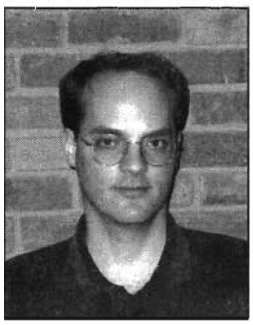
I want to commend Roman Miller, the editor of this journal, for giving Professor McGrath the opportunity to respond to my article. I thank McGrath for taking the time to respond and for his exceedingly generous comments about me and my work.

I think it is helpful the way that he has clearly put the 1998 volume I reviewed in the context of his developing thoughts and his more recent three volume work, *A Scientific Theology*. My preliminary reading of that comprehensive and stimulating work suggests that my major concerns are addressed there. Hence, I recommend that readers begin with the forthcoming *An Introduction to a Scientific Theology* rather than the 1998 volume. I only wish I could read, digest, and write reviews of McGrath's work as quickly as he produces them! ◈



Has Robert Gentry Refuted Big Bang Cosmology? On Energy Conservation and Cosmic Expansion

J. Brian Pitts



J. Brian Pitts

Robert Gentry has argued that Big Bang cosmology is unsatisfactory because photon redshifting violates energy conservation and because cosmic expansion ought to occur on all distance scales and so not cause redshifting. By remembering to include the gravitational energy and discussing how to account for it, I show here that Big Bang cosmology satisfies energy conservation adequately. Recognizing the merely conventional nature of Gentry's key distinction between expansion-based and Doppler-based redshifts reconciles the allegedly suspiciously conflicting explanations. A survey of the work matching Big Bang exterior solutions to local inhomogeneities gives plausible support for traditional claims that cosmic expansion has a negligible effect on small scales. Thus both of Gentry's conclusions are unsupported by his arguments. I suggest that Big Bang cosmology is neither very harmful nor very helpful for Christian faith, but it is a serviceable physical theory.

I refute [Gentry's] energy conservation objection ... and show his objection to the expansion of the universe to be ill-founded.

Physicist Robert Gentry has written (or co-authored) a number of articles critical of Big Bang cosmology on physical grounds, arguing instead for an alternate "New Redshift Interpretation," "GENESIS" model, or "Cosmic Center Universe."[1] This model is based on the static Einstein metric, but has a universal center, to which Earth is fairly close. Steve Carlip and Ryan Scranton have partially addressed Gentry's criticisms of the Big Bang and have posed objections to his alternative model.[2] Here I confine my attention to two of Gentry's scientific criticisms of the Big Bang pertaining to general relativity. He asserts that Big Bang cosmology violates energy conservation due to photon redshifting energy loss and that the expansion of the universe is a muddled concept. I refute his energy conservation objection, noting (as did Carlip and Scranton) that Gentry neglects the energy of the gravitational field itself. He also neglects most of the relevant literature. I then show his objection to the expansion of the universe to be ill-founded. If there are theological or other objections to Big Bang cosmology, one should not be misled into thinking that these two physical objections also have force.[3]

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Cosmological Energy Nonconservation?

Gentry asserts that the cosmic expansion in standard Big Bang cosmology violates energy conservation, because the photons of light lose energy as they get redshifted. While it is true that the photons lose energy, the energy is transferred to the gravitational field. In a world containing gravity and electromagnetism, one does not expect electromagnetic energy to be conserved by itself, but only the sum of gravitational and electromagnetic energy. Gentry, however, neglects the energy of the gravitational field, and then worries that the electromagnetic energy alone is not

conserved. Steve Carlip and Ryan Scranton pointed out this error several years ago,[4] but Gentry persists in this claim.[5]

Gravitational energy is a messy subject, as the literature shows from the 1910s to the present. The problem is not the lack of expressions for a distribution of gravitational energy, but the abundance of different ones: there are many such expressions which differ, but which have comparably good claims on being accepted. Mathematical transformations that make no physical difference, turn out to make a mathematical difference in the localization of gravitational energy to regions in spacetime. In this literature—which Gentry hardly notices—one finds many approaches, including pseudotensors,[6] orthonormal tetrads,[7] background metrics,[8] quasilocal expressions,[9] contingently preferred vector fields,[10] Killing vector fields,[11] spinor formulations,[12] superenergy tensors,[13] and Hamiltonian methods.[14] While none of these approaches is fully satisfactory in describing the local distribution of gravitational energy at each point in space at a moment in time, it should be emphasized that many give satisfactory answers for the *total* energy from all points in space together. (The local conservation laws are true, but they possess an undesirable element of conventionality.) The localization problem seems to arise due to the difficulty of finding an intrinsic description of the physics, free of physically insignificant "gauge" artifacts of the labeling with redundant variables. A suitably intrinsic physical description in terms of the true degrees of freedom (two at each point in space), as sought by Luca Lusanna and Massimo Pauri,[15] might help, but the search is technically daunting and results appear to involve gauge-variant elements after all. Even so, the total energy and its conservation can be discussed securely.

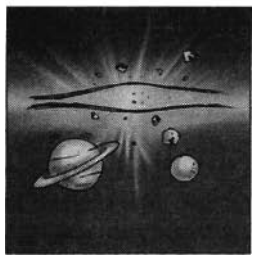
For energy conservation to be violated, there must be a well-defined value of the total energy in all space at one moment, including the contributions from both the gravitational and electromagnetic fields, and this value must change over time. Standard Robertson-Walker Big Bang cosmological models are "homogeneous": exactly the same situation exists at every place at a given moment of time. In the standard spatially flat and negatively curved cases—which are Euclidean and "open," respectively (assuming the usual topologies)—the total volume of space is infinite. But in the positively curved ("closed") case, the volume is finite, though there is no boundary surface. For the first two cases, it follows that if a finite region of space has nonzero energy, then the whole of infinite space will have infinite energy. But if the total energy is infinite today, and infinite tomorrow, what does it mean to say that the energy tomorrow is less than the energy today? Suppose that Euclidean three-dimensional space is filled with one inch by one inch by one inch boxes, each of which contains $10.00 today. It follows that the total amount of money today is infinite. If tomorrow each box contains $7.50, then the money tomorrow will be infinite. If each box has $6.25 two days from now, the money will still be infinite. It simply does not make sense to say that the total amount of money in the world is decreasing, because there is always infinitely much money present (and the infinities have the same cardinality). By the same reasoning, assuming that nonzero energy density exists at each point in space, the total energy will be infinite, and one cannot speak of a change in its value. In that case, Gentry's objection collapses because global energy conservation is meaningless.

For energy conservation to be violated, there must be a well-defined value of the total energy in all space at one moment, including the contributions from both the gravitational and electromagnetic fields, and this value must change over time.

In defense of his claim of energy nonconservation, Gentry cites a standard work by the eminent cosmologist P. James E. Peebles, but in vain. It reads:

> The resolution of this apparent paradox [about the energy loss of photons] is that while energy conservation is a good local concept ... and can be defined more generally in the special case of an isolated system in asymptotically flat space, there is not a general global energy conservation law in general relativity.[16]

Gentry omits the crucial line about isolated systems. Peebles doubts that a global energy conservation law exists because its definition requires adding up the energy throughout all space, and that addition can fail to give a finite answer, if energy is present throughout an infinite volume. Just this problem can arise in Big Bang cosmology, because the homogeneity of the universe implies that the matter content is not confined to only one portion of space. For the flat or negatively curved models, the infinite spatial volume ensures that the total energy in all space is infinite—unless the energy density at each point is zero, a possibility that perhaps did not occur to Peebles. Peebles is not arbitrarily waiving energy conservation as a physical principle, but evidently recognizing mathematical facts about divergent integrals. Without actually calculating the energy density at each point in space, Peebles might anticipate (if perhaps incorrectly) that the energy conservation



Dialogue II: Big Bang Cosmology

Has Robert Gentry Refuted Big Bang Cosmology? On Energy Conservation and Cosmic Expansion

principle is meaningless. This sort of mathematical worry is not a special feature of gravitation. An analogous problem with charge (rather than energy) conservation would arise for electromagnetism if matter with a net charge were present throughout infinite space, though this mathematical possibility is clearly unlike the actual world and so rarely is discussed.

As it turns out, the energy density in Robertson-Walker models has been calculated in a number of cases.[17] In several approaches, the gravitational energy density just cancels the matter energy density to give zero total energy density. Adding up the total energy in all space, one gets zero total energy. Many calculations of the energy of a flat Big Bang model have yielded zero energy. A number of calculations for the positively curved case also give zero energy (with one exception whose meaning is unclear[18]). The negatively curved case has not been considered as often, though Banerjee and Sen find an infinite answer, while Cooperstock and Israelit, and Cooperstock and Faraoni, favor zero total energy. Finally, T. Vargas Auccalla finds zero total energy in all three cases.[19] So when one does calculations of the sort that Gentry did not, it generally turns out that either the total energy is infinite, or it is zero. (The ambiguities might be connected with different choices of boundary terms, as will appear briefly below. My purpose does not require deciding which answer is correct.) In the first case, the question of energy conservation is meaningless, whereas in the second case, energy conservation is satisfied because the energy, being always zero, does not change over time. Either way, the nonconservation objection fails.

The Hamiltonian (also called "canonical") formulation of general relativity, the standard theory of gravity, ... help[s] to explain why energy can reasonably have a value of zero.

Why Energy Might Be Zero in General Relativity

A few remarks on the Hamiltonian (also called "canonical") formulation of general relativity, the standard theory of gravity, will help to explain why energy can reasonably have a value of zero. In mechanics, the evolution of a system over time can be derived from a Hamiltonian function, which is basically a function of the coordinates and momenta of the parts of the system. In field theories, the values of the field at each point serve as (generalized) coordinates, while the "canonical momenta" are related, at least in simple cases, to the rate of change of the fields over time. The Hamiltonian H, which generally is equal to the energy E of the system, can be expressed as the integral of a Hamiltonian density $\mathcal{H}(x)$ over all of space at one moment:

$$E = H = \int d^3x\, \mathcal{H}(x).$$

The Hamiltonian density $\mathcal{H}(x)$ is not fully determined by the equations of motion, but typically is defined up to the addition of a divergence term. In more complicated theories, like Maxwell's electromagnetism, not all of the momenta are related to the fields' rate of change. This fact takes one into the realm of constrained Hamiltonian dynamics,[20] in which one deals with physical quantities, called constraints, which have the value of zero when the equations of motion are satisfied. General relativity is like electromagnetism in this respect, only much more so. Both theories possess "gauge freedom," implying that the typical description involves some redundant variables. The redundancy implies that some of the variables can be changed without making any physical difference. In general relativity, the Hamiltonian is a sum of constraints and a divergence term:

$$H = \int d^3x\, [N(x)\mathcal{H}_0(x) + \beta^i(x)\mathcal{H}_i(x) + \partial_i f^i(x)].$$

Using the divergence theorem, one rewrites the volume integral of the spatial divergence as a surface integral over the boundary of the volume:

$$H = \int d^3x\, [N(x)\mathcal{H}_0(x) + \beta^i(x)\mathcal{H}_i(x)] + \int dS_i\, f^i.$$

When the Hamiltonian H is differentiated with respect to the lapse function N(x) and shift vector field $\beta^i(x)$, their coefficients, the constraints $\mathcal{H}_0(x)$ and $\mathcal{H}_i(x)$, must equal 0. The quantity $\mathcal{H}_0(x)$ looks roughly like an energy density for matter plus one for gravitation, but the term for gravitation can be negative, canceling positive matter energy density to give an overall value of zero. It follows that the value of the Hamiltonian, when the constraints are zero, is just the boundary term

$$H = \int dS_i\, f^i.$$

Thus the energy is zero, unless the boundary term gives a nonzero value. The proper choice for the function f^i depends on the boundary conditions assumed for the fields.[21] It therefore is not too surprising if the energy E is in fact 0. Obviously if E = 0 for all time, then $dE/dt = 0$, so energy is conserved. If E is some finite number, it retains that value over time. For spatially closed models, there is no boundary, so E = 0.[22]

The Expansion of the Universe

Gentry asks: "How, if the whole universe and everything in it is expanding, can one observe the expansion?" This is a reasonable question. The short answer is that not everything in the universe is expanding. The homogeneous Robertson-Walker solution to Einstein's field equations, though a good approximation on large distance scales, does not apply on small scales, so the cosmic expansion does not either. This question has been addressed in some mathematical detail.[23] Gentry's assertion that GPS measurements support some solution other than the Robertson-Walker model is therefore not news. The long answer is more mathematical: one matches the Schwarzschild or Kerr solution at small distance scales to a Robertson-Walker solution on larger scales, imposing suitable junction conditions at the boundary. Here, as elsewhere in modern physics, one should trust the mathematics more than inherently imprecise English translations such as "the universe is expanding."

Gentry also discusses whether the cosmological redshifts are due to the motion of stars, or due to expansion of space between the stars, and finds various sources disagreeing. To him, this disagreement signals a fundamental problem casting doubt on the model, but the distinction just has no deep meaning in general relativity. This lack of a robust distinction is a facet of the difficult philosophical issues regarding absolute vs. relational theories of space and motion, individuation of events, and the like, which surround general relativity.[24] It is a useful *convention* to speak of (idealized) stars at rest in an expanding space via the mathematics of comoving coordinates to identify spatial points over time. The spacetime metric for a flat (for simplicity) Robertson-Walker model, using the standard comoving spatial spherical coordinates (and choosing a time coordinate that measures proper time for the preferred "fundamental observers," such as the idealized stars) is $ds^2 = -dt^2 + a(t)^2 (dr^2 + r^2(d\theta^2 + \sin^2\theta\, d\varphi^2))$.[25]

A fundamental observer will correspond to fixed spatial coordinates (r, θ, φ), and thus can reasonably be called "at rest." One would reasonably describe the redshift as due to cosmic expansion. However, one could use noncomoving coordinates instead; one might then speak of moving stars. Defining a noncomoving radial coordinate ρ by $\rho = r\, a(t)$, one re-expresses the line element above as

$ds^2 = (\dot{a}^2\rho^2a^{-2} - 1)\, dt^2 - 2\dot{a}\rho a^{-1} dt\, d\rho + d\rho^2 + \rho^2 (d\theta^2 + \sin^2\theta\, d\varphi^2)$,

where $\dot{a}$ is the time derivative of $a(t)$. A fundamental observer, satisfying $r(t) = b$ (and having some fixed values of θ and φ) for some constant b in the comoving coordinate system, is described by $\rho(t) = b\, a(t)$, giving coordinate velocity $d\rho/dt = b\dot{a}$, which is nonzero and directly proportional to its distance from the (arbitrarily chosen) coordinate origin $r = \rho = 0$. One might now speak of a generalized Doppler shift due to the outward radial motion of the stars from the "center" $\rho = 0$. Neither of these descriptions is truer than the other. At most, one is more convenient than the other, or more commonly used. Given the conventional, as opposed to factual, nature of the mathematical distinction, it is neither surprising nor worrisome that two different translations into English might result. A similar situation could arise if a Greek text has a meaning which is clear to scholars, but which is difficult to render into English in a concise way: divergent English renderings would not indicate a problem in the Greek.

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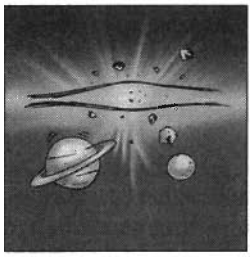
Recently Andrew S. Repp has also provided a refutation of Gentry's critique of the standard explanation of the cosmological redshift.[26] As Repp observes, standard Big Bang cosmology does not need to claim that redshifting ceases during emission and absorption, *pace* Gentry, because the brief time taken by emission and absorption implies that such redshifting will be negligible.

Although Gentry has not provided a good argument for the existence of a center of the universe, the question is interesting. Though Big Bang cosmology in its usual form lacks a center, one can posit a center if one wishes.[27] Other inhomogeneous cosmological models[28] are worth investigating, too. Christians have little a priori reason to assume that our location in the universe is not special, though it might well turn out a posteriori not to be so. If our physical situation is special in any sense, it might be in a sense more sophisticated than a mere central location.[29]

Big Bang Cosmology and Christianity

Attitudes of Christians toward Big Bang cosmology range from enthusiasm due to its alleged apologetic value for creation *ex nihilo* and hence theism on the one hand, to rejection due to its allegedly atheistic character on the other



Dialogue II: Big Bang Cosmology

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I suggest that making minor modifications to [Big Bang cosmology] in order to remove whatever tension it might have with Christian faith would be vastly preferable to a blunt dismissal of a framework that renders intelligible a great mass of data.

hand. Intermediate positions are also possible. For example, perhaps Big Bang cosmology is compatible with Christian truth claims just because science and religion are basically independent subjects. Or perhaps Big Bang cosmology is compatible with theism and core Christian doctrines such as the Trinity and the Incarnation, but incompatible with the details of biblical teaching which, however minor their intrinsic importance, affect the credibility of the sources for core Christian doctrines. Two important questions to consider are whether Big Bang cosmology is (approximately) empirically adequate, and, if so, is it (approximately) true? It is difficult to ascertain precisely what attitude Gentry takes toward Big Bang cosmology theologically. His well-known defense of a young earth suggests that he takes Big Bang cosmology to be at least inconsistent with the details of biblical teaching. But given that he takes Big Bang cosmology to be empirically inadequate and thus demonstrably false even apart from Scripture's details, he need not address its compatibility with Christianity carefully.

If the arguments presented above tend to vindicate the belief that Big Bang cosmology fits the data quite well, still the question of its compatibility with Christian faith remains. I can hardly do justice to this much discussed[30] issue here, and will be content merely to advise against the extreme views of regarding Big Bang cosmology as deeply helpful or deeply harmful to Christian belief. *Pace* those who deploy the Big Bang as a major apologetic tool, I recall that the singularity, which allegedly corresponds to the creation event (which correspondence is itself a difficult claim), is inferred by extrapolating general relativity far beyond its plausible realm of validity. Thus Robert Wald writes:

> Of course, at the extreme conditions very near the big bang singularity one expects that quantum effects will become important, and the predictions of classical general relativity are expected to break down.[31]

A possible historical parallel from a century ago is the classical Rayleigh-Jeans law for blackbody radiation. This law holds that radiated power increases with frequency. Integrating over all frequencies implies that a blackbody radiates infinite power, an absurdity called the "ultraviolet catastrophe." (The Rayleigh-Jeans law was known not to tell the whole story even empirically, but it was fairly well motivated.)

Max Planck's solution to this theoretical problem helped lead to modern quantum mechanics. It seems plausible that the arrival of a good theory of quantum gravity will similarly remove the infinite curvature at the Big Bang in favor of a model defined for arbitrarily remote past times, and with the singularity will disappear an argument used in Christian apologetics. Worries about God-of-the-gaps arguments can be overdone, as several people have argued recently.[32] Yet the particular example of the Big Bang singularity does look like the sort of gap that physics should and will overcome. (Teleological arguments involving fine tuning are another matter.) Already there exist interesting results tending toward the removal of the singularity.[33] The views of Narlikar are instructive.[34] *Pace* those who reject the Big Bang as atheistic, I suggest that making minor modifications to it in order to remove whatever tension it might have with Christian faith would be vastly preferable to a blunt dismissal of a framework that renders intelligible a great mass of data. Such a dismissal would risk reducing astronomy to a pile of brute facts, an outcome to be avoided as far as possible. ◈

Acknowledgments

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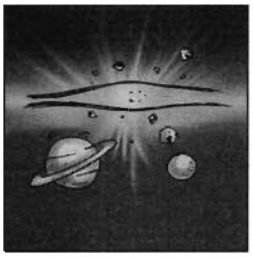
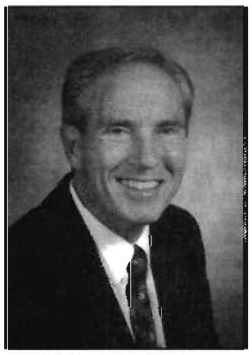


Collapse of Big Bang Cosmology and the Emergence of the New Cosmic Center Model of the Universe

Robert V. Gentry



Robert V. Gentry

God does not intend that his record of the literal six-day creation and seventh-day Sabbath rest ... to lapse into obscurity and ridicule without providing ... scientific evidence that affirms these records.

It is good that respected theorist J. Brian Pitts has contested my refutation of Big Bang Cosmology (BBC).[1] This gives opportunity to show that its huge nonconservation-of-energy losses are genuine, that its key spacetime expansion hypothesis is false, and that its expansion redshifts are mythical entities, without any physical reality. In making these discoveries, I point out that cosmologists committed modern science's greatest faux pas by decades-long promotion of BBC while, incredibly enough, never bothering to test its key spacetime expansion postulate experimentally.[2] These results invalidate BBC's explanation of the Hubble redshift relation, its identification of the 2.7K Cosmic Blackbody Radiation (CBR) as relic radiation, and show that its Cosmological Principle has always been science fiction.[3] This led to my discovery that the locally observed, spherically symmetric galactic redshift distribution is unique and hence that a universal Center exists nearby.[4] I identify it as the location of God's eternal throne, as per Hebrews 8–10 and Revelation 20. Finally, I describe my Cosmic Center Universe model that reproduces eight of BBC's major predictions.[5]

Before launching into my response to Brian Pitts' article, the reader is entitled to understand just what it is about my scientific work that he is challenging. They are also entitled to know the philosophical basis of my work in order to more intelligently evaluate my findings, both those now under discussion, and those obtained earlier. The Bible says God will not give his glory to another. To me this means he does not intend that his record of the literal six-day creation and seventh-day Sabbath rest, as given in Genesis and in the Fourth Commandment, to lapse into obscurity and ridicule without providing the scientific community and the world with scientific evidence that affirms these records. This approach necessarily means I believe there are flaws in the current evolutionary paradigms, and that part of revealing God's glory of creation means exposing the scientific flaws in these paradigms as well as promoting those evidences of creation that affirm the Genesis record. This is the philosophical basis of my work, and I realize it is a minority view, both scientifically and within the Christian community. It is also controversial; so Pitts has done the Christian scientific community a great service by attempting to expose what he thinks are its defects. My scientific response to Pitts is necessarily couched within the framework of my philosophical view. I have done so in a forthright manner, trusting that if I have run the race by just beating the air, the readers of this response will respond accordingly and show me the errors of my ways.

In the last few years, I have reported several discoveries that I claim either falsify big bang cosmology directly or disprove its fundamental postulates.[6] Briefly these discoveries are:

1. Big bang cosmology involves gargantuan nonconservation-of-energy losses equal to the mass/energy contained in a universe

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thirty million times the size of our own.[7] This denial of energy conservation on a universal scale proves that at least one of the theory's fundamental postulates must be fallacious and hence that the theory must be fallacious.

2. The universe is relativistically governed by Einstein's static spacetime general relativity (GR) instead of the Friedmann-Lemaître expanding spacetime postulate upon which the big bang is critically hinged.[8] Disproof of this fundamental postulate proves that neither big bang's spacetime expansion nor expansion redshifts even exist. Without the latter, everything in the big bang collapses.

3. The decades-long belief that the 2.7K Cosmic Blackbody Radiation (CBR) is big bang's relic radiation is proven false because the many hundreds of thousands of astronomers and cosmologists who have promoted the theory over the past fifty or more years committed one of the greatest errors in the history of science when they failed to include a critically important term in the equation they developed to compute big bang's prediction of the present CBR temperature.

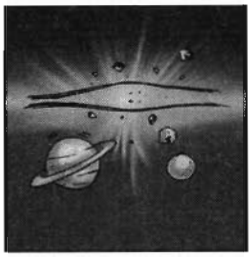
When I discovered this missing term and modified the resulting equation accordingly, then as shown herein, I found two things of extraordinary consequence: First, instead of big bang's temperature prediction of the CBR agreeing with the experimentally determined 2.7K, actually it is more than a million times less.[9] This means what has been thought of as BBC's greatest success is now exposed as its greatest contradiction. Secondly, I found big bang's hypothesized rate of expansion-induced photon wavelength increase, which is the foundation of its expansion redshifts, depends on both the present value of H, the Hubble constant, and its hypothesized existence at time of emission, H_e.[10] On this basis, every photon in the universe—whether having originated locally, or in distant galaxies, or in the CBR—has a memory of the hypothesized H_e at emission and, in some mysterious way, must be instantaneously processing that value in order to universally synchronize the rate of wavelength expansion for every photon with the same value of H_e. For photons in the CBR, which supposedly originated 13.7×10^9 years ago, this memory must stretch back that far and instantaneously induce the same change wherever those photons are in the cosmos now. Such a requirement is a bizarre contradiction to all of modern quantum electrodynamics, but actually no more bizarre than BBC's acceptance of gargantuan nonconservation-of-energy losses.

Thus, what appeared to be modern science's and big bang's greatest twentieth-century success has turned into its worst twenty-first-century nightmare. This fatal contradiction to its CBR temperature prediction—as well as its demand for photons to be inscribed with H's value at time of emission—falsifies the entire theory, thus proving it never happened.[11] And because the big bang never existed, neither was there ever a Hubble constant different from the present one. Furthermore, I found that disproof of expansion redshifts opens up exciting new vistas both on the structure of the universe as well as the biblical implications of this structure. Without expansion redshifts the big bang has no explanation of the Hubble redshift relation and no explanation for the 2.73K CBR. A new model of the universe is needed, not dependent on spacetime expansion and expansion redshifts.

Instead of big bang's temperature prediction of the Cosmic Blackbody Radiation agreeing with the experimentally determined 2.7K, actually [I discovered] it is more than a million times less.

In particular, astronomers and cosmologists have long promoted expansion redshifts to justify the idea that observers on any distant galaxy would detect the same spherically symmetric distributions of galaxies and quasars as seen on Earth. But disproof of expansion redshifts immediately invalidates the Cosmological Principle, which led me to understand the universe is truly spherically symmetric about only our point of observation, or some point that is astronomically nearby.[12] Obviously this location must be none other than the Center of the entire Universe.

My discovery of the nearby universal Center forms the basis of my new Cosmic Center Universe (CCU) model which postulates that the universe is relativistically governed by Einstein static spacetime.[13] In it galaxies are physically receding from this nearby Center in accord with the standard Hubble redshift relation, and the Hubble constant has a new, well-defined meaning in terms of a true measure of the rate of recession. In this new model, galactic redshifts are attributed to a combination of relativistic Doppler and gravitational redshifts. The force driving galactic recession from the nearby Center is cosmic repulsion due to the repulsive force of the vacuum. The 2.7K CBR is shown to be gravitationally redshifted blackbody cavity radiation from an anciently-created outer shell of galaxies (see note 59) that circumscribes those of the more recently-created (6,000 yr.) visible universe. This model deserves scientific attention as a replacement for the big bang because it matches eight of big bang's most promi-



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nent predictions, as well as predicting the existence of galaxies with redshifts >10, which is far higher than that allowed by the big bang. Additionally I herein suggest the CCU model also deserves attention from the biblical perspective as well, for I believe this physical Center is also the Command Center of the Universe, none other than the location of God's eternal throne where, as described in Hebrews 8–10, Christ is now ministering his blood in behalf of all who are calling upon him for salvation. On that basis, I believe God created the visible universe, that is within the ancient outer galactic shell, so as to focus attention on this nearby Center as a means of attracting even greater attention to the divine ministry of Christ that is now continuing there.

I believe these discoveries complement my earlier ones in nuclear geophysics. Beginning over three decades ago, I repeatedly published evidence in the world's leading scientific periodicals[14] showing that polonium radiohalos that originated with primordial polonium left their worldwide imprints in Earth's foundation rocks, the granites. The brevity of the relevant polonium half-lives, stretching from the geologically-short 138 days for ^{210}Po, to the very brief three minutes for ^{218}Po, to the virtually instantaneous 164 microseconds for ^{214}Po, provide unambiguous evidence that all of these rocks were the result of God's divine fiat creation of planet Earth. It is significant in this respect that, in Heb. 1:10 and similar passages, the Bible refers to Earth's foundation rocks as those made in the beginning. This proof of Earth's rapid creation – which has remained unrefuted in the open scientific literature for over three decades – disproves evolutionary geology's claim that the Earth formed by slow cooling over billions of years. In my view, God purposefully formed these creation halos – the Fingerprints of Creation – to provide unambiguous evidence that he called the Earth into existence just as the Bible states in Ps. 33:6, 9. And I believe he did so to glorify his name, just as he left his Signature of Cosmic Creation – the nearby universal Center – to point to him as Creator and Sustainer of all, and Author (John 1:1–3) of the literal six-day Genesis record of creation, as affirmed in Exod. 20:8–11.

Nonconservation of Energy Is Recognized in the Big Bang—Why Does Brian Pitts Attempt To Deny It?

I believe most scientists other than big bang practitioners would agree that any theory that is found to significantly violate energy conservation must be badly flawed and should be quickly relegated to the trash heap, regardless of how highly esteemed it may have been held prior to such a finding. But in the big bang, things are different, and I should think that Pitts would be aware that its huge inconsistencies have long been openly accepted and taught in prestigious universities. Concerning energy in the big bang, take, for example, renowned cosmologist Edward Harrisons' widely used text *Cosmology: Science of the Universe.*[15] His frank admissions concerning nonconservation-of-energy in the big bang appears in the section entitled "Where has all the energy gone?" There we find the following:

> Radiation, freely moving particles, and also gases lose energy in an expanding universe. Where does the energy go? We take for granted that light is redshifted and usually do not concern ourselves about where the energy has gone (p. 275).
>
> The conclusion, whether we like it or not, is obvious: energy in the universe is not conserved (p. 276).
>
> Science clings tenaciously to concepts of conservation, the most fundamental of which is the conservation of energy principle ... The conservation of energy principle serves us well in all sciences except cosmology ... To the question of where energy goes in an expanding universe and where it comes from in an collapsing universe the answer is – nowhere, because in this one case energy is not conserved (p. 276).

Obviously these descriptions have been in print in an authoritative format for over two decades. During this period, there was virtual silence about them. Neither Pitts nor any other scientist brought this contradiction of known physical laws to the focus of attention in the open scientific literature. I attribute this, first, to the fact that big bang

cosmology (BBC) is almost universally accepted as ultimate scientific truth. With this mindset, it follows that whatever the theory requires also must be true, irrespective of how many contradictions it involves, even to defying energy conservation. What may have awakened Pitts to now attempt to defend energy conservation in the big bang scenario is that in 1998, for the first time ever in print, David and I published just how much energy was lost in BBC's nonconservation scenario.[16]

Big Bang's Cosmic Expansion Is a Mirage That It Leads to Gargantuan Nonconservation-of-Energy Losses

According to big bang theory, the universe is undergoing spacetime expansion, and there supposedly exists at any time what is known as the cosmic expansion factor, $\Re(t) = \Re$. Despite its fundamental importance, the mysterious thing about this expansion factor is that its value at any point in time is unknown. In fact, no one has ever proposed how it could be measured. So if big bang practitioners had told the whole truth about it, they should have long ago admitted they had no direct experimental evidence that it has ever existed. The first thing we need to understand about big bang cosmology is that it has always been based on a huge leap of the imagination. But cosmologists and astronomers have never admitted to this. Indeed, it is a topic they have studiously avoided. Instead they introduce an assumption that tends to cover up the imaginary status of the cosmic expansion factor. Without any experimental or theoretical justification whatsoever, or any direct physical evidence that expansion even exists, they claim cosmic expansion has an effect on photons.[17] They hypothesize that a photon that is emitted with some standard wavelength, λ_s, at time, t_0, when the cosmic expansion factor is $\Re(t_0) = \Re_0$, will during its transit have had its wavelength increased by cosmic spacetime effects until it is absorbed. At that point, the expanded wavelength is presumed to be given by the equation, $\lambda = \lambda_s (\Re/\Re_0)$, where $\Re$ is the presumed—but unmeasurable—value of the expansion factor at time of absorption. But since a photon's wavelength is inversely proportional to its energy, ν, then wavelength expansion means energy lost during a photon's transit.

This leads us to consider the magnitude of the nonconservation-of-energy loss of CBR photons as in theory they were expansion-redshifted from 3000K at decoupling to the present 2.7K. Assuming a nominal universe volume, V_{univ} of 15 billion ly radius, the 2.7K CBR having about $\bar{n} = 410$ photons-cm^{-3} with average energy of about $\varepsilon_{2.7} = 10^{-15}$ erg, and the 3000K radiation with $\varepsilon_{3000} = 1.13 \times 10^{-12}$ erg, and an equal number of photons,[18] we compute the total CBR expansion energy loss as $E_{exp} = \bar{n} \times (\varepsilon_{3000} - \varepsilon_{2.7}) \times V_{univ} = 5.5 \times 10^{75}$ erg. This is about three times the galactic mass of a universe composed of 10^{21} solar masses. For an initial fireball temperature of 3 million K, the total radiation energy loss would be three thousand times the mass of such a universe. Even more incredibly, since in theory photon conservation extends back to a fireball temperature of 30 billion K, in this case the theorized nonconservation-of-energy loss projects to be thirty million times the mass of such a universe. These gargantuan energy losses command our attention. If they are real, then certainly it means that BBC's underlying premise of cosmic expansion is badly flawed, and hence BBC is a falsified theory.

Despite its fundamental importance, the mysterious thing about this expansion factor is that its value at any point in time is unknown. In fact, no one has ever proposed how it could be measured.

Even though Harrison did not report this energy loss calculation[19] (as David and I did in 1998),[20] we have proof it commanded his serious attention, as shown by comments in his book's second edition published in 2000. There we find him sending out the following SOS on this issue:

> The energy in the cosmic background radiation, once very large, is now quite small. Where has this energy gone? Can you think of an answer that conserves total energy? (The author has tried and failed.) Do you think that the second law of thermodynamics is a better conservation principle than the familiar conservation of energy principle?[21]

It is amazing that Harrison, one of the world's leading cosmologists, frankly admits to not only finding no solution to big bang's vast nonconservation-of-energy losses, but seeks answers from others far less qualified than himself, even from students, who surely must be mystified that a cosmologist of his stature would consider that any of them might think of a way to solve what has escaped a generation of cosmologists. After all, in their physics classes they are taught that energy is conserved. How could it be that in the big bang it is not conserved?

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Exposing the Phantom Link Between Expansion Redshifts and Astronomical Redshifts

Now Pitts does not challenge the above nonconservation-of-energy loss calculation.[22] But he quotes others to the effect that these huge energy losses are compensated by energy gained by gravity. Even though it must be assumed that Harrison is familiar with all the papers cited by Pitts, he obviously had reasons for not discussing Pitts' argument as a valid solution. And, of course, I also have reasons which Harrison may not have been aware of. In particular, as I have previously shown, and will now show again even more explicitly herein, a number of gravitational redshift experiments of the interactions of gravity with photons prove there is no exchange of photon energy with the gravitational field.

To understand what follows necessitates we start with essential background information given by three of the world's eminent general relativity theorists, Misner, Thorne and Wheeler (hereafter MTW), in *Gravitation*,[23] the book that for decades has been considered the ultimate authority on the general relativistic basis of BBC. Figure 29.1 on page 776 shows BBC assumes GR expansion processes operate on wavelengths while photons are in-flight, but not at emission. What is so puzzling is that Pitts argues this is not the case. He quotes Andrew Repp as saying this is not a necessary condition because the emission/absorption process is so short that the wavelength would experience almost no change even if expansion does continue to operate during these periods.[24] Apparently both he and Repp fail to understand that the ultimate reason for cosmologists assuming cessation of expansion effects during emission/absorption is that they must do this in order to insure agreement with the astronomical requirement of a fixed standard emission wavelength, λ_s, in the standard expression used to calculate astronomical redshifts, which is $z = \lambda/\lambda_s - 1$. This failure then led Repp to argue for the physical reality of BBC's expansion redshifts when in fact, as now to be shown, neither he, nor Pitts, nor anyone else has ever verified their existence. Thus, in essence Repp's argument is only a repetition of BBC's mantra.

This brings us to the phantom link whose implications are never discussed in big bang cosmology—namely: If the expansion factor, $\Re$, is never measurable, then what meaning can the hypothesized equation $\lambda = \lambda_s (\Re/\Re_0)$ possibly have in the real world? What prediction could this equation possibly make about what the expanded wavelength should be at time of reception? The fact is that it does not make a prediction because it *cannot* make a prediction. The truth is that it is a phantom equation that cannot be tested.

Thus for big bang cosmology to even get off the ground, cosmologists had to invent some plausibility argument to link the imaginary effects of cosmic expansion with the real world, and then make it appear that this was a natural consequence of the theory. This they did by first assuming the universe was governed by the Friedmann-Lemaître expanding spacetime solution of the Einstein field equations and then *ex cathedra* pronouncing that cosmic expansion would cause galaxies to move apart as space itself was presumed to move apart. Hence that this expansion-induced motion of every galaxy away from every other galaxy would result in what they called cosmological redshifts. In this fictional scenario, astronomically determined redshifts of *nearby* galaxies were still to be interpreted in terms of the Doppler effect—true recession away from the observer. But for high redshifts, cosmological redshifts and something called the Hubble flow were invented to portray *distant* galaxies as uniformly moving apart, in which case the universe was said to be everywhere the same and everywhere moving apart.[25] In time this assumption of sameness was elevated and called the Cosmological Principle, when, in fact, there was no principle involved. Obviously, if experiments show the universe is not governed by Friedmann-Lemaître expanding spacetime general relativity, but instead by Einstein's static spacetime solution, wherein spatial volumes do not change in time, then it is impossible for cosmic expansion and cosmological redshifts to exist in our universe, which, of course, leads to the collapse of BBC. Before discussing the experiments which show this, we first analyze Pitts' attempts to reject BBC's nonconservation-of-energy losses.

This brings us to the phantom link whose implications are never discussed in big bang cosmology—namely: If the expansion factor, $\Re$, is never measurable, then what meaning can the hypothesized equation $\lambda = \lambda_s (\Re/\Re_0)$ possibly have in the real world?

Pinpointing Brian Pitts' Three Failed Attempts To Reject BBC's Nonconservation-of-Energy Losses

Two of Pitts' attempts to reject BBC's huge nonconservation-of-energy losses rely on lengthy General Relativity (GR) discussions concerning gravitation and the total energy content of the universe. Here he admits to be dealing with a "messy subject." This is borne out by his discussion. On one hand, he cites several GR authorities whose results support the concept of the universe's total energy being infinite. Then he cites other authorities in support of the total energy being zero. He admits not knowing which is true and is apparently not troubled by the possibility that this infinite difference may suggest a tremendous flaw in the underlying paradigms he uses to arrive at these results. Or at least he does not mention this possibility. Instead he says that whichever it is, nonconservation of energy is not a problem for BBC. If the total energy is zero, then not to worry; by definition it must remain zero. On the other hand, if it is infinite, then again not to worry because it will not make any difference how much energy is lost since you will still have an infinite amount left. I do not think these alternatives require much comment from me except to say that his proposed solutions are quite imaginative and beyond the scope of modern science to test them.

Pitts' other method of rejecting BBC's monumental nonconservation-of-energy losses, as given above, is again his reliance on the results of others. Like the other two just discussed, he does not really contest the above calculation. Instead he argues the cosmic energy lost would be energy gained by gravity, in which case energy is conserved. He recognizes this would require the interchange of photon energy with gravitational energy and references the work of Carlip and Scranton (C&S) to sustain this view. Here is what they say:

> Finally, let us briefly address one other issue raised in references 2 and 19 [in this paper notes 2 and 3], the problem of energy conservation in cosmological expansion. Gentry notes, correctly, that the electromagnetic energy of the cosmic microwave background is not conserved during expansion: in a volume expanding along with the universe, the radiation energy goes as $(1 + z)^{-1}$, and the redshift represents a genuine loss of photon energy. But there is nothing particularly "cosmological" about this loss—a photon rising in a static gravitational potential experiences a similar energy loss. In the laboratory, there is nothing mysterious about this phenomenon, which simply reflects the need to include gravitational potential energy in one's accounting. Indeed, energy conservation can be used to derive the redshift (see, for instance, section 7.2 of *Gravitation*, by Misner, Thorne and Wheeler [note 23 in this paper]).[26]

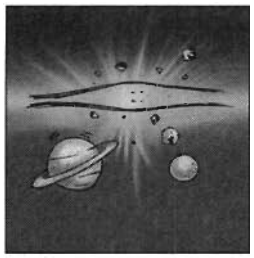
The above, first of all, affirms my claim that cosmic expansion, if it exists, does represent a genuine loss of photon energy. But C&S do not believe it represents nonconservation-of-energy. Instead they say this loss is compensated by energy exchange with gravity, and Pitts cites their result as being correct. But there are two big problems here. The first flaw in their reasoning, which Pitts obviously accepts, is their assumption that cosmic expansion does exist. They accept it in spite of the fact that I had already reported experimental evidence showing that it does not exist.[27] Secondly, they compare how cosmic expansion is presumed to work to expand wavelengths with how, in their view, photons lose energy rising in a static gravitational potential. The second big problem is that the same report that disproved the existence of cosmic expansion is also the one that showed there is no photon energy loss in that instance.[28] That is, I have already shown that comparison of atomic clock rates at two different altitudes, as per the operation of the GPS, provides conclusive experimental proof that no such interchange takes place. Now it is certain Pitts knows of this particular result because he cites this report in the general listing of a number of my papers in his abstract. But he signally fails to do so at this crucial point, thus leaving the distinctly erroneous impression that C&S's contention is correct. As the following analysis shows, however, it is not.

The Universe Is Governed by Einstein Static Spacetime General Relativity, Not the Expanding Spacetime Paradigm

When we examine the many relativistic gravitational experiments performed over the last few decades, we find that, while those results conflict with the expansion paradigm's basic assumptions, they are completely in accord with the predictions of the static-spacetime theory of general relativity as Einstein first proposed it in 1916. In that seminal paper, he predicted that gravity should cause a perfect clock to go

> more slowly if setup in the neighborhood of ponderable masses. From this it follows that the spectral lines of light reaching us from the surface of large stars must appear displaced towards the red end of the spectrum.[29]

In 1954 Brault's redshift measurement of the sodium D line emanating from the sun's spectrum did succeed in confirming the *magnitude* of the gravitational redshift that Einstein had predicted.[30] But this result did not settle the question of its *origin*. More specifically, was Einstein correct in postulating that different gravitational potentials at source and observer meant that clocks at these locations



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On any rational basis, ... BBC's underlying spacetime expansion premise must be fatally flawed ... all the foregoing results show the universe we inhabit is one governed by Einstein's static-spacetime general relativity, and not by Friedmann-Lemaître's expanding-spacetime general relativity, which is the foundation of BBC.

should run at intrinsically different rates, and hence that this was the origin of the gravitational redshift? Or did the measured redshift instead have its origin in photons experiencing an in-flight energy exchange with gravity as they moved in a changing gravitational potential in their transit from a star to the Earth?

Even the 1964 Pound-Snider experiments did not settle this question.[31] True, these observers did find a $\Delta\nu/\nu = -\Delta\varphi/c^2 = gh/c^2$ fractional frequency difference between ^{57}Fe gammas emitted at the top and received at the bottom of a tower of height, h, separated by a gravitational potential difference, $\Delta\varphi$, and this result did more precisely confirm the *magnitude* of the Einstein redshift. But it did not settle its *origin*, for they could not tell whether the redshift resulted from in-flight wavelength change as the photon passed through a gravitational gradient, or whether it was due instead to differences in gravity affecting the relative frequency at the point of emission. They did suggest, however, this issue could be decided by comparing coherent light sources operating at different potentials.

As is now well known, atomic clock experiments have repeatedly shown that a clock on a mountain top does run faster than its sea level counterpart by a fractional amount $\Delta\nu/\nu = -\Delta\varphi/c^2 = gh/c^2$, which is exactly the same shift found by Pound and Snider. Although not generally recognized as such until now, this result proved long ago that the Einstein redshift is due to local gravity operating to affect relative emission frequencies as seen by an observer in a different gravitational potential. Moreover, the basic principle of local gravity affecting relative emission frequencies is further confirmed many thousands of times every hour in the continuing operation of GPS atomic clocks. Synchronization of those clocks utilizes the Einstein static-spacetime paradigm with its predicted effect of gravity on emission frequency to calculate how much faster satellite clocks will be expected to operate once they are in orbit. Thus, prior to launch, satellite clocks are preset to run about 38,400 ns/d slower than the base master clock to compensate for their faster rate in orbit.[32]

The reason this result is exceptionally important is that, as Carroll Alley noted in setting up the GPS, it proves there is only one redshift of the amount gh/c^2 detected between source and detector, and not two times this quantity. He relates this was a very great surprise to certain eminent general relativity theorists engaged in setting up the GPS.[33] Before the experimental results were in, they had strongly affirmed the detected shift would be two times gh/c^2. They so firmly believed there would be one redshift due to difference in clocks operating at a different potential, and another redshift due to photons changing energy (frequency) in transit, that they refused to believe otherwise until the experimental results absolutely proved there was no energy or frequency change as a photon transits a gravitational potential. Alley's experience shows there is a widespread misunderstanding of this critically important fact within the community of general relativity theorists, and it is doubtless this error that has led Pitts, and Carlip and Scranton,[34] and countless others to erroneously believe they have a sure foundation for expansion redshifts, whereas in fact GPS experiments prove this foundation is vacuous.

Another remarkable confirmation of gravity's effect on emission frequencies comes from Taylor's comparison of atomic clock time with pulsar timing data. To synchronize both data sets he found it necessary to account for the change of local atomic clock time due to the monthly variation in the sun's gravitational potential at Earth. In Taylor's own words:

> Here is direct proof, based on a clock some 15,000 light years from the solar system, that clocks on Earth run more slowly when the moon is full—because at this time of the month we are deeper in the gravitational potential of the sun!"[35]

Thus Einstein's 1916 predictions about both the origin and the magnitude of the gravitational redshift have been confirmed by a variety of general relativistic experiments, so as to obtain the following conclusions: (1) The Pound-Snider results show there is only one gravitational redshift between two points at different potentials, and it is given by $\Delta\nu/\nu = -\Delta\lambda\lambda = -\Delta\varphi/c^2$, and (2) this redshift does not originate with photons exchanging energy with gravity during transit through a potential gradient, but

instead originates in precisely the way that Einstein stated it in 1916, and again in 1952—namely, "An atom absorbs or emits light of a frequency which is dependent on the potential of the gravitational field in which it is situated."[36] This is further confirmed by Vera's theoretical work showing there is no exchange between gravity and photon energy.[37]

There are two very significant conclusions which can be drawn from the foregoing results, and they complement each other. One is that this result disproves Carlip and Scranton's assertion that cosmic energy loss could be compensated by exchange with gravity, thus proving that if cosmic expansion had existed at all, it would—as the above calculations show—result in a nonconservation-of-energy loss equivalent to over thirty million times the mass of the visible universe. On any rational basis, this means BBC's underlying spacetime expansion premise must be fatally flawed. And this indeed is the second conclusion to be drawn because all the foregoing results show the universe we inhabit is one governed by Einstein's static-spacetime general relativity, and not by Friedmann-Lemaître's expanding-spacetime general relativity, which is the foundation of BBC. And there is more.

Additional Disproof of BBC and the Emergence of a New Cosmic Center Universe Model

One of BBC's greatest presumed triumphs is the idea that the 2.7K CBR is relic radiation from the big bang fireball. In theory, cosmic expansion effects caused exceedingly high energy photons in the fireball to diminish in energy to become those now present in the CBR. However, we have already seen that the universe is not governed by Friedmann-Lemaître expansion; so it is impossible for this scenario to be correct. Nevertheless the question arises as to how can it be that BBC's temperature prediction is supposedly exactly the experimentally observed 2.7K. The answer is that it is not. I have discovered this prediction is based on a badly flawed equation. And when that flaw is corrected, it turns out that cosmic expansion's presumed effects on photon wavelength expansion lead to a predicted CBR temperature that is hundreds of millions of times less than the experimentally observed 2.7K. The details of this discovery now follow.

We seek to compare the local CBR temperature with cosmic expansion's prediction. In theory any CBR photon emitted with standard wavelength, λ_s, has since expanded so as to now exhibit a presently measurable wavelength, λ, given by[38]

$$\lambda/\lambda_s = 1 + z = (?)\ \Re/\Re_e \qquad (1)$$

where z is the present expansion redshift, and $\Re$ and $\Re_e$ are, respectively, the expansion factors at present time, t, and at time of photon emission, t_e. We remember that in the above $\lambda/\lambda_s = 1 + z$ is the standard astronomical redshift. The question mark emphasizes that BBC's only attachment to the real world is via the ad hoc practice of interpreting astronomically observed redshifts, $z_{obs} = \lambda/\lambda_s - 1$ in Equation (1), with the mythical cosmological redshifts, $z_{cos} = \Re/\Re_e - 1$. Because the expansion rate is presumed to be diminishing, the question arises whether long-term redshift monitoring of light from a distant source might provide evidence of this presumed change. Indeed, on page 451 of his text Weinberg focuses attention on this question[39] and Peacock likewise focuses on it in his Problem 3.2, the first part of which reads as follows:

> An object is observed at redshift z in a Friedmann universe with density parameter Ω. Calculate the observed rate of change of redshift of the object.[40]

Now *one method* of calculating expansion's present rate of change of λ, both for photons from galaxies or in the CBR, uses Equation (1) together with MTW's assumption[41] of the *temporal constancy* of λ_s and $\Re_e$, to obtain $(d\lambda/dt)/\lambda = (d\Re/dt)/\Re = H$ (the Hubble constant, see note 13), or

$$d\lambda_{appx}/dt = H\lambda = H(1 + z)\lambda_s \qquad (2)$$

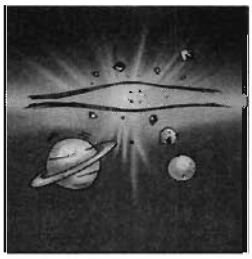
which agrees with the result obtained by Peebles.[42] The subscript in the above appears because Equation (2) is only an *approximation* due to the fact that it does not account for the *temporal variation* of $\Re_e$ at time of emission. The *correct expression* for $(d\lambda/dt)$ is obtained using results from Weinberg[43] and Peacock[44] of the exact expression for $\dot{z}$ from Equation (1). Both correctly include the *temporal variation* of $\Re_e$, $d\Re_e/dt_e$, when taking its time derivative,

$$\dot{z} = dz/dt = [\Re_e\,(d\Re/dt) - \Re(d\Re_e/dt_e)\,(dt_e/dt)]/\Re_e^2 \qquad (3)$$

In this instance dt and dt_e refer to differential time increments at present and at time of emission, respectively. Both Weinberg[45] and Peacock[46] find $dt_e/dt = \Re_e/\Re$, so the foregoing can be rewritten as

$$\dot{z} = [(\Re/\Re_e)\,((d\Re/dt)/\Re) - ((d\Re_e/dt_e)/\Re_e)] = (1 + z)\,H - H_e \qquad (4)$$

which, except for different notation, is equivalent to Equation 14.6.23 in Weinberg's text,[47] and that obtained in Problem 3.2 on p. 618 in Peacock's text.[48] In both instances their calculations stop with the expression for $\dot{z}$, and neither comment about any unusual implications of their equivalents to Equation (4). Here, however, we continue the calculation to find the exact expression for $(d\lambda/dt)$. To do this we first remember that astronomical redshift determinations of distant galaxies are always obtained from Equation (1) on the premise that λ_s represents the exact laboratory emission line value corresponding to λ, the present astronomically measured, redshifted wavelength. It follows that λ_s is a constant for all times—which again disproves Repp's assertion[49] to the contrary—and hence that Equation (1) leads to $\dot{z} = (d\lambda/dt)/\lambda_s$. Equating this



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This discovery again proves spacetime expansion and big bang's expansion redshifts are nonexistent mythical constructs in the universe we inhabit. In turn this means big bang's explanations of the Hubble redshift-distance relation, and the 2.7K Cosmic Blackbody Radiation (CBR) as relic radiation from big bang's fireball, are nothing more than science fiction.

quantity with the last expression in Equation (4) leads to

$$(d\lambda/dt) = \lambda_s [(1 + z)H - H_e] = \lambda H - \lambda_s H_e \quad (5)$$

where λ represents, as earlier stated, the observed *present rate of wave length change* of photons that were emitted from some source with wavelength λ_s at $H_e = (d\Re_e/dt_e)/\Re_e$, and time, t_e, as measured after the big bang at $t = 0$. Thus Equation (5) is a prediction of BBC that applies to either a stream of photons emitted from a distant galaxy, or to those in the CBR, that BBC presumes originated at its fireball. But since BBC does not provide any data on H, then it is not possible to directly test BBC using Equation (5) in its present form. However, if we apply the expanding universe condition, $(d\lambda/dt) > 0$ to this equation, we discover some truly amazing and very definitive predictions about the values of the photons' redshift expected to exist at present.

By remembering that Peacock's problem deals with a Friedmann universe, we first impose on Equation (5) the condition $H \sim t^{-1}$ for various Friedmann models.[50] This leads to the conclusion that local redshift measurements of photons, either from galactic sources or the CBR, must obey the redshift condition, $1 + z > H_e/H = t/t_e$. If we let $t = t_e + \Delta t$, where Δt is the elapsed time from photon emission to the present, we find

$$z > \Delta t/t_e \quad (6)$$

which is expansion's prediction of the minimum redshift to be expected from the measurement of any arbitrary group of photons emitted with the same standard laboratory wavelength, λ_s, and having a common origin at time t_e. Its unusual implications begin to be evident when it is applied to photons arriving from sources with $z > 6$. But its most extraordinary implications are even more evident when applying it to photons in the CBR.

For example, if we apply Equation (6) to the big bang's presumed fireball photons at time $t_e = 1$ s, when the radiation temperature of its primordial photons is theorized to be $\sim 10^{10}$ K, we find the elapsed time from then to the presumed time of decoupling, when the redshift is theorized to be $z = 1089$,[51] is only $\Delta t \sim 1000$ s, or less than half an hour. This value sharply contradicts the presumed 3.8×10^5 year value recently reported by Bennett.[52]

We can also use Equation (6) to find the expected present value of the CBR temperature by utilizing the most recent estimate[53] of the big bang at $t = 13.7 \times 10^9$ yr. On that basis, $\Delta t \approx 5 \times 10^{17}$ s. Thus it follows that when the dynamic variation of $\Re_e$ is correctly included into the calculation of expansion's effect on CBR photons, then from the expressions $z > \Delta t/t_e$ and $T_{CBR} = 10^{10}/t^{1/2}$—where in this instance t is measured in seconds from the big bang[54]—we find the present CBR expansion redshift and CBR temperature are predicted to be $z_{exp} > 5 \times 10^{17}$ and $T_{CBR} < 2 \times 10^{-8}$ K, respectively. This is a factor of one hundred million less than the experimental 2.73K. Even if we just apply Equation (6) to the usual scenario where the CBR temperature is predicted to be ~ 3000 K at decoupling when $t_e = 3.8 \times 10^5$ yr., we still find predictions of $z_{exp} > 36000$ and $T_{CBR} < 0.08$ K.

Obviously, both sets of predictions are severely contradicted by the presently observed 2.73 K. Thus, instead of present CBR observations confirming the most important predictions of big bang cosmology, we find they contradict them. It proves there must be a major flaw in big bang's underlying postulate, which is the assumption that the universe is governed by the Friedmann-Lemaître solution of the field equations. Even more evidence of the very serious nature of this flaw comes from noticing the extraordinary implications of Equation (5). It reveals that the present rate of expansion-induced wavelength change of any photon depends on both the present value of the Hubble constant, H, and its value at time of emission, H_e. If this were true, then photons in the CBR must have retained a memory of the value of H_e at emission 13.7×10^9 years ago, and moreover, in some unknown way, must now be able to process that memory on an instantaneous basis throughout the universe in order for Equation (5) to hold. The idea of photons having a memory of the Hubble value at emission is bizarre and in contradiction to all of modern quantum electrodynamics.

This discovery again proves spacetime expansion and big bang's expansion redshifts are mythical constructs in the universe we inhabit. In turn this means big bang's explanations of the Hubble redshift-distance relation, and the 2.7K CBR as relic radiation from big bang's fireball, are nothing more

than science fiction. This result is a disaster of unimaginable proportions, for it destroys decades of seemingly triumphal efforts cosmologists put into showcasing the big bang as a real event because its relic radiation was identifiable as the 2.7K CBR. This particular disproof of big bang's Friedmann-Lemaître paradigm and its expansion redshifts removes the linchpin supporting big bang cosmology and the Cosmological Principle (CP), thus showing that spherical symmetry of the cosmos demanded by the Hubble redshift relation can no longer be attributed to the universe being the same everywhere. The CP is fallacious. Instead of the universe being both homogeneous and isotropic, it is only isotropic about a nearby universal Center. As note 13 explains, BBC's apparent success in explaining the Hubble relation was, ironically, because in practice cosmologists and astronomers actually employed the CCU framework to explain the Hubble redshifts. That is why big bang's fatal flaws went unnoticed for so many decades. Thus a new model of the cosmos is needed, one not indebted to the Friedmann-Lemaître paradigm and its expansion redshifts, but one based on observational evidence of a nearby Center, which can also account for the $z = 3.91$ BAL quasar with its high Fe/O ratio.[55] A new Cosmic Center Universe model—an upgraded version of the NRI model[56]—has already been developed. It reproduces eight of BBC's major predictions and for that reason alone deserves close scientific inspection because I have already responded to five categories of objections that were lodged against the earlier version of this model.[57]

This model may also be of interest to the Christian scientific community, for I have already suggested this nearby Center may be none other than the throne of God described in Hebrews 8–10 and Revelation 4 and 20. Hebrews 10 in particular describes the ministry of Christ as our great high Priest officiating his blood in behalf of sinners on the throne of the universe in the heavenly Sanctuary. It is on this basis that I suggest the spherical symmetry of the universe as seen from our point of observation is not a cosmic accident,[58] but instead a direct result of God not only creating the visible universe on the literal Day 4 of creation week,[59] but of doing it so as to provide unambiguous astronomical proof that a nearby universal Center does exist, with the logical deduction that he intends for Earth's inhabitants to reflect strongly on this fact as evidence that he is both Creator and Ruler of the Universe and Author of the Ten Commandments (Exod. 20:1–17). ◈

Notes

[1]J. Brian Pitts, "Has Robert Gentry Refuted Big Bang Cosmology? On Energy Conservation and Expansion," *Perspectives on Science and Christian Faith* 56, no. 4 (December 2004): 260–5.

[2]Robert V. Gentry, "Discovery of a Major Contradiction in Big Bang Cosmology Points to the New Cosmic Center Universe Model," http://cdsweb.cern.ch/search.py?recid=6126488. These results mean that all theories of the cosmos that depend on spacetime expansion, whether evolutionary or creationist, are just as badly flawed as the big bang theory.

[3]Ibid.; and Robert V. Gentry and David W. Gentry, "The Genuine Cosmic Rosetta," www.arxiv.org/abs/gr qc/9806061.

[4]Gentry, "Discovery of a Major Contradiction in Big Bang Cosmology."

[5]Robert V. Gentry, "New Cosmic Center Universe Model Matches Eight of Big Bang's Major Predictions without the F-L Paradigm," http://cdsweb.cern.ch/search.py?recid=6126498.

[6]Gentry, "Discovery of a Major Contradiction in Big Bang Cosmology"; and Gentry and Gentry, "The Genuine Cosmic Rosetta"; and Gentry, "New Cosmic Center Universe Model."

[7]Gentry and Gentry, "The Genuine Cosmic Rosetta."

[8]Gentry, "Discovery of a Major Contradiction in Big Bang Cosmology"; and Gentry and Gentry, "The Genuine Cosmic Rosetta."

[9]Gentry, "Discovery of a Major Contradiction in Big Bang Cosmology."

[10]Ibid.

[11]Ibid.

[12]Gentry, "New Cosmic Center Universe Model"; and ——, www.orionfdn.org/PosterSession/TenDocuments.htm, "Flaws in the Big Bang Point to GENESIS, A New Millennium Model of the Cosmos" (28 February 2001). On this date LANL staff removed these ten papers from the eprint arXiv. Since then LANL, NSF and Cornell Univ. have conspired to continue to prevent their release. See www.orionfdn.org for details.

[13]Gentry, "New Cosmic Center Universe Model." The CCU model accounts for, explains, or predicts a $T(z) = 2.73\ (1+z)$ K relation, velocity dipole distribution of radiogalaxies, the $(1+z)^{-1}$ dilation of SNe Ia light curves, the S-Z thermal effect, Olber's paradox, a $\sim(1+z)^{-3.56}$ modified Tolman relation, SN dimming for $z<1$, and brightening for $z>1$, extreme redshift ($z>10$) objects > BBC predictions, visible universe galaxies with high-Z element abundances independent of z, quasar redshift peaks with different $z_i \pm \Delta z_i$ intervals, a well-defined Hubble constant, $H=\sqrt{(4\pi G(2\rho_v - \rho)/3)}$, where ρ_v and ρ are vacuum and ordinary mass densities, galaxies receding from C at distances r with velocities $v=dr/dt$ due to vacuum gravity repulsion and redshifts given by $1+z = (1+Hr/c)/\sqrt{(1-2(Hr/c)^2)}$, where $H = v/r = (dr/dt)/r$. Thus, whereas in theory, BBC cosmologists claimed to believe in their mythical $H=(d\Re/dt)/\Re$ expression, in practice they mimicked my CCU model and envisioned galaxies receding with $v= Hr$ from our location, which is near the Center. Ironically then, they actually employed the CCU model to explain the Hubble redshifts, and that is why the big bang was able to impersonate the truth as long as it did.

[14]Robert V. Gentry, See Reports section of www.halos.com for my reports in *Science, Nature, Geophysical Research Letters, Annual Reviews of Nuclear Science* and *Physical Review Letters*, or the Appendix of my book *Creation's Tiny Mystery*, as described on the same website.

[15]E. R. Harrison, *Cosmology: Science of the Universe*, 1st ed. (Cambridge University Press, 1981) 275–6; and ibid., 2d ed. (Cambridge University Press, 2000), 363.

[16]Gentry and Gentry, "The Genuine Cosmic Rosetta."

[17]Harrison, *Cosmology: Science of the Universe.*

[18]Joseph Silk, *The Big Bang* (W. H. Freeman and Company, 1995), 417–29.

[19]Harrison, *Cosmology: Science of the Universe.*

[20]Gentry and Gentry, "The Genuine Cosmic Rosetta."

[21]Harrison, *Cosmology: Science of the Universe*, 363.

[22]Gentry and Gentry, "The Genuine Cosmic Rosetta."

[23]Charles W. Misner, Kip S. Thorne, and John A. Wheeler, *Gravitation* (W. H. Freeman and Co., 1973).

[24]Andrew S. Repp, "The Nature of Redshifts and an Argument by Gentry," *Creation Research Society Quarterly* 39 (2002): 269; http://creationresearch.org/crsq/articles/39/39_4/ Redshifts.pdf.

[25]Gentry and Gentry, "The Genuine Cosmic Rosetta"; Silk, *The Big Bang*; and Misner, Thorne, and Wheeler, *Gravitation.*

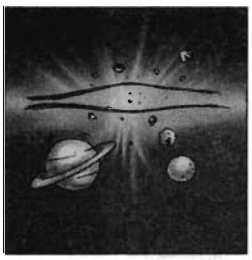
[26]Steve Carlip and Ryan Scranton, "Remarks on the 'New Redshift Interpretation,'" *Modern Physics Letters A*14 (1999): 71; www.arxiv.org/abs/astro-ph/9808021, v.2 (January 5, 1999).

[27]Gentry and Gentry, "The Genuine Cosmic Rosetta."

[28]Ibid.
[29]A. Einstein, "Die Grundlage der allgemeinen Relativitatstheorie," *Ann. der Physik* 49 (1916): 756. English reprint in *The Principle of Relativity* (Dover Publications), 111–64; See also *Relativity: The Special and General Theory* (New York: Crown Trade Paperbacks), 130.
[30]J. W. Brault, Abstract, "Gravitational Redshift of Solar Lines," in *Bulletin of the American Physical Society* 8 (1963): 28.
[31]R. V. Pound and J. L. Snider, "Effect of Gravity on Nuclear Resonance," *Physical Review Letters* 13 (1964): 539–40.
[32]C. O. Alley, "Proper Time Experiments in Gravitational Fields with Atomic Clocks, Aircraft, and Laser Light Pulses," in *Quantum Optics, Experimental Gravity, and Measurement Theory*, ed. P. Meystre and M. O. Scully (New York: Plenum Press, 1981), 343–424.
[33]Ibid. Alley writes:

> A common mistake in dealing with relativistic time was also made by one of the Air Force contractors in relation to the GPS. This is the notion that electromagnetic radiation changes frequency (or a photon changes energy) as it propagates through a gravitational potential difference. If the physical clock adjustments have been made as described above so that all clocks are keeping a common coordinate time, then there is no effect on the frequency of radiation as measured in that coordinate time. However, the contractor had included in the computer program to operate the system just such a correction, effectively correcting twice for the relativistic effects. Actual experience with test GPS equipment in orbit was required to persuade some engineers of their error.
>
> We should not be surprised at such lack of understanding of some fundamental concepts of General Relativity since the subject is almost never taught to engineers and rarely even to physicists. Also, confusion about these concepts is not restricted to engineers and others who must deal with ultra-stable clocks, but is widespread even among eminent physicists.
>
> Consider the following excerpts from *Relativity Re-examined* by Leon Brillouin (Academic Press, 1970): "... All the clocks at rest in our inertial frame will give the same frequency definition with or without gravity potential. The gravity shift is only due to the motion of the photons" (Brillouin, pp. 83–4).
>
> Our [Alley referring to his] experiments clearly contradict this statement. To his credit, at another place in the book, he wrote: "... [improved atomic clocks] would allow us to perform many important experiments that would tell us definitely what to think of relativity!" (Brillouin, p. 40).
>
> If Professor Brillouin were still living, perhaps he would accept our [Alley referring to his] experiments as convincing evidence for the correctness of Einstein's views on time (Alley, p. 424).

[34]Carlip and Scranton, "Remarks on the 'New Redshift Interpretation.'"
[35]J. H. Taylor, "Astronomical and Space Experiments to Test Relativity," in *General Relativity and Gravitation* (Cambridge University Press, 1987), 214.
[36]Einstein, *Relativity: The Special and General Theory*, 130.
[37]Rafael A. Vera, "A Dilemma in the Physics of Gravitational Fields," *International Journal of Theoretical Physics* 2, no. 1 (1981): 19.
[38]Silk, *The Big Bang*.
[39]Steven Weinberg, *Gravitation & Cosmology* (John Wiley & Sons, 1973), 451.
[40]John Peacock, *Cosmological Physics* (Cambridge University Press, 1999), 99.
[41]Misner, Thorne, and Wheeler, *Gravitation*.
[42]P. J. E. Peebles, *Principles of Physical Cosmology* (Princeton: Princeton University, 1993), 95.
[43]Weinberg, *Gravitation & Cosmology*.
[44]Peacock, *Cosmological Physics*.
[45]Weinberg, *Gravitation & Cosmology*.
[46]Peacock, *Cosmological Physics*.
[47]Weinberg, *Gravitation & Cosmology*.
[48]Peacock, *Cosmological Physics*.
[49]Repp, "The Nature of Redshifts and an Argument by Gentry."
[50]Silk, *The Big Bang*.
[51]Ibid.
[52]C. L. Bennett, et al., "First Year Wilkinson Anisotropy Probe (WMAP) Observations: Preliminary Maps and Basic Results," www.arxiv.org/abs/astro-ph/0302207.
[53]Ibid.
[54]Silk, *The Big Bang*.
[55]G. Haisinger, G. Schartel, S. Komasa, "Discovery of an ionized Fe-K edge in the **z=3.91** Broad Absorption Line Quasar APM 08279?5255 with XMM-Newton," *Astrophysics Journal* L77 (2002): 573. See note 2 for details why this quasar directly contradicts BBC's scenario for the properties of high redshift quasars.
[56]Robert V. Gentry, "A New Redshift Interpretation," *Modern Physics Letters A* 12 (1997): 2919; www.arxiv.org/abs/astro-ph/9806280.
[57]Robert V. Gentry, "New Cosmic Center Universe Model Matches Eight of Big Bang's Major Predictions without the F-L Paradigm." My earlier model, first presented at the 1982 Santa Barbara AAAS meeting, also involved a nearby universal Center. It is described in "Radiohalos in a Radiochronological and Cosmological Perspective," *Proceeding of the 63rd Annual Meeting of the Pacific Division, American Association for the Advancement of Science* 1, Part 3 (1984): 38, which is reprinted on pages 267–95 of the 4th ed. of my book, *Creation's Tiny Mystery* (see www.halos.com).
[58]Robert V. Gentry, "Election Implications of Censorship of Disproof of Big Bang Cosmology (BBC)," *Bulletin of American Physical Society* 49 (2004): 163. Depending on reader interest, I may yet post on www.orionfdn.org, proof of referee and editorial bias at the highest echelons of *Physical Review Letters* and other journals in suppressing publication of the discoveries described herein.
[59]I assume some readers will be interested in learning a few more details about how I reconcile my faith with science. I believe the Bible teaches God created all of the visible universe, including Earth and all its life forms during the six literal days described in Genesis and affirmed in Exod. 20:8–11, and that creation week occurred only about 6,000 years ago. Evidence for Earth's recent creation is given in my book at www.halos.com. The other question concerns how light from the most distant objects in the visible universe—about 14 billion light years in my new Cosmic Center Universe model—could have been seen by Adam and Eve on Day 6. I believe the record of glory coming from the Father to Christ on the Mount of Transfiguration, as recorded in 2 Peter 1:16–18, and Paul's record of Stephen gazing into heaven and seeing Christ standing at the right hand of the Father, as recorded in Acts 7:54–56, shows conclusively that the transit time of light from God's throne—which I believe is at the universal Center within the Galaxy—was exceedingly brief so as to accomplish the purpose at hand. Likewise I believe God utilized a similar physical process both during creation week and continuing thereafter to enormously reduce the transit time of light from distant celestial objects, so much so that I believe that light is arriving within a relatively short time after emission, even from the most distant reaches of the visible universe. This means we are seeing the universe almost in real time. I suggest radial changes in vacuum properties may cause light to tunnel rapidly from distant points to Earth. Alpha particle tunneling through the nuclear potential barrier is well known. The differences in time of arrival of light from different images of lensed quasars do not contradict this because the delays that are observed are differences in transit time, not a measure of the transit time itself. Lastly I believe the outer galactic shell, described in my CCU model as circumscribing the visible universe, is referenced in the Bible as the ancient heavens (Ps. 68:32, 33; RSV and NASB), which I believe are the result of a significantly earlier creation that also included angels as well as many worlds in those outer galaxies that were, like Earth, created to be inhabited by unfallen intelligent beings. The latter I associate with the sons of God referred to in Job 1:6 and 2:1. The fact that galaxies in the CUC model are physically receding from the nearby Center agrees with a universe that is described as being stretched out at creation (Isa. 40:22; 45:12 and 51:13). More details will be given later.



Reply to Gentry on Cosmological Energy Conservation and Cosmic Expansion

J. Brian Pitts

While by now Gentry is acquainted with the claim that the energy lost by photons is gained by the gravitational field, he mistakenly believes that this claim needs independent testing and that it could be refuted independently from the rest of Einstein's theory of gravity.

In reply to my recent criticism of his work, Robert Gentry has composed a long and energetic reply. Unfortunately he maintains the key erroneous claims that Big Bang cosmology violates energy conservation and that it relies on a confused notion of cosmic expansion. He also raises some additional matters, a few of which I will address. In particular, the issue of cosmology and young earth views will be discussed briefly.

Energy Conservation

While by now Gentry is acquainted with the claim that the energy lost by photons is gained by the gravitational field, he mistakenly believes that this claim needs independent testing and that it could be refuted independently from the rest of Einstein's theory of gravity. The fact that Gentry appeals to experiments in deciding whether a solution of the Einstein-Maxwell equations conserves energy indicates a failure to understand classical field theories such as Einstein's and Maxwell's. On the contrary, local energy conservation follows with *mathematical necessity* from the Einstein-Maxwell equations, for *every* solution of those equations. Experiments help to decide whether the Einstein-Maxwell equations describe the world accurately, but they do not decide whether a given solution of those equations also conserves energy. Gentry is confused in taking gravitational redshift experiments to have any relevance to energy conservation, and yet confidently relying on the Einstein-Maxwell equations as he appears to do.

To dispel these errors, it is necessary to review some classical field theory. Previously I observed that Gentry not only neglected to account for gravitational energy, but also neglected to address the literature on the subject. In that literature, one finds a wide variety of mathematical treatments of gravitational energy. When these treatments are applied to the issue of energy conservation for gravitation and electromagnetism combined, the result is that the combined energy of the gravitational and electromagnetic fields is conserved, but neither is conserved separately.

Perhaps the simplest and most familiar method for deriving the conservation laws is by deriving the densitized stress-energy-momentum tensor $T^{\mu\nu}\sqrt{-g}$ (t, x^i) for electromagnetism and corresponding densitized pseudotensor $t^{\mu\nu}\sqrt{-g}$ (t, x^i) for gravitation, which together form the stress-energy-momentum complex

$$\mathfrak{J}^{\mu\nu}(t, x^i) = (T^{\mu\nu} + t^{\mu\nu})\sqrt{-g}.$$[1]

(Each of these quantities forms symmetric 4x4 matrix of numbers at every point in space and moment of time. The indices μ and ν each take on all the values of 0, 1, 2, 3, where 0 represents time and 1, 2, 3 represent space. The coordinate x^0 is the time t.) Using the techniques of classical field theory, which have had a recognizably modern form for more than eighty years, there is a mathematical recipe for constructing tensors (with respect at least to Lorentz boosts and rigid translations) that represents the energy and momentum densities and flux densities. Making the standard assumptions that the laws of physics are the same everywhere and always,[2] and that these laws can be derived from a Lagrangian density function $\mathfrak{L}$, one can readily derive the form of the conserved quantities like energy and momentum using Noether's first theorem.[3] The sameness of physical laws at every

moment implies that the Lagrangian density $\mathfrak{L}$ is independent of time and leads to conservation of energy. The sameness of physical laws in every place implies that the Lagrangian density is independent of location and leads to conservation of momentum. The resulting energy and momentum are locally conserved as a consequence of the dynamical equations—in this case, the combined equations of Einstein's gravity and Maxwell's electromagnetism—for *every* solution of those equations, including the Robertson-Walker cosmological models used in Big Bang cosmology. One can write the local conservation of energy and momentum as $\partial \mathfrak{T}^{\mu\nu}/\partial x^{\mu} = \partial \mathfrak{T}^{0\nu}/\partial t + \partial \mathfrak{T}^{i\nu}/\partial x^{i} = 0$. Setting $\nu = 0$ gives the equation for local energy conservation alone:

$$\partial \mathfrak{T}^{00}/\partial t + \partial \mathfrak{T}^{i0}/\partial x^{i} = 0.$$

Gentry casts his energy nonconservation objection in terms of global rather than local conservation laws, so let us consider the relationship between the two. Global conservation laws say that the total amount of some physical quantity—energy, momentum, charge, or the like—collected over the entire volume of space, is constant over time. While such global laws are more familiar than local laws, modern relativistic field theory takes local laws to be more fundamental. A local conservation relation takes the form

$$\partial \rho/\partial t + \partial J^{i}/\partial x^{i} = 0,$$

where $\rho(t, x^{i})$ and $J^{i}(t, x^{i})$ are the density (amount per unit volume) and current density (amount flowing out through the boundaries of a small directed surface surrounding the little volume in question), respectively, for the energy, momentum, charge, or the like. This equation is called the continuity equation, and implies that energy (or momentum or charge) can disappear from a small region of space only by passing out through the surrounding imaginary walls. The local conservation of energy equation above takes the form of the continuity equation once one makes the identifications $\mathfrak{T}^{00} = \rho$, $\mathfrak{T}^{i0} = J^{i}$. The requirement of local conservation of energy is stricter than global conservation, which by itself would permit energy to disappear in Indiana and to reappear immediately in Georgia.[4] Furthermore, local conservation laws always make sense, whereas global conservations sometimes are meaningless, as will now appear.

One can try to add up all the energy (or momentum or charge) in the world by integrating the continuity equation over all space to get the rate of change of the conserved energy (or other conserved quantity) $E = \int dx \int dy \int dz\ \rho$. Using the divergence theorem, and letting the boundary surface be removed far outside the matter distribution gives

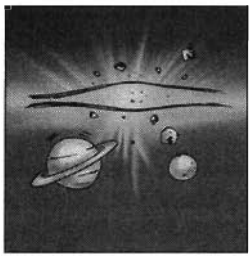
$$dE/dt + \int dS_{i}\, J^{i} = dE/dt = 0,$$

which shows that energy is conserved globally, if the matter distribution is bounded and the manipulations involving interchanges of mathematical limits hidden in the above expressions permit. However, in the standard cosmological models, matter is present everywhere, so the various limits might behave badly. Thus the integral E tends to diverge if there is nonzero energy density ρ everywhere throughout infinite space, as occurs in some of the cosmological cases at hand. Relevant work was done in the literature that my previous paper cited. Applying these lessons to cosmology, we find that Big Bang cosmologies satisfy global energy conservation insofar as it is meaningful—that is, as long as the mathematical limits behave suitably. If global conservation is not meaningful, then Gentry's objection is meaningless. In no case does there exist for Big Bang cosmology a meaningful notion of energy conservation, local or global, that is violated. Should Gentry venture to reject Einstein's equations, his claim would still be false, because any reasonable alternative theory will also be derivable from a time-independent Lagrangian density and so, like general relativity, it will have a local energy conservation law that holds for every solution of the field equations. The lack of novelty in my first paper refuting Gentry's claims is because the relevant results implicitly refuting them are already present in the specialist literature and disseminated in standard textbooks.

Although Gentry's energy nonconservation claim is demonstrably incorrect, the question of finite or infinite energy remains unsettled. One difficulty is that the energy-momentum complex $\mathfrak{T}^{\mu\nu}$ is not uniquely defined, in addition to worries about mathematical limits discussed above. More specifically, the energy-momentum complex suffers ambiguities from "superpotentials" or generalized curls, which are quantities that by themselves automatically satisfy the continuity equation.[5] One can therefore alter the distribution of energy and momentum in space and time without altering the total amounts of energy and momentum. This is a mathematical generalization of the vector calculus result that the divergence of a curl is zero, so specifying the divergence of a vector field leaves its curl unspecified. This ambiguity explains why it is unclear whether the energy for infinite-volume Big Bang solutions is infinite or zero. With this fact in mind, one can consider Gentry's reply to my refutation of his objection.[6] He writes of my previous paper:

> On one hand, he cites several GR authorities whose results support the concept of the universe's total energy being infinite. Then he cites other authorities in support of the total energy being zero. He admits not knowing which is true and is apparently not troubled by the possibility that this infinite difference may suggest a tremendous flaw in the underlying paradigm he uses to arrive at these results.[7]

On this point Gentry is correct: I am not worried about the status of classical field theory, Noether's first theorem, or tensor calculus. The only way that energy conservation could be threatened in a classical field theory is if the laws



Dialogue II: Big Bang Cosmology

Reply to Gentry on Cosmological Energy Conservation and Cosmic Expansion

of physics changed over time, but nothing of the sort holds for the Einstein-Maxwell field equations or any other plausible theory. The fact remains that, whether the energy is 0 and stays constant, or is infinite and remains infinite, Gentry's claim of violation of energy conservation is not true. In the first case, the claim is false; in the second case, it is meaningless.

Whether the energy is 0 and stays constant, or is infinite and remains infinite, Gentry's claim of violation of energy conservation is not true. In the first case, the claim is false; in the second case, it is meaningless.

Gentry comments:

> I do not think these alternatives require much comment from me except to say that his proposed solutions are quite imaginative and beyond the scope of modern science to realistically test them.[8]

It is disappointing that Gentry fails to notice when his position suffers a mortal wound. Be that as it may, my imagination plays little role in the argument. Rather, the relevant well-publicized mathematics, which Gentry persistently ignores, does all the work. Literature contrary to Gentry's claims continues to appear. Another paper that calculates the energy of some Big Bang models has recently appeared, with the conclusion that four different pseudotensor calculations give zero total energy.[9] Also a careful treatment of the Hamiltonian formalism for Big Bang spacetimes more realistic than the typical homogeneous toy models has been provided, according to which at least in some cases the energy is zero.[10]

Gentry cites four texts in defense of his claim of energy nonconservation in Big Bang cosmology,[11] but closer inspection shows that none of them provides a serious argument for such a claim. The case of Peebles' cosmology text was addressed in my earlier paper. The cited pages 423–5 of Silk's book say nothing about energy conservation, but when Silk discusses energy conservation on pages 100, 101 (albeit in a simplified way), he *affirms* it.[12] While Alpher and Herman do seem to assert that energy is not conserved in relevant cosmological models, this assertion is quite devoid of relevant argumentation, which would have to consider and refute the possibility that a gravitational contribution restores conservation.[13] Finally, Gentry cites Edward Harrison's generally admirable undergraduate cosmology text,[14] which indeed does assert that energy conservation is violated in cosmology.

Decisive justification for Harrison's claims must come from technical mathematics that accounts for possible gravitational energy contributions. But as we have seen, the detailed mathematics shows that energy conservation is satisfied in Big Bang cosmological models locally and, insofar as global conservation is meaningful, globally as well. Disappointing as it is for a fine undergraduate cosmology text to contain such an error, nevertheless it hardly suffices for Gentry to depend on a weakly argued claim in an undergraduate text in the face of detailed mathematical refutation in many journal articles and implicit refutation in standard graduate texts. Such a move is a bit like ignoring an atomic clock in favor of data from the telephone number for the time and temperature in running NASA's space program. Continued reliance on Harrison's authority would make sense if he were divinely inspired, if he were giving eyewitness testimony, or if he were blowing the lid on some conspiracy to which he was a party. But on this issue that is publicly understood in terms of rather technical mathematics, it does not make sense. Perhaps one problem is Harrison's effort to make thermodynamic arguments without including gravitational thermodynamics, a subject which has approached a mature form only in the last few years.[15]

The work of Vera in no way refutes the account given above of energy conservation.[16] Vera considers nonlocal situations with macroscopic rods and clocks of finite size. But the Noether field theoretic derivation of local energy and momentum conservation discussed above is more exact and fundamental: Noether's theorem is purely local (involving infinitesimal coordinate distances only), and uses an exact microscopic description in terms of classical field theory, not an approximate macroscopic description using rods and clocks which ought somehow to be built out of fields. (To be truly exact, one should of course use quantum rather than classical field theory, but that is beyond the call of duty.) Should any conflict arise between Vera's work and Noether's first theorem applied to classical field theory, the nonfundamental nature of the former implies that it, not the Noether field theoretic account, would have to give way.

Cosmic Expansion

Gentry's claim that the cosmic redshift is an arbitrary postulate is incorrect, because in fact the cosmic redshift (like energy conservation) is a consequence of the gravitational and electromagnetic field equations, in much the way that the Schwarzschild solution's terrestrial gravitational redshift follows.[17] Therefore the cosmic redshift also neither needs nor admits experimental testing in isolation from the rest of the theory and the assumed matter distribution.

Gentry makes various obscure claims regarding the Big Bang's cosmic expansion. For example, he claims that the cosmic expansion factor $\Re(t)$ is never measurable, and concludes that the equation involving the expansion factor and the wavelength of photons has no predictive value. Though the expansion factor is defined only up to an arbitrary multiplicative constant, the equation relating the expansion factor to photon wavelengths involves the *ratio* of the expansion factor at two different times. The overall multiplicative constant cancels out, so there is no difficulty in getting a prediction for the influence on wavelengths. Gentry's mysterious claim that I disagree with Misner, Thorne, and Wheeler's text regarding photon redshifting seems to be the result of his conjoining a statement of mine with an error of his own.

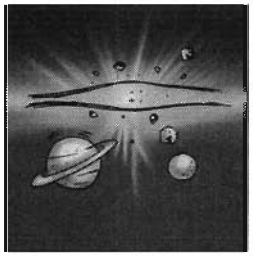
While it is difficult to uncover which of Gentry's errors are foundational and which are derived, I will attempt to do so. His older work makes a bogus distinction between two descriptions of what are in fact the same process:

> Was Einstein correct in postulating that different gravitational potentials at source and observer meant that clocks at these locations should run at intrinsically different rates, and hence that this was the origin of the gravitational redshift? Or did the measured redshift instead have its origin in photons experiencing an in-flight energy exchange with gravity as they moved in a changing gravitational potential in their transit from a star to the Earth?[18]

To Gentry, this distinction is an important physical question. In reality he is setting at opposition two standard alternative descriptions used for conservative forces in sophomore vector calculus and mechanics, transposed into a new context. For conservative forces, one can describe a process either in terms of what happens during the process, or in terms of the states before and after the process. Having erected this bogus distinction, Gentry deploys it so as to consider the possibility that these are two distinct processes, both of which conceivably might operate so as to give two gravitational redshifts. He writes in his recent reply to me: "(1) The Pound-Snider results show there is only one gravitational redshift between two points at different potentials ... and (2) this redshift does not originate with photons exchanging energy with gravity during transit through a potential gradient, but instead originates ..."[19] in effects dependent upon the potentials at the endpoints. Gentry's bogus opposition between equivalent descriptions of the same process encourages his misplaced emphasis on the significance of what goes on during photon emission and absorption processes.

To discuss the effect of the cosmic expansion on localized objects, one would consider a solution of Einstein's field equations that is a standard Big Bang solution on large scales, but with one or more local inhomogeneities. Objects such as stars, planets, and human bodies naturally violate homogeneity to some degree. One might use numerical approximations to get realistic approximate solutions, perturbation theory to get somewhat realistic and mathematically cleaner solutions, or exact but rather idealized solutions of Einstein's equations. The standard idealized model matches a Schwarzschild (uncharged, nonrotating) interior to a Big Bang exterior solution, while requiring the two solutions to match suitably at the boundary. Works discussing this question and its generalizations appeared in the 1930s and have continued to the present day, in some cases discussing the (generally nonexistent or negligible) influence of cosmic expansion on local systems.[20] Gentry cites the Noerdlinger-Petrosian paper, which is a good point of entry to the earlier literature, but rejects its relevance because "a close reading shows it is ambiguous in addressing the question of galactic expansion."[21] Presumably this ambiguity that Gentry finds is between redshifts as being due to expansion or to Doppler velocity effects. But as my previous paper discussed, this difference is merely conventional and linguistic, not physical, so Gentry's dismissal is unwarranted.

As it happens, this issue has been reconsidered by those using correct methods, and it has appeared that some of the earlier results are not as generally applicable as had been believed.[22] Some recent work found that there is an expansion effect on all scales—even stars and planets and trees—but it becomes negligible on small scales,[23] much as Noerdlinger and Petrosian found some time ago. Bonnor has considered a more general spherical scenario and found that cosmic expansion has no effect,[24] as well as a model atom for which the effect is negligible.[25] Mars and others have shown that spherical symmetry is indeed important in getting results along these lines, because they do not generalize to nonspherical exact solutions.[26] As Mars notes, a satisfactory treatment involving nonspherical systems embedded in the cosmic expansion will likely require techniques besides exact solutions. When proper techniques are applied to Gentry's question, it turns out that the issue is less resolved than was once believed. But many partial results, old and new, indicate that cosmic expansion has little or no effect on small distance scales and so support the conventional view, whereas Gentry provides no good reasons to doubt it.



Dialogue II: Big Bang Cosmology

Reply to Gentry on Cosmological Energy Conservation and Cosmic Expansion

Despite the tension between time scales, there seems to be no compelling reason for young-earth advocates to reject the bulk of Big Bang cosmology, stellar evolution, and the like. Instead it would be preferable to make minor modifications to the orthodox astrophysical theory to achieve consistency with the interpretation of Scripture.

Should There Be a Distinctive Young-Universe Cosmology?

In his introduction, Gentry reveals some important features of his theologically influenced philosophy of science. But even granting Gentry's literal six-day creation premise, the existence of scientific flaws in Big Bang cosmology as an evolutionary paradigm does not follow. Given that literal six-day creation should be manifest somehow or other, why should it be through *scientific* flaws in Big Bang cosmology? For example, Big Bang cosmology might be empirically adequate and internally consistent, but just false as a history of the universe, as demonstrated by comparison with the true literal six-day story in Scripture. For Gentry to demand that the falsehood of Big Bang cosmology be manifest by ordinary scientific standards appears to be a form of scientism. He neglects various philosophical issues, such as the scientific realist *vs.* antirealist controversy and the question of presuppositionalist *vs.* evidentialist apologetics, and so is forced to find nonexistent scientific flaws in Big Bang cosmology.

Despite the tension between time scales, there seems to be no compelling reason for young-earth advocates to reject the bulk of Big Bang cosmology, stellar evolution, and the like. Instead it would be preferable to make minor modifications to the orthodox astrophysical theory to achieve consistency with the interpretation of Scripture. In his philosophically sophisticated defense of a young-earth view,[27] John Byl concludes that young-earth cosmologies must include some notion of mature creation, though such might involve process rather than or in addition to instantaneous *fiat*. Young-earth advocates more given to scientific than philosophical defenses are increasingly coming to take orthodox astrophysics seriously,[28] at least in intent if not always execution.[29] The respectful attitude of Faulkner and DeYoung toward stellar evolution is noteworthy in comparison to attitudes of a previous generation.[30] But what better alternative theory to stellar evolution could a young-earth advocate find than stellar evolution itself?

Probably the best bet for young-earth advocates is to allow for an old universe with the help of miraculous time dilation on and near the earth, while the distant heavenly bodies behave much as standard cosmology asserts. This move combines types 3 and 5 in John Hartnett's taxonomy for addressing the problem of seeing distant stars on a young earth.[31] In that case, unlike stories of light created in transit, the story about the past given by the cosmological model is largely *true*, not merely empirically adequate. Such a view would largely demilitarize the field of astronomy, as far as issues of Genesis chronology are concerned, to the benefit of both Christianity and science.

Appendix

Returning to the case of electromagnetic and gravitational fields, for some purposes it might be useful to distinguish (somewhat artificially) among pure gravitational energy, an interaction term between gravitation and electromagnetism, and pure electromagnetic energy. The pure gravitational energy does not depend explicitly on the electromagnetic four-vector potential A_μ, and is represented in the pseudotensor $t^{\mu\nu}\sqrt{-g}$. The gravitational-electromagnetic interaction energy and the pure electromagnetic energy are both represented in $T^{\mu\nu}\sqrt{-g}$. One could separate them using an auxiliary background metric $\eta_{\mu\nu}$, so that the purely electromagnetic piece depends on $\eta_{\mu\nu}$ and A_μ but not the dynamical curved metric $g_{\mu\nu}$, whereas the interaction term depends on $g_{\mu\nu}$, $\eta_{\mu\nu}$ and A_μ. (It has been argued that proper treatment of conservation laws requires a background metric.[32]) In this way the gravitational-electromagnetic system looks more like traditional systems with an explicit interaction term between the fields. Thus a Newtonian limit, giving photons kinetic and potential energies, such as Silk uses, is facilitated. Moreover, a useful distinction between the Schwarzschild and cosmological redshift cases might be drawn to nuance the statement that lost photon energy is transferred to the gravitational field. In the Schwarzschild case for the redshifting of light in the gravity of a localized body, one expects the purely gravitational energy in $t^{\mu\nu}\sqrt{-g}$ not to change over time (there being a timelike Killing vector field); then there should be only conversion between the purely electromagnetic and the

interaction energies within $T^{\mu\nu}\sqrt{-g}$. By contrast, one expects even the purely gravitational energy in $t^{\mu\nu}\sqrt{-g}$ to change over time in the cosmological case. ◈

Acknowledgments

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Notes

[1]James L. Anderson, *Principles of Relativity Physics* (New York: Academic, 1967); and Hans Stephani, *General Relativity*, second edition (Cambridge: Cambridge University, 1990).

[2]Naturally Christians will wish to make exceptions for divine miracles, such as the creation of the world and the incarnation and resurrection of Christ, but these exceptions are not relevant for the purpose at hand.

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[17]Robert M. Wald, *General Relativity* (Chicago: University of Chicago, 1984), sections 5.3, 6.3.

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[19]Gentry, "Collapse of Big Bang Cosmology."

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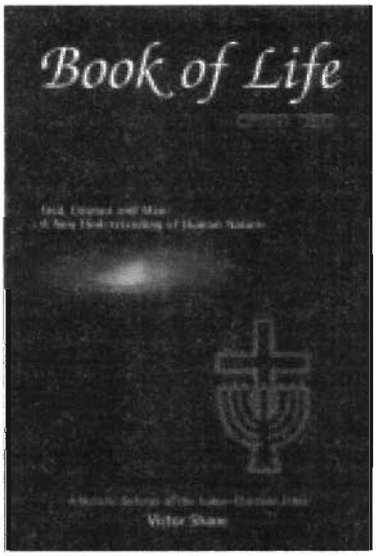

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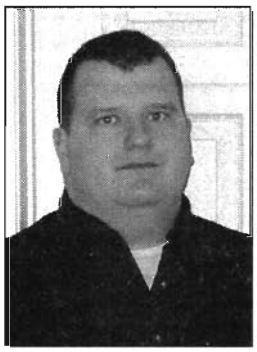
What Intelligent Design Does and Does Not Imply

James Madden and Mark Discher



James D. Madden

The authors believe that the debate between theological critics of intelligent design theory, best represented by Howard Van Till, and proponents of such views is often predicated on a false dichotomy between methodological naturalism *and* interventionist creationism, *and this way of casting the issue leads to errors on both sides. We argue that there are other explanations besides the theory of an interventionist designer which are equally capable of accounting for the intelligent design scientist's findings, and* the scientific findings themselves do not favor any of these options over any others. *Nobody may simply help himself or herself to interventionism on the basis of intelligent design findings. Furthermore, objectors such as Van Till are mistaken inasmuch as they take intelligent design proponents to task for advocating a theory that supposedly requires an interventionist designer. In short, theological objections to intelligent design are at best premature.*

The ID theorist claim[s] that the scientific evidence suggests a designer who has manipulated the matter at some point(s) in the course of history [while] objectors ... claim that the notion of such an interventionist designer is theologically unnecessary and cumbersome.

Howard Van Till has repeatedly thrown down the gauntlet to proponents of the Intelligent Design (ID) movement.[1] He asks them to distinguish between the mind-like sense of design and the hand-like sense of design, and then to specify which type of design it is that the proponents of ID are talking about in their theory. Mind-like designing is designing in the conceptualizing, blueprint-making sense. Hand-like design is design in the sense of fabricating, constructing or assembling. Van Till is prepared, with his Robust Formational Economy Principle, to grant design in the former sense, but he takes ID theorists to task for suggesting that there has been design in nature, and in particular in biological structures, in the latter sense.

On Van Till's view, nature has had within itself since the initial singularity all of the potentiality and wherewithal to bring about the entire array of things in existence, including human beings and consciousness. ID theorists, on the other hand, claim that matter and the laws that govern matter are not sufficient by themselves to have brought about by chance at least some of the highly specified and complex systems and structures that are to be found in nature. But if ID scientists are correct, how is it precisely, Van Till wants to know, that this hand-like assembling takes place? If the designer has not equipped creation at the beginning with all of the potential to develop into what we see around us, then, Van Till claims, the ID proponent is committed to saying that the designer has intervened along the way; he has engaged in hand-like tinkering with the materials through some act(s) of organizing and assembling them. But Van Till thinks that this purported implication of ID is theologically offensive, because it is unnecessary. Since it is, on Van Till's view, perfectly theologically acceptable to posit that creation was fully-gifted by the creator at the beginning, and since such a theory is simple, there is no need, he argues, for IDers to try to demonstrate subsequent intervention. So, the debate has been cast in terms of the ID theorist claiming that the scientific evidence suggests a designer who has manipulated the matter at some point(s) in the course of history against objectors such as Van Till who claim that the notion of such an interventionist designer is theologically unnecessary and cumbersome.

We believe, however, that this debate is predicated on a false dichotomy. As it stands,

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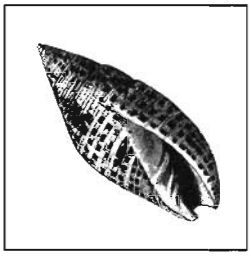


the way the debate has been cast is between practical materialism (what often travels under the moniker of *methodological naturalism*), and interventionist creationism, the idea that (at least some) biological structures have required hand-like tinkering by a designer. We believe that framing the discussion in this way is likely to lead to errors on both sides. On the one hand, ID proponents are mistaken to the degree that they suppose that something like hand-like manipulation of the material is entailed by their scientific findings—assuming that their findings are, in fact, empirically sound.[2] We claim that (sound) ID science neither entails nor implies any such thing. As we shall see, there are other explanations besides the theory of an interventionist designer which are equally capable of accounting for the ID scientist's findings, and *the scientific findings themselves do not favor any of these options over any others.* Therefore, it is not necessary that the ID proponent assume that he is saddled with the task of explaining a process of "hand-like manipulation or assembling." Furthermore, it is inappropriate for Van Till to press ID proponents to do so. It is not necessary to infer "hand-like" design from the evidence the IDer will use to support his claim.

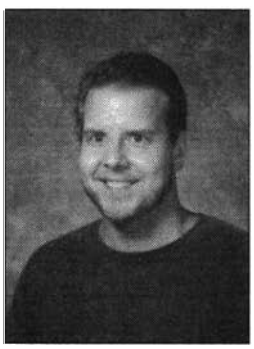
On the other hand, we believe that in this particular case Van Till is committing an error by raising theological objections to the purported empirical findings of ID. Although we applaud Van Till's willingness to bring the demands of Christian faith to bear on his evaluation of ID, we take this particular instance to be methodologically unsound. Because the advocates of ID purport to be engaged in a scientific enterprise (and we see no reason not to take them at their word) the questions concerning their empirical findings are just that—empirical. Hence, it is inappropriate for Van Till to object to such findings on the basis that they are to him theologically distasteful. The question as to whether a plausible (broadly) materialist explanation for biological complexity can be given is a question that should be kept separate from questions concerning how it might be that a creator relates to his creation.

In what follows, we will proceed in three phases. First, we shall offer arguments for what we take to be the legitimate expectations for a successful ID project. In short, we argue that ID is best construed as a materialism defeater, and not a positive case for any particular form of nonmaterialist explanation. Second, we shall discuss the relationship between the nonmaterialist modes of explanation that would become live options if ID's scientific enterprise is successful. We conclude that the adoption of any one of these possible models of explanation would require a radical rethinking of the basic materialistic assumptions of biological science and therefore would require broad scientific, philosophical, and theological dialogue. The results of that dialogue, we maintain, are an open question—even for the orthodox Christian believer—and therefore it is premature to reject ID on the basis of any presumed results of this wider debate. Finally, we shall offer two principles for how the ID debate should proceed from here, which we believe will assist in ensuring that the dialogue is positive and constructive.

ID Theory: A Materialism Defeater and not a Theistic Proof

Part of our main thesis is that the empirical deliverances of a successful ID would primarily constitute an argument sufficient to undermine materialism but insufficient for determining which nonmaterialist explanation of biological origins is most plausible. Hume cautioned us to restrain the conclusion(s) of any teleological argument to match closely the evidence it cites. For example, it is difficult to justify belief in an omnipotent, omniscient, and perfectly good being based on the evidence of design alone. The evidence adduced by the ID theorist is quite consistent with a variety of designers with various competencies and moral proclivities. Thus, we cannot say that ID, if successful, proves the existence of God, or for that matter any particular theory of creation or divine causality, e.g., interventionist creationism. Such considerations, we take it, are part of what led Michael Behe himself to express

Part of our main thesis is that the empirical deliverances of a successful ID would primarily constitute an argument sufficient to undermine materialism but insufficient for determining which nonmaterialist explanation of biological origins is most plausible.



Mark Discher

Mark Discher *received a B.A. from Wheaton College (Illinois), an M.Div. from Fuller Theological Seminary, an STM from Yale Divinity School, and a D.Phil from Oxford University. He is presently a member of the faculty of philosophy at the University of St. Thomas in St. Paul, Minnesota where he continues to work in the field of ethics generally, and in particular on the question of how God's commands might ground moral obligations. He was received into the Catholic Church on Easter Sunday morning in April of 2000. His email address is: MRDISCHER@stthomas.edu.*

We submit [interventionist creationism, atheistic panpsychism, and Aristotelianism] as evidence for our thesis that there are multiple metaphysical theories which can support the findings of a successful ID hypothesis, but no one of which is entailed or implied by any body of empirical evidence.

great restraint when proposing the implications of his own ID arguments. As Behe puts it, his argument "is limited to design itself; I strongly emphasize that it is not an argument for the existence of a benevolent God" and "questions about whether the designer is omnipotent, or even especially competent, do not arise in my argument."[3]

But even this is not modest enough. While it is commendable that the likes of Behe desist from making claims concerning the attribute(s) of the purported designer, we argue that it is illicit and goes beyond the scientific evidence to posit at this point any designer at all. Even though careful ID theorists may refrain from drawing robust theological conclusions from their empirical work, they do at times seem to believe that they have delivered strong evidence of some sort of designer. However, as long as ID theory is taken to be part of a *scientific* research program, we maintain that the ID theorist, *even if his science is sound, cannot help himself to a designer based on the empirical evidence alone.* Indeed, if theism were true, we might well expect the sort of empirical phenomena that ID theory cites as evidence to obtain. However, *we would also expect much the same phenomena to obtain if any one of a variety of other nonmaterialist theories of origins were to be true.* While positing a designer would be sufficient for accounting for the design that a design theorist might uncover (recognize, encounter), it is not necessary; our aim is to point out that there are other live metaphysical options available for accounting for design. We submit the following as evidence for our thesis that there are multiple metaphysical theories which can support the findings of a successful ID hypothesis, but no one of which is entailed or implied by any body of empirical evidence.

a. *Interventionist Creationism.* The notion that there is an omni-competent deity that involves itself occasionally in the natural history of the universe is consistent with the evidence cited by ID. One would expect to find in nature the sort of phenomena the IDer points to on the assumption of interventionist creationism. So interventionist creationism is one possible metaphysical explanation of a successful ID scientist's data. But the scientific data themselves neither entail nor even imply that this is the correct metaphysical account of the empirical data.

b. *Atheistic Panpsychism.* Some prominent philosophers of mind, e.g., Thomas Nagel and Mary Midgely, attempt to account for consciousness by supposing that at the most basic level physical particles have nonphysical, mental properties. One could also adopt such a pansychic theory in order to explain bio-complexity. According to such a theory, the structure of organisms is the product of intrinsic intentional states had by otherwise inert fundamental particles. That is, if we were to take the supposed mental properties of fundamental particles as being intentional states, then it seems we can build a nonmaterialist (although broadly naturalistic) theory of natural teleology, which would not necessarily commit us to the existence of a designer. It might strike us at first as being wildly implausible, but it is neither more nor less supported by the empirical evidence than any other nonmaterialist position. As we have said, none of these metaphysical theories is either implied or excluded by the findings of a successful ID science.

c. *Aristotelianism.* Historically, followers of Aristotle have believed that each organism has an immaterial component, a "form." It is in virtue of its form that an organism is structured in a certain way such that it is a member of a natural kind. Irreducible complexity, so the Aristotelian might argue, could then be accounted for by the influence of the organism's form. Since Aristotelian forms are not empirically detectable, Aristotelianism is underdetermined by any scientific research program. Although Aristotelianism suffered a set-back following the scientific revolution, it is increasingly an option that contemporary metaphysicians and philosophers of science, including nontheists, are willing to consider.

In claiming that each of these models is a live option[4] and is equally supported by the empirical evidence adduced by ID proponents, we are not suggesting that the ID scientist is not allowed to go beyond the empirical data by giving reasons either for or against one of these explanatory models. (Indeed, the scientific enterprise, when construed on any but the most facile positivist models, requires the scientist to go beyond the empirical data.) We are only insisting that successful ID science itself does not imply any one of these options over any other; a scientist who accepts ID is within his

intellectual rights to accept any one of these nonmaterialist models, assuming that an ample metaphysical case can be made in its favor. Given this, it is an error for the likes of Van Till to reject ID because of its association with interventionist creationism.

Of course, the question arises at this point as to what intellectual work ID might do, if it ultimately does not recommend any one theory of origins. Our answer, in short, is that a successful ID theory would limit the range of plausible explanations of bio-complexity by eliminating any theory that relies upon strictly materialist presuppositions. By materialism we mean the view that *efficient* and *material causes* along with precise laws of nature are by themselves sufficient to explain and predict all phenomena in the natural world; it is the view that we do not need to include anything in our explanation of how things in nature operate and why they are arranged in any particular way that is not empirically observable and mathematically calculable.[5] If ID succeeds against the variety of *scientific objections* arrayed against it, then it seems to give strong evidence that materialism is false. At a minimum, then, even if ID ends up offering no significant constructive scientific proposals, it will have provided the invaluable service of defeating materialism and opening us up to seeking nonmaterialist explanations for all that for which materialism cannot account. Our claim is only that ID limits or narrows the options by defeating materialism. If and when materialism has been defeated, there is then a host of different nonmaterialist models of explanation that become live options.

Biology Beyond Materialism

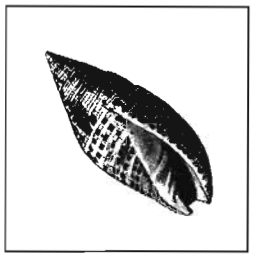
If it were the case that ID science made a legitimate claim that Darwinian natural selection is in principle unable to explain the occurrence of certain instances of bio-complexity, then, assuming that some version of Darwinian natural selection is the best materialist explanation of bio-complexity available and that we cannot really envision a materialist replacement for this theory, we would be left with a dilemma in choosing between the following two options: (1) We could accept a version of "promissory note materialism," and in lieu of giving an explanation simply bank on the historical precedent of scientific progress to deliver at some point in the future a full materialist account of biological origins; or (2) We could recognize the need to rethink the materialistic presuppositions of the life sciences and attempt to construct and defend a nonmaterialist model of reality that explains biological complexity.

As for (1), one may worry whether life is too short to wait to see whether the materialist will make good on this promise. As long as the materialist's fulfillment of the promise is outstanding, we may wish to grant to the IDers that, *if they can successfully defend their evidence in the scientific arena,* materialism has been defeated, and biologists, as a result, need to rethink the materialistic assumptions of their discipline. Assuming that ID is scientifically credible and that there is currently available no plausible alternative to Darwinian natural selection that can serve to do the same theoretical work for the materialist, it seems reasonable to reject the materialist's promissory note. Without at least some broad outline of what a non-Darwinian account would look like, we are well within reason to reject materialism. Of course, if it does turn out to be the case that further down the road more evidence comes to light and the materialist can make good on his promise to give a plausible and reasonably complete explanation of biological complexity, then we are always within our intellectual rights to revise our commitments by rejecting ID and adopting a materialist perspective. As open and honest seekers of the truth, we must go where the evidence leads. But for the present, a successful ID program would force us to entertain (2).

If we do relinquish the current materialistic paradigm, then it would be at this point that the scientific enterprise becomes theoretical rather than merely empirical ...[since] the empirical data are insufficient to determine which nonmaterialist model of explanation is to be preferred.

It is important to notice, however, that, if we do relinquish the current materialistic paradigm, then it would be at this point that the scientific enterprise becomes theoretical rather than merely empirical; we would no longer be strictly within the domain of empirical science. The reason for this is that the empirical data are insufficient to determine which nonmaterialist model of explanation is to be preferred. In short, the data underdetermine theory.

Of course, this instance of the data underdetermining theory is not a special case. The scientific enterprise regularly involves more than, and extends beyond, strict empiricism. Nevertheless, in the wake of a successful ID program, the need for rethinking the basic materialist assumptions of modern biology would take us far beyond the usual data-theory gap accepted as a matter of course by scientists. Normally the scientist has available to him



Our first principle [for mediating the ID debate] is that all parties to the debate need to see ID primarily as a materialism-defeater, and not as a positive case for a designer. ... our second principle ... [is that] the empirical case must be the primary concern in the debate for and against ID.

a basic stock of concepts and methodological standards by which to judge the plausibility of a theory beyond its adequacy to the empirical data. Successful ID, however, would rob the biologist of many of these relevant tools, and some of the standards of theoretical plausibility would be open for revision. As such, options such as interventionist creationism, pan-psychism, and Aristoteliansim, which were previously beyond the pale for legitimate biological explanation (as we put it above, "wildly implausible" for the biologists), would need to be reevaluated in terms of their philosophical coherence and explanatory power. At such times of paradigm shift (to borrow a tired and overused phrase), the scientist must appeal to broader intellectual fields than that of his or her specific area of scientific expertise.

In short, the biologist, in the wake of a successful ID program, must make use of the results of inquiries that go beyond the region of biological inquiry. It is at this point that together we, as scientists (practitioners of the physical and biological sciences alike), philosophers, and theologians, would need to engage in the revision of the basic presuppositions of inquiry in the life sciences in an effort to articulate new standards of plausibility. Successful ID would require the debate among scientists in general and biologists in particular to be opened to include the insights of theology and philosophy.

Thus, in a sense Van Till proceeds properly by offering theological and philosophical arguments, not without force, against the plausibility of interventionist theism. For, assuming that ID is successful, those are the arenas in which this debate will ultimately be played out. However, Van Till is hasty in assuming that a successful ID entails an interventionist designer, for the results of this interdisciplinary rethinking of foundations are yet to be determined. Serious thinkers can be found who advocate each of the models we have mentioned above, and we are a long way from seeing which will gain consensus. It is important to keep in mind the rich debate that is being had about these matters before the issue is deemed settled. To assume beforehand that the matter has been settled in favor of an interventionist designer will likely lead one to ascribe a position (and its attendant difficulty) to the IDer which he need not hold.

Two Principles for Mediating the Debate

We believe that our arguments offer a number of points that will help organize the ID debate hereafter. Our first principle is that all parties to the debate need to see ID primarily as a materialism-defeater, and not as a positive case for a designer. Although both sides need to exercise restraint in what they take the results of ID to be, we think that it is particularly important point for the ID advocate to recognize this. Because there is a spectrum of live metaphysical options to consider, the "design" scientist cannot automatically assume the existence of a designer. By conceding this, the ID proponent will be in a better position to defend the scientific legitimacy of his work. This sort of theoretical modesty is bound to repay the ID advocate with a much stronger theory, a theory that can be defended on all planes of intellectual inquiry—scientific, metaphysical, and theological. As far as we know, prominent members of the ID movement have not claimed that an interventionist designer is entailed by their purported scientific findings, but we believe that matters would be helped if this point were given greater clarity and emphasis.

Interpreting ID as primarily a case against materialism will also help clarify the issue for the critic such as Van Till. The evidence for or against ID stands in need of response on strictly scientific grounds, regardless of whether or not it is deemed theologically acceptable. For it could turn out to be the case that, even if ID is theologically odious, the scientist may nevertheless need to accept it, if that is the direction that the inquiry goes. In such situations, the scientist may need simply to leave the theological problems for the humanist disciplines to sort out. In other words, theological objections do not serve to deter ID once it has been framed as being primarily a scientific program and materialism defeater.

This brings us to our second principle for mediating the ID debate. The empirical case must be the primary concern in the debate for and against ID. Since none of the philosophical and theological worries arise unless ID is scientifically successful, strictly scientific issues should at this point be the focus of concern.

If we are correct that the empirical issue is of paramount concern, then Van Till's motives for attacking the alleged interventionist designer of the ID movement are wrong-headed. It looks to us as though Van Till (and others who might hold a position similar to his) want to have a perspective on biological science that begs an important question. He assumes that the correct (best) theory will be one that is compatible with orthodox Christian theism and at the same time (broadly) materialistic. While such a theory may turn out to be precisely what is required, it is illicit for Van Till to assume this a priori without giving ID a fair chance to defeat even this broad sort of materialism. Although it is possible that a broadly materialist perspective is compatible with traditional Christian theology, it does not follow from the mere possibility of compatibility that a broad materialism is true. Whether it is true or not will depend upon whether ID can serve as a materialism defeater. Whether ID will succeed in that capacity, it is too early to tell. But since Van Till is an open and liberal-minded seeker of the truth, there is no reason for him to foreclose on ID's scientific project ahead of time by ruling out by way of theological and philosophical commitments the possibility that even a broad materialism may be false.[6] ◈

Notes

[1]See, for example, Van Till's "Is the Creation a 'Right Stuff' Universe?" in *Perspectives on Science and Christian Faith* 54, no. 4 (2002): 232–48.

[2]Our claim is not that any ID theorist has accepted this dichotomy, although we will later note a case in which we believe Michael Behe has illicitly helped himself to the notion of a designer. Rather we are only out to warn against the temptation of this interpretation of the ID project by both its proponents and opponents.

[3] Michael Behe,"The Modern Design Hypothesis: Breaking Rules," *Philosophia Christi*, Series 2, vol. 3, no. 1, 165.

[4]We do not mean to limit the options to just these; there are certainly many more.

[5]We limit the scope of this definition to phenomena above the quantum level. As such we remain agnostic as to whether indeterminacy at the quantum level of analysis provides a counterexample to materialism as we define it.

[6]Special thanks to Prof. Martin Curd for his critical comments on an earlier draft of this paper. We are also quite indebted to the detailed criticism we received from blind reviews from *Perspective on Science and Christian Faith*. It is likely that they still do not agree, but our thoughts are much clearer for having had the opportunity to entertain their criticism. Any mistakes are solely the authors' responsibility.

ASA Plans Its 60th Annual Meeting

IPSWICH, MA: The 2005 ASA Annual Meeting will be held August 5–8, at Messiah College, Grantham, PA. The theme of the meeting is: "Alternative Energy Resources, Conservation, and the Environment."

The program chair is Kenell Touryan from the National Renewable Energy Laboratory of the USDOE assisted by Jack Swearengen, and local arrangements co-chairs are Edward Davis and Gerald Hess from Messiah College.

We have four plenary speakers who are experts in alternative energy technologies, conservation, and the environment: (1) Stan Bull, Ph.D., Associate Director, National Renewable Energy Laboratory (NREL), Golden, CO; (2) George Sverdrup, Ph.D., Manager, USDOE Hydrogen Program at NREL; (3) Robert Wauzzinski, Ph.D., Associate Professor of Philosophy and Religion, Ball State University, author of *Discerning Promethius: The Cry for Wisdom in our Technological Society* (Rosemont, 2001). Held Lindeman Chair in Philosophy of Technology at Whitworth College, and has published papers in *Perspectives on Science and Christian Faith*; (4) Egbert Schuurman, Ph.D., Professor and Chair, Department of Christian Philosophy, Technological Universities of Delft and Eindhoven, Netherlands, author of numerous books and articles on technology and ethics from a Christian perspective. Schuurman is also a graduate engineer.

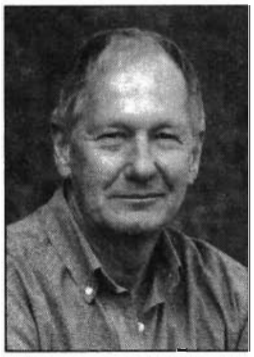
The alternative energy resources will include solar energy (solar thermal and solar electric), wind, biomass (bio-gas; biodiesel; ethanol, heat, etc.), geothermal, hydrogen and distributed systems, including hybrid systems (for example, renewable energy with diesel backup) for the developing and underdeveloped world countries. Bull and Sverdrup will be speaking on renewable energy resources/technologies, conservation and hydrogen, Wauzzinski and Schuurman will speak on the limits of technology and how alternative energy resources, conservation, and environmental care provide a biblical framework for technology.

There will be related sub-themes, such as environmental ethics and climate change. In fact, what is exciting about this annual meeting is that attendees will be confronting and wrestling with several of the critical issues raised in Ken Touryan's article, "ASA in the 21st Century: Expanding Our Vision for Serving God, the Church, and Society Through Science and Technology" (*PSCF* 56, no. 2 [2004]: 82–8).

The site of the annual meeting will be on the Messiah College's scenic main campus, located on 400 beautiful rolling acres in the suburban town of Grantham, in south central Pennsylvania, a 30-minute drive from the Harrisburg International airport and a 1½-hour drive from Baltimore International airport. Tourist attractions include among many others: the National Civil War Museum, Civil War Gettysburg, Hershey Chocolate World and Amish Country.

Is the ID Movement Capable of Defeating Naturalism? A Response to Madden and Discher

Howard J. Van Till



Howard J. Van Till

Are Madden and Discher ... warranted in charging me with an error for "raising theological objections to the purported empirical findings of ID"?

Madden and Discher are correct, I believe, in arguing that the scientific program of the ID movement is inherently incapable of developing a positive case for any particular non-naturalistic world view. I also concur with these authors that ID's scientific case should be judged on its scientific merits independently of ID's close association with divine interventionism. However, when I perform the scientific critique that Madden and Discher invite, I am led firmly to the conclusion that the ID movement's scientific strategy is wholly incapable of accomplishing its goal of defeating naturalism.

James Madden and Mark Discher are correct in noting that I have often asked advocates of Intelligent Design (ID) to be more clear and candid about the kind of action they intend to denote by the terms *design* and *intelligent design*.[1] I have also cited (a) the mind-like action of purposefully conceptualizing and planning something, and (b) the hand-like action of forming or assembling something, as the two categories of action that are most relevant to the issues of concern to the ID movement.[2] Furthermore, I indeed have frequently expressed my preference (without categorically precluding other possibilities) for envisioning the universe as having been fully equipped by God with a *robust formational economy*—a universe possessing all of the physical resources, all of the formational capabilities and all of the structural and functional potentialities needed for the natural formation of every kind of structure, system, and organism that has appeared in the universe's formational history. (I use *natural* here in the specific sense of *by creaturely action that does not need to be supplemented by divine, form-imposing intervention.*)[3]

Madden and Discher are also justified in contrasting my preferred view of the universe with the view proposed by ID advocates by noting that "ID theorists, on the other hand, claim that matter and the laws that govern matter are not sufficient by themselves to have brought about by chance at least some of the highly specified and complex systems and structures that are found in nature."[4] One essential clarification of terminology must, however, be made. As it is here used, the term *by chance* has the considerably less than obvious meaning, *by the joint effect of all natural causes, both known and unknown*.[5] Indeed, the scientific success of the ID movement hangs on whether it will ever be able to demonstrate from empirical evidence that the system of natural causation is inadequate to bring about the forming or assembling of particular biotic structures.

But are Madden and Discher also warranted in charging me with an error for "raising theological objections to the purported empirical findings of ID"? No actual example of such an error is cited from my writings, so it is difficult for a reader to eval-

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uate their charge.[6] I indeed have criticized theological dimensions of the ID movement on theological grounds.[7] I also have criticized key scientific claims of the ID movement on scientific grounds.[8] However, I do not recall criticizing ID's *scientific* argumentation on *theological* grounds.

The Goal of the ID Movement

Madden and Discher argue that the ID movement is inherently incapable of developing a positive case for any particular "nonmaterialist" approach for explaining empirical evidence and that the movement instead should be content to focus on the more modest goal of becoming a successful "materialism defeater." I am inclined to agree with the first part of this assessment, but I will argue below that success as a "materialism defeater" is impossible to achieve by ID's scientific strategy. In agreement with Madden and Discher, I believe that the ID movement can never hope to identify the particular designing agent (or the particular nonmaterial aspect of the universe) that is responsible for forming certain biotic structures that ID theorists judge impossible to form by the system of natural causes alone. But in their references to the religious implications of their program, ID advocates themselves sometimes make similar disclaimers, so I see no need to dwell on this point here. I heartily agree that specifically *scientific* claims made by ID theorists should be evaluated on their *scientific* merits. The ID movement's success as a "materialism defeater" is wholly dependent on its ability to make its scientific case. If that scientific case cannot be made, however, then the movement has no basis whatsoever for asking that the concept of "intelligent design" be presented as an alternative to mainstream science's understanding of biotic evolution in a pubic school *science* classroom. *Public school board members and legislators need to know this.*

But if we wish to evaluate whether or not ID theorists have been, or will ever be, successful as "materialism defeaters" (Madden and Discher's term), we must know with some precision what package of views is included under the rubric of "materialism." Consequently we must pay careful attention to Madden and Discher's actual words when they define this term. "By materialism," they say:

> We mean the view that *efficient* and *material causes* along with precise laws of nature are by themselves sufficient to explain and predict all phenomena in the natural world; it is the view that we do not need to include anything in our explanation of how things in nature operate and why they are arranged in any particular way that is not empirically observable and mathematically calculable.[9]

I find this definition of materialism highly problematic in many ways, especially these three:

1. Positing that materialism entails the idea that efficient and material causes are sufficient "to *predict* all phenomena in the natural world" appears to exclude all authentically contingent events from natural phenomena. To exclude authentic contingencies, which are inherently unpredictable, from natural phenomena strikes me as being radically unrealistic.[10] Furthermore, the accuracy and relevance of predictions are always limited by the less than perfect knowledge and skill of the human beings that are doing the predicting.

2. Positing that materialism entails the idea that "empirically observable and mathematically calculable" causes are sufficient to explain *why* things are "arranged in any particular way" needs considerable qualification in order to avoid slipping into such metaphysical or religious matters as the "why questions" of purpose or ultimate end.

3. More conventional definitions of materialism ordinarily include a denial of the existence of any immaterial Deity, making materialism an explicitly atheistic and maximal form of naturalism. If, as Madden and Discher argue, ID is best seen as an enterprise that would play the role of "materialism-defeater," then some persons might mistakenly be led to infer that all critics of ID fall in the category of materialism-affirmers. Such is not the case. Most of the critics of ID that I know personally are members of the Christian community.

I believe it would be better if we stayed with the language most commonly employed by the ID movement itself and say that the goal of ID is the defeat of "naturalism."

For these and other reasons, I believe it would be better if we stayed with the language most commonly employed by the ID movement itself and say that the goal of ID is the defeat of "naturalism."[11] In this context it is, I believe, sufficient to say that the *naturalism* that the ID movement wishes to defeat is any world view (whether theistic or atheistic) that posits the sufficiency of the system of natural causes to bring about the actualizing (forming, assembling, constructing, fabricating) of the full spectrum of physical structures and biotic forms and systems that have appeared in the formational history of the universe.[12] Included among the several world views that the ID movement is out to defeat is any world view that posits, as I have done, that the universe is gifted by its Creator with a *robust formational economy*—a universe lacking nothing needed to actualize, without any compensatory nonnatural action, every type of structure and organism that has appeared in its formational history.

Dialogue: Response

Is the ID Movement Capable of Defeating Naturalism? A Response to Madden and Discher

Madden and Discher have successfully argued ... that ID is inherently unable to establish a positive case for any particular "nonmaterialist" explanation of empirical observations. ... I would add ... that ID is equally unable to establish a conclusive scientific case that any non-naturalistic explanation is even necessary.

Is ID's Scientific Goal Achievable?

How do ID theorists seek to achieve this goal of defeating naturalism? Although the theoretical literature of the ID movement may not be the easiest to digest, ID's strategic approach is actually quite straightforward. Non-natural *intelligent design* action would be needed only on those occasions for which natural action is inadequate to accomplish what needs to be done. Thus, when seeking to establish their scientific case for the necessity of supplemental non-natural action, ID theorists seek to identify specific biotic systems (usually some portion of an organism, such as the bacterial flagellum) for which it is possible to demonstrate, by reasoned appeal to empirical evidence and mathematical computation, that the system of natural causes is in fact incapable of assembling those structures. (It could also be noted, however, that many ID proponents seem inclined to go far beyond this and to speak of this non-natural action solely in terms of a succession of episodes of form-conferring intervention by an unidentified, unembodied, choice-making agent that bears a striking resemblance to the God of the Judeo-Christian tradition. But Madden and Discher are correct, I believe, to argue that ID's *scientific* case provides no warrant for such a specific inference and that several other "nonmaterialistic theories of origins" are consistent with ID's scientific argumentation. The problem for ID advocates in North America, however, is that the vast majority of them hold to a traditional Christian world view and the other options that Madden and Discher list are radically unacceptable on theological grounds, leaving divine interventionism as the only attractive option available for serious consideration. It is in the light of this reality that I see ID and compensatory, hand-like, supernatural action as effectively constituting a package deal.)

How do ID theorists attempt to make their scientific case? ID theorist William A. Dembski builds his case around the idea of what he calls *specified complexity*. No object that possesses this quality, he argues, could have been assembled by natural causes alone. To be *specified* is to exhibit a "detachable" pattern, one that is independent of the particular structure under scrutiny. The *complexity* of some structure is, by Dembski's unconventional definition, a measure of the difficulty of forming that structure by chance, where "by chance" means "by the joint effect of all natural causes." Dembski counts a structure sufficiently complex if the probability for forming it "by chance" (that is, by natural means) falls below the minuscule value 10^{-150}. This has the peculiar result that the "Dembski-type complexity" of some object is not so much a property of the object itself, but a property of the rest of the universe—viz., its ability or inability to actualize that object.

As I have explained in detail elsewhere, I find Dembski's scientific case for the specified complexity of the bacterial flagellum to be seriously flawed.[13] After a lengthy development of the idea of *specification* as a structural or configuration pattern, illustrated with numerous examples of letter strings and numerical sequences, Dembski simply asserts that "biological specification always refers to function."[14] It is, he argues, the flagellum's biological functioning as something like a rotary outboard motor that serves as the flagellum's specification. Dembski's abrupt move from configurational patterns to biological function as the definitive mark of specification struck me as astoundingly facile.

Even more serious problems arise in regard to the way in which Dembski seeks to demonstrate that the bacterial flagellum, or any other biotic structure X, is sufficiently "complex" (as he defines this term) as to require some non-natural means of assembly. In order to do so, he must demonstrate by computation that $P(\text{flag} \mid N) < 10^{-150}$, where $P(\text{flag} \mid N)$ is the probability that the *E. coli* bacterium could have become equipped with a flagellum by the joint effect of *all* natural causes, N (which includes both *known* causes—operating in both *known* and *unknown* ways—and *unknown* causes). But, of course, that probability cannot be computed—not by Dembski, not by anyone who has less than a complete knowledge of the universe's formational economy.[15] The best that anyone can do is to compute $P(X \mid n)$, the probability that biotic system X could have been actualized by the application of *known* natural causes in *known* ways, here denoted by "n." The assertion that no adequate natural causation will ever be discovered in the future is, in the spirit of Madden and Discher's rhetoric, nothing more than "promissory note anti-naturalism."

ID's success as a naturalism defeater depends, therefore, on knowing far more than anyone will ever know. ID theorists are now unable, *and will necessarily remain unable,* to reach a computationally warranted conclusion any more forceful or specific than this: In the absence of a detailed and causally specific scientific account of the particular sequence of natural processes and events that can fully explain the formational history of biotic system X, it is *logically permissible* to posit that the actualization of X required at least one instance of non-natural action. That is certainly true, but the logical permissibility of positing a religiously attractive, non-natural explanation in the context of incomplete knowledge is a weapon far too weak to defeat (or even bruise) naturalism of any type.[16]

Madden and Discher have successfully argued, I believe, that ID is inherently unable to establish a positive case for any particular "nonmaterialist" explanation of empirical observations. To that conclusion I would add my own judgment, based not on religious concerns but on sound scientific criteria, that ID is equally unable to establish a conclusive scientific case that any non-naturalistic explanation is even necessary. *Consequently, there is no scientific basis for political action promoting the inclusion of the ID hypothesis in the public school science classroom.* ◈

Notes

[1]I am a bit puzzled, however, at Madden and Discher's choice to use an old combat metaphor when they say that I have "thrown down the gauntlet" to advocates of ID. The intent of my request was not to issue a hostile challenge to engage in combat. Rather, it was a request for clarification and candor in their use of key terminology. This is but one of many instances in which Madden and Discher write as if they had privileged information regarding my personal motivations (including some they characterize as "wrong-headed") for criticizing claims made by the ID movement or for favoring particular positions differing from ID.

[2]A person could well posit many other forms of action that might be denoted by the terms "design" or "intelligent design," but these two are, I believe, the principal meanings that are at issue for those ID advocates (the vast majority) who are committed to traditional Christianity and the concept of supernatural divine action (God exercising power over nature).

[3]Form-imposing intervention by a Creator, for example, would constitute an instance of the supernatural divine action to which I referred in the previous note.

[4]James Madden and Mark Discher, "What Intelligent Design Does and Does not Imply," *Perspectives on Science and Christian Faith,*" 56, no. 4 (2004): 286.

[5]One of my continuing criticisms of the rhetorical strategies of ID theorists is that the operative meanings of key terms are often radically different from what most readers would expect. I have called attention to this phenomenon in a number of publications dealing with the published work of the ID movement's chief theorist, William A. Dembski. See, for example, either of two versions of my review essay of Dembski's book, *No Free Lunch: Why Specified Complexity Cannot Be Purchased without Intelligence* (Lanham, MD: Rowman & Littlefield, 2002): (1) "Are Bacterial Flagella Intelligently Designed? Reflections on the Rhetoric of the Modern ID Movement," *Science and Christian Belief* 15, no. 2 (October, 2003): 117–40, or (2) a more detailed version posted on the website of the American Association for the Advancement of Science. Go to www.aaas.org/spp/dser/evolution/perspectives.shtml and look under the heading "Intelligent Design" for my essay, "*E. coli* at the No Free Lunchroom: Bacterial Flagella and Dembski's Case for Intelligent Design," followed by an exchange between Dembski and myself.

[6]I find it odd that, although Madden and Discher refer to me by name twenty times in their essay, they did not once offer a direct quotation from my published writings to substantiate what they say about my position. How can a reader judge whether or not I have said something that is "inappropriate," or "methodologically unsound," or "hasty," or "illicit," or "wrong-headed" if they are not even shown examples from my publications?

[7]To understand the Intelligent Design movement comprehensively one must recognize that it has not only a scientific dimension but religious and political dimensions as well, each of which should be open to an appropriate form of scrutiny. To neglect the ID movement's religious dimension or to suggest that it is a purely scientific enterprise that would exist even if the religious agenda of its most vocal advocates were absent strikes me as utter silliness. Furthermore, for anyone to suggest that the religious agenda of the current ID movement in North America is not dominated by the concerns of Christian supernaturalism would, I believe, require a denial of the obvious. For an analysis of the multifaceted character of the ID movement, see Barbara Forrest and Paul R. Gross, *Creationism's Trojan Horse: The Wedge of Intelligent Design* (New York: Oxford University Press, 2004), especially the book's final chapter, "Religion First – and Last."

[8]Madden and Discher seem not to be familiar with the material that I cite in note 5. This material is concerned, not with ID's theological connotations, but with the highly questionable nature of Dembski's rhetorical strategy and the serious flaws in his scientific argumentation.

[9]Madden and Discher, "What Intelligent Design Does and Does not Imply," 289.

[10]I cannot predict what the precise wind velocity will be at some specified location in my yard at 9 a.m. next Tuesday, but I have every right to posit that its particular value will be the outcome of purely natural (creaturely, not supernatural) causes.

[11]I made precisely the same point in my essay, "Are Bacterial Flagella Intelligently Designed?" *Science and Christian Belief* 15, no. 2 (2003): 121.

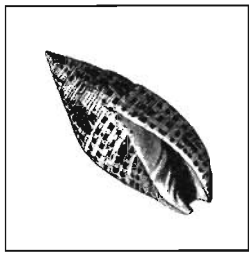
[12]In the essays to which I referred in note 5, I list several variant strains of naturalism that differ from one another in very important ways. In spite of those differences, however, the ID movement is opposed to all strains of naturalism because they are uniform in their rejection of the idea that compensatory non-natural action is either necessary or empirically detectable.

[13]See the references listed in note 5.

[14]Dembski, *No Free Lunch,* p. 148.

[15]Actually, ID's case is even more deeply flawed. I would argue that even if Dembski's probability condition could be satisfied, this is not the probability value that needs to be computed to make ID's scientific case against naturalism successful. The most relevant probability, I believe, is not the probability that some *particular* biotic structure came to be formed naturally, but this one: given the innumerable multitude of genetic variations that might occur in any population, and given the vast diversity of environmental circumstances that might prevail, what is the probability that at least one of these variations (or any other type of biological novelty) will trigger a positive feedback process that eventuates in the actualization of some functionally successful biotic structure or system (say for locomotion, which is the biotic function of the bacterial flagellum)?

[16]A few thousand years ago, in the absence of knowledge about electrostatic discharge, and in the context of religious beliefs held by polytheistic cultures, it was both logically permissible and religiously attractive for some people to posit that lightning required the direct action of a divine agent. In the long run, however, a belief that is both logically permissible and religiously attractive remains vulnerable to defeat by knowledge based on empirical science. Lightning, we now know, is an electrical phenomenon.



What Would Count as Defeating Naturalism? A Reply to Van Till

James D. Madden and Mark R. Discher

Since Van Till does not [disabuse us of our false claims], we are confident that we have represented his views carefully and faithfully.

We are quite honored that Howard Van Till has taken the time to give a detailed response to our paper, and we are likewise pleased to find that he does express some agreement with us on a few salient points. Nevertheless, we are still far from being in complete agreement with Van Till, as any reader of his reply to our paper will surmise. Van Till has three major concerns about our paper. First, he suggests that we have misconstrued the nature of his objection to the ID movement,[1] and in doing so we have failed to cite any texts from his prior work. In conjunction with this, he laments that we have employed "combat metaphors" and other less than flattering language to characterize his intentions. Second, Van Till argues that we operate under an inadequate definition of materialism. Third, Van Till argues in opposition to one of the main theses of our paper that ID is unable to operate as a materialism ("naturalism" in Van Till's preferred idiom) defeater. We will address each of these concerns in what follows below.

Van Till's Three Concerns

1. Our misconstruction of the nature of Van Till's objection to the ID movement

Let us make three quick points. First, as philosophers we are accustomed to vigorous, critical exchanges. We thus meant no offense in our use of a "combat metaphor," and we apologize if any offense was taken. Second, regarding our failure to quote Van Till's earlier writings, all that can be said is that our paper is itself a response to an earlier exchange between Van Till and Discher in the pages of this journal.[2] As such we assumed that the reader would be familiar with the prior positions staked out in this debate, and therefore there was no need to clutter our paper with quotations. Third, we do not believe that we have mischaracterized or misrepresented Van Till's position in any way. We assume that if we had, Van Till would have disabused us of our false claims. Since he does not, we are confident that we have represented his views carefully and faithfully.

2. Our use of an inadequate definition of materialism

Van Till objects to our use of the term "materialism." We define "materialism" in our article as

> the view that *efficient* and *material causes* along with precise laws of nature are by themselves sufficient to explain and predict all phenomena in the natural world; it is the view that we do not need to include anything in our explanation of how things in nature operate and why they are arranged in any particular way that is not empirically observable and mathematically calculable.[3]

Against our use of the term Van Till has three complaints, which we will treat in order. First, he claims that our understanding of materialism rules out instances of "authentic contingency" which are "inherently unpredictable." He claims that our account of materialism "excludes all authentically contingent events from natural phenomena." On this, we make two quick points. First, in footnote four of our paper

we emphasize that we do not wish to exclude authentically contingent (indeterminate) phenomena at the quantum level. Thus, we did not construe materialism to exclude all forms of contingency in nature. Second, the purported macro-level example of contingency that Van Till adduces as problematic for our definition of materialism, the wind velocity in his yard at 9:00 a.m. next Tuesday, can in fact be accounted for by our use of the term. The reason that Van Till assumes that it cannot is because he fails to make a distinction between that, on the one hand, which we as predictors must effectively take to be contingent on account of our imperfect knowledge and that, on the other hand, which is genuinely contingent. We take the wind velocity in Van Till's yard at 9:00 a.m. next Tuesday to be contingent in the former sense, because we do not have at any time before 9:00 a.m. next Tuesday complete knowledge of all the relevant material conditions and laws of nature that will determine the wind velocity then and there. But if we did have such knowledge, à la Laplace, then it would in principle be possible for us to make the prediction in question, and this in perfect accord with our definition of materialism. Therefore, our definition of materialism would deny that such an event is authentically contingent. Furthermore, we are confident that this understanding of "materialism" is in uniformity with what materialists have typically meant historically in their use of the term. Contrary to being, as Van Till puts it, "radically unrealistic," our use of the term "materialism" is coherent and conventionally accepted.

Van Till's second worry regarding our use of "materialism" concerns the possibility that it might be construed to include teleology, given that we claim that a materialist is committed to the view that efficient and material causes provide the explanation of *why* events occur in nature. Van Till suggests that we need to qualify our use of "why" in a way so that it does not slip into "such metaphysical and religious matters as the 'why questions' of purpose or ultimate end." We answer Van Till's request for qualification as follows: "Why," when used in our definition of materialism, is to be taken only in the straightforward sense we find in "The reason why the puddle dried up is that the sun is shining today," where what we mean is that the material properties of the water in the puddle reacted to the increased air temperature brought about by the shining of the sun, and it was this that caused the water in the puddle to change state. We hope that with this qualification we are able to avoid in our use of "why" any hint of "metaphysical or religious" teleology.

Third, Van Till then notes that our use of "materialism," which could be easily conflated with "naturalism," might mislead people into thinking that all critics of ID, many of whom are materialists in our sense, are atheists, since the latter term connotes atheism, whereas the former term (in our usage) does not. Van Till rightly points out that many critics of ID are, in fact, theists. On this, perhaps Van Till is right. Perhaps it would have been better for us to use "naturalism" in place of "materialism." This is just a matter of coming to terms. In actual fact, we intentionally used "materialism" instead of "naturalism" in order to avoid this problem. But perhaps we were ill-advised to do so. Nonetheless, what is important here is that our intention was to define the position in such a way so as to encompass a Christian who has a materialist conception of the natural world, i.e., a non-interventionist conception of the natural world, such as Van Till has with his robust formational economy principle. It is this sort of view that we wanted to include among those positions that would be defeated by a successful ID project. In any case, we do believe that nothing we wrote either explicitly states or strictly implies that all critics of ID are atheists. We certainly do not believe that to be the case. Furthermore, we certainly do not want anyone to infer mistakenly that to be the case.

3. Our error to suggest that the primary aim of ID should be to defeat naturalism

Van Till claims that ID is wholly incapable of defeating naturalism. The reason Van Till thinks this to be the case is that we can never be certain that we have complete knowledge of the natural world—for example, knowledge regarding the natural causes of a given biotic structure such as the bacterial flagellum. Because such perfect and complete knowledge is never available to us, Van Till claims that we are never warranted in saying anything more in attributing the existence of any such structures to non-natural, interventionist causes than that it is logically possible that the actualization of the structure required non-natural action. As Van Till puts it, all that it is permissible for an IDer ever to claim is that "in the absence of a detailed and causally specific scientific account of the particular sequence of natural processes and events that can fully explain the formation history of biotic system X, it is logically permissible to posit that the actualization of X required at least one instance of non-natural action." Because ID is in this way "unable to establish a conclusive scientific case that any non-naturalistic explanation is even necessary," Van Till warns that the arguments for ID should be excluded form public school science classrooms.

We agree, of course, with Van Till's central point—that we can never be absolutely certain that a naturalistic cause might eventually be found to explain some phenomenon that we might be tempted to ascribe to interventionist design. We are not inclined to disagree with Van Till that ID interventionism could never be established conclusively by any empirical evidence. Because in both philosophy and the natural sciences such decisive proof is very rarely forthcoming, we take this point of Van Till's to be so obvious as to be almost trivial. The mistake we believe Van Till makes in his argument against interventionist ID is that he sets the epistemic bar for it too high.

Dialogue III: Intelligent Design and Naturalism

What Would Count as Defeating Naturalism? A Reply to Van Till

The mistake we believe Van Till makes in his argument against interventionist ID is that he sets the epistemic bar for it too high. ... If and when the empirical evidence warrants it, fair-minded science requires that the interventionist designer hypothesis be accepted as a plausible theory of explanation ...

The best we can hope, when hypothesizing about the causes of empirically observable phenomena and when direct observation of the phenomena in question is not possible is to make an inference to the best explanation regarding its cause, given all that we do confidently know. If, given all that we do presently know both scientifically and philosophically, the best explanation of some phenomenon seems to require positing the intervention of an intelligent designer, then we ought to accept that hypothesis. To rule that hypothesis out in the teeth of pretty compelling evidence for it would be to exclude a plausible hypothesis on a priori grounds. But ruling it out on a priori grounds is not at all tantamount to ruling it out on scientific or empirical grounds.[4] It would be to rule it out on the basis of a philosophical commitment, a faith, if you will, in naturalism.

As God is a jealous God, so naturalism is a jealous explanatory tool; it will not tolerate any other mode of explanation. But if it can be shown that, in our current state of knowledge, there are phenomena that are not explained by any known, scientifically accessible cause, then there is reason to doubt, in the sense of suspending judgment, the truth of naturalism. That for us would constitute a naturalism defeater (and if this does not constitute a naturalism defeater for Van Till, we wonder what in the world ever would qualify for him as one). Of course, the purported defeat of naturalism would not be conclusive; it is itself always subject to being defeated by a scientific discovery that vindicates naturalistic explanation in the relevant area. But unless and until such a discovery is made, the current hegemony that naturalism holds in the science classrooms would be called into question by a successful ID project.

Van Till's basic strategy here is to make any potential interventionist ID claim a "God of gaps" type of argument; whenever the IDer adduces an interventionist designer in an explanatory role, he is always doing so with less than absolutely perfect knowledge of the natural world. Consequently, he can never be absolutely certain that the phenomenon in question is to be explained by an interventionist designer, because he always has gaps in his knowledge of the natural world, and the intelligent designer might just be illicitly filling one of these gaps. But notice that this argument is Janus-faced and can be turned against Van Till himself. For Van Till refuses ever to posit an interventionist designer, because he takes it as a matter of faith/philosophical commitment that naturalism will eventually fill whatever gaps there are. So Van Till has a "naturalism of the gaps" argument always underway. In this respect, even if Van Till's argument were correct, there is parity between Van Till's position and that of the interventionist IDer. Logically they are on an equal footing.

In conclusion, if and when the empirical evidence warrants it, fair-minded science requires that the interventionist designer hypothesis be accepted as a plausible theory of explanation, perhaps one that competes with and deserves to be evaluated in light of the competing hypothesis of naturalism. We agree that ID cannot defeat naturalism in the sense of providing a once and for all refutation, but we also believe that ID could defeat naturalism in the sense of providing space for non-naturalist theories within the context of scientifically respectable debate regarding certain biological issues. What would tell the tale in such a debate would be which of these theories can be best identified with a coherent and intellectually satisfying world view. Of course, and we are sure Van Till will agree, this is a moot point until ID can prove itself on scientific grounds. ◈

Notes

[1]What is really at issue in this discussion is an interventionist understanding of intelligent design. We recognize that there are non-interventionist intelligent design views, such as those belonging to the family of anthropic arguments. Van Till himself is a non-interventionist IDer.

[2]Mark Discher, "Van Till and Intelligent Design," *Perspectives on Science and Christian Faith* 54, no. 4 (2002): 220–31; Howard J. Van Till, "Is the Creation a 'Right Stuff' Universe?" *PSCF* 54, no. 4 (2002): 232–9; and Mark Discher, "Is Howard Van Till's Response to 'Van Till and Intelligent Design' a 'Right Stuff' Response?" *PSCF* 54, no. 4 (2004): 240–1.

[3]James Madden and Mark Discher, "What Intelligent Design Does and Does not Imply," *PSCF*," 56, no. 4 (2004): 287.

[4]That Van Till is wont to rule ID out on a priori grounds was precisely the subject of Discher's critique of his assessment of ID. See Discher, "Van Till and Intelligent Design," *PSCF* 54, no. 4 (2002): 220–31.

Book Reviews

HEALTH AND MEDICINE

FAITH IN THE FUTURE: Healthcare, Aging, and the Role of Religion by Harold G. Koenig and Douglas M. Lawson. Radnor, PA: Templeton Foundation Press, 2004. 215 pages. Hardcover; $24.95. ISBN: 1932031359.

In March 2001, Duke University was the site of a conference on "Faith in the Future, Religion, Aging, and Healthcare in the 21st Century" sponsored by a variety of organizations. It assembled persons from medicine, healthcare policy, religion, government, the media, and many professional and lay groups. This book presents a synthesis and expansion on themes discussed at the Duke University conference.

This book is relevant because soon there will be an increase worldwide in older people with chronic health problems requiring chronic care. Demographers guess that the American population of people aged 85 and above will jump from four million in 2000 to eighteen to thirty million in 2050. Parallel to the increase in demand for such services will be an increase in their costs. This raises such questions as: How can quality healthcare be provided for those with chronic illness or disabilities needing long-term care? Who will provide this care; how will it be paid for? and How can solutions be implemented via international systems and cooperation?

The seven million healthcare and social-service professionals in the USA need help. One source, applauded by the authors, is the potential provided by America's 350,000 faith-based congregations. This book presents examples of what is being accomplished by the alliance of government, philanthropy, and faith-based communities. These include parish nursing homes, wellness centers, congregations with social-senior outreach programs, retirement communities, and housing provisions.

Gallop polls indicate that 96% of people over age 65 believe in God or a universal spirit. The book also explores the link between spirituality and health. Some studies indicate that religious faith encourages better health among the elderly, reduces the need for hospitalizations, increases longevity, and improves the immune system. Additional benefits come from volunteers who assist the elderly through less stress, depression, and physical illness.

The book's four parts contain eleven chapters, an introduction, and an index. In addition, for those who would like to volunteer, an appendix is provided with links to social-service organizations. A second appendix gives a bibliography of resources on aging, caregiving, religion, and volunteerism.

Harold Koenig, researcher on the effects of religion on health, and Douglas Lawson, fund-raising consultant, are both previously published authors. Koenig is identified by *Newsweek* as a "pioneer faith-and-medicine researcher." Their appropriate book dedication reads "to all those who give of themselves because of their faith."

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

HISTORY OF SCIENCE

THE BOOK NOBODY READ: Chasing the Revolutions of Nicolaus Copernicus by Owen Gingerich. New York: Walker and Company, 2004. 306 pages. Hardcover; $15.00. ISBN: 0802714153.

This is an absolutely fascinating book—difficult to read, but fascinating, nevertheless. Those interested in the history of science will find the thesis as well as the storyline an intriguing read. Gingerich, research professor of astronomy and the history of science and senior astronomer emeritus at the Smithsonian Astrophysical Observatory at Harvard, recounts his attempt to examine 600 plus copies of Copernicus's *De Revolutionibus (On the Revolutions of the Heavenly Spheres)* which was published in 1543.

Finding a richly annotated first edition of *De Revolutionibus*, Gingerich began to doubt Arthur Koestler's claim in his book *The Sleepwalkers* that nobody read Copernicus' book when it was published. He became convinced that the volume was, indeed, read and appreciated by many other scholars through the centuries. This conviction led Gingerich to a decades-long pilgrimage which this book details. The "census" (his word for his quest to examine as many copies of the book as he could find) led him to twenty-four countries where *first* edition copies and twenty-nine countries where *second* edition copies of *De Revolutionibus* were found. In almost all of these countries, multiple copies were found in a variety of places.

Clearly the book was read—contrary to what Koestler claimed. Of interest is the fact that while the greatest number of copies were found in Germany (51), twenty-five were found In Italy—where the Vatican eventually put the book on *The Index*. A total of forty-three copies are in the United States. Gingerich includes in an Appendix the location of the all the volumes he studied.

Called a "literary detective" by one reviewer, Gingerich has become, through his sleuthing, the world's preeminent authority on the authenticity of various copies of Copernicus' book. He reported numerous times where auction houses and others have sought his consultation. On more than one occasion, he recounts situations in which copies disappeared from libraries only to appear for sale at a later date. His detailed notes on the unique conditions of each individual volume were central to more than one of these volumes being identified as "stolen" and returned, thereby, to the original library.

Gingerich worked out a four-fold rating system for judging the "value" of each book. "Value," in his investigations, came to mean how intense was the response to Copernicus' ideas. The criteria for these judgments were the amount and content of the annotations written in the margins. Some copies did not seem to evoke a reaction or were, simply, not read. In a number of cases, Gingerich was able to identify the writer of the annotations and make

some hypotheses about both the circulation of the book and/or its influence on subsequent astronomic conclusions. It is noteworthy that Copernicus ended up with a *dual* revolutionary hypothesis—which, of course, was later rejected. He suggested that the planets revolved around the earth which, in turn, revolved around the sun.

Of particular interest to Gingerich was the copy of the book belonging to Galileo. The reclamation of the significance of Copernicus' heliocentric for science has long been attributed to Galileo. Galileo's copy showed only minimal annotations when compared, for example, to Kepler's. The interpretation Gingerich offers for Galileo's scant attention to Copernicus' volume serves as yet another counter to Koestler's contention that the book was rarely read. Even though Copernicus wrote in Latin, which made the book only available to scholars, the annotations which Gingerich found convinced him that the book was widely studied—particularly among the astronomers of northern Europe. By the time of Galileo, Copernicus' thesis was widely known and accepted. Galileo was a participant in these discussions even before his telescopic observations convinced him that not everything revolved around the earth. It is well known that Galileo become the focus of the dialogue because he published in Italian and chose to intentionally enter into debate with the Dominicans over whether his ideas were hypotheses or facts.

During the years of his search, Gingerich presented many of his conclusions about *De Revoutionibus* at scholarly meetings. The 500th anniversary of Copernicus's birth was celebrated during 1973, with conferences around the world. This volume is a testimony to thorough scientific investigation about the history of science as reflected in literary sources. Our debt to Copernicus, the genius priest, is inestimable. Gingerich's contribution to the broadening of our appreciation is likewise of great value.

Reviewed by H. Newton Malony, Senior Professor, Graduate School of Psychology, Fuller Theological Seminary, 180 North Oakland Avenue, Pasadena, CA 91101.

ORIGINS & COSMOLOGY

JESUS IN THE NEW UNIVERSE STORY by Cletus Wessels. Maryknoll, NY: Orbis Books, 2003. 240 pages. Paperback; $25.00. ISBN: 1570754659.

Cletus Wessels, professor and president emeritus of Aquinas Institute, has written a book which attempts to "understand the meaning of Jesus Christ in the context of what modern cosmology tells us about the nature of the universe." The publisher, Orbis Books, is the publishing arm of Maryknoll Fathers and Brothers.

Orbis Books "seeks to explore the global dimensions of the Christian faith and mission, to invite dialogue with the diverse cultures and religious traditions, and to serve the cause of reconciliation and peace." The aims of both author and publisher are noble.

The book's two main parts contain seven chapters, with a helpful bibliography and index. Wessels writes that traditional Christianity has been challenged in the recent past by new findings about the universe. How does Jesus fit into these new findings? Wessels aims to inform the reader by reinterpreting the biblical story of Jesus through the lens of the "new universe story."

Wessels tells the story of humankind in three stages: childhood, from the start of human history about three million years ago until the agricultural revolution, focusing on humanity's physical development; adolescence, from ten thousand years ago until the present, focusing on humanity's ego and mental development; and adulthood, beginning now and leading into the future, focusing on humankind's spiritual development.

Wessels thinks that: (1) Genesis does not present an historically accurate picture of the beginnings (p. 1); (2) the expanding universe "flashed forth" about 15 billion years ago (p. 2); (3) the infancy narratives are not to be taken literally (p. 144); (4) human violence is contrary to the evolutionary goal of earth (p. 184); and (5) in an emerging universe, there is no irrefutable evidence for original sin (p. 191).

It took Wessels three years to write this book. Wessels devotes considerable space in analyzing and interpreting passages of Scripture. Sometimes the exegesis drifts into philosophical channels difficult to follow. There is considerable speculation, and quite often the reader will wish Wessels could be more specific. Wessels' method and subject matter, however, tend to negate a less abstract approach.

The book is intended for the educated Christian. While Wessels obviously values Scripture, his treatment of it is not in the literalist tradition. This book may appeal to those who are drawn to a philosophical-psychological, metaphorical approach.

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

THE EMERGENCE OF EVERYTHING by Harold J. Morowitz. New York: Oxford University Press, 2002. 200 pages, notes, index. Hardcover; $28.00. ISBN: 119513513X.

Morowitz is a leading figure in the study of complexity. He is a professor of biology at George Mason University and is on the board of the Santa Fe Institute. This is his latest book in a prolific career of publishing. In its thirty-six chapters, he examines the emergence of complexity in twenty-eight different areas of evolutionary history. Morowitz begins with outlining the issues, stating the twenty-eight steps of increasing complexity. He then proceeds to examine each one.

Morowitz begins with the question of why there is something rather than nothing. Then he discusses, among other things, the creation of the universe, the emergences of stars, chemistry planets, metabolism, cells, multicellularity, neurons, animals, chordates, toolmaking, language, and technology. In general these items are taken in historical order but occasionally Morowitz gets them out of order. He discusses the periodic table and the implications of the Pauli exclusion principle after the origin of stars, where the principle is already in operation.

Morowitz takes his readers on a grand tour which is vast and often too brief. The necessity of the emergences and exactly why they occur is often left out of the discus-

sion, although it is difficult to see the necessity behind the development of reptiles, mammals or agriculture.

The most interesting part of the discussion concerns his view of the origin of life, a field which is the area of his expertise. He notes, with a bit of amazement, at how few chemicals really lie at the heart of the metabolic cycle. By this, Morowitz implies that getting the metabolic cycle going on a primitive earth would be much simpler than is often depicted by many Christian apologists. He also notes that five of the twenty universal amino acids hang off of this same metabolic cycle. He suggests that, in a chemical reaction he calls the ping-pong cycle, the chirality problem (left- or right-handed amino acids) is solved because all output of that cycle will have the same chirality as does the glutamic acid used in that cycle.

Another area which will interest those of a theological bent is Morowitz's discussion of the origin of mind. He notes that the neuron was a major landmark in the development of life on earth. But he also has a fascinating discussion of the appearance of teleological behavior in single-celled organisms. In particular he discusses *Stentor*, which, if presented with chemical irritants in its environment undergoes a sequence of increasingly complex behaviors in order to get away from it. The repertoire seems amazing in such an animal lacking even a second cell, much less a brain.

Only in the later chapters do we find Morowitz following the lead of Teilhard de Chardin in seeing the collective mental activity of the species as another incipient emergence. This, like Chardin, he equates to the emergence of the spirit to the collective consciousness. For those believing in a more traditional Christian theology, Morowitz begins to move wide of the mark. He offers what the snake offered. Morowitz believes, "We, *Homo sapiens*, are the transcendence of the immanent God." He then suggests that "we are made in God's image because we are totally constrained by the laws of nature" and that our volitional mind collectively is the emergence of an immanent God.

The book is a very interesting review of the history of the universe and Morowitz makes his case well even if it is unsatisfying to this traditionalist. The book is worth owning if for no other reason than the discussion of the universe's history. One might doubt that Judeo-Christian theology, not to mention humankind's history of inhumanity, could sit comfortably with the concept of humans as God. If we are God, one could ask the question Samuel Morse asked. This is the one taken from the book of Numbers, "What hath God wrought?"

Reviewed by Glenn Morton, 10131 Cairn Meadows Dr., Spring, TX 77379.

WHAT DARWIN DIDN'T KNOW by Geoffrey Simmons. Eugene, OR: Harvest House Publishers, 2004. 325 pages. Paperback; $12.99. ISBN: 0736913130.

The foreword to *What Darwin Didn't Know*, by Geoffrey Simmons, likens the field of evolutionary biology to *The Crucible*. In Arthur Miller's play, which vividly describes the fervor surrounding the Salem witch trials, the judges realize that several people have been convicted and executed on fabricated evidence. However, rather than admit that the trials are a sham and lose credibility, the judges elect to proceed with the executions. While some may object to this analogy, it does emphasize the tremendous momentum of Darwinian evolution. Scientists in all fields are faced with the presumption that evolution is scientific fact. In the realm of humanism, there is no competing theory, so challenges are not tolerated. In fact, the theory of evolution is not presented as a theory at all, but as a proven scientific principle.

Christian scientists are in a unique position in the origins debate. The rest of the scientific community has no choice but to believe the naturalistic explanation for the origins of the species. For them, it is not a question of whether evolution occurred, but how it occurred. In contrast, Christian scientists can examine the evidence without bias. The presence of Darwinian evolution does not require the absence of intelligent design. However, the absence of a naturalistic explanation for the origins of the species necessitates the existence of an intelligent Creator. In *What Darwin Didn't Know*, Simmons seeks to catalog the evidence against a naturalistic explanation.

This book centers on the complexity in human physiology that has been discovered since Darwin wrote *On the Origin of Species*. Philosophically, it revolves around three arguments, none of which should come as any surprise to any reader who as spent time contemplating the origins of humankind:

1. Human physiological systems are extraordinarily complex, which makes it unlikely that these systems were created through random genetic mutations.
2. In addition to being complex, these systems invariably involve a series of successive steps to be effective. In each case, the intermediate forms are either useless or lethal.
3. The evolution of these physiological systems, had they occurred, would have given rise to a multitude of transitional forms. However, despite an abundant fossil record, there is a conspicuous absence of transitional fossils.

One example that Simmons uses that incorporates all three arguments is that of the reproductive system. Without intelligent design, Simmons argues, human reproduction would have had to evolve in "unbelievably specific, compatible, and parallel ways—or else all these aspects arrived simultaneously." Successful reproduction requires 23 male chromosomes and 23 compatible female chromosomes, complementary genitals, male and female hormones, mobile sperm, a mature egg, not to mention a suitable substrate for fertilization. The complexity of the system (argument #1), the nonviability of incompatible intermediate forms (argument #2), and the absence of transitional fossils (argument #3), all argue for the existence of an intelligent designer.

A similar approach is employed in all four sections of *What Darwin Didn't Know*, which are entitled "Basic Issues," "External Connections," "Internal Systems," and "More Enigmas." The majority of the text is devoted to describing, in great detail, a specific aspect of human physiology (such as the cell, the eye, or the endocrine system). Far less time is spent developing these examples into novel arguments against Darwinian evolution.

Because it is light on analysis and heavy on examples, *What Darwin Didn't Know* is not an appropriate stand-alone work for a reader wishing to think about the evidence for and against natural selection and Darwinian evolution. However, it is effective as a broad survey of the complexity of human physiology. In the final analysis, any intellectually honest person who believes that *Homo sapiens* evolved from a more primitive species (whether in the presence or absence of intelligent design) must do so only after confronting the arguments that Simmons raises.

Reviewed by Imad Libbus, Senior Research Scientist, Guidant Corporation, St. Paul, MN 55112.

UNINTELLIGENT DESIGN by Mark Perakh. Amherst, NY: Prometheus Books, 2004. 430 pages, appendix, bibliography and index. Hardcover; $32.00. ISBN: 1591020840.

Perakh was professor of physics at California State University in Fullerton. This, the first book by this Russian émigré, discusses the claims of a number of apologetical authors from the skeptics' perspective. The book begins with a discussion of William Dembski's ideas, which occupies one-quarter of the book's pages. Perakh then moves on to criticizing Michael Behe, Phillip Johnson, Hugh Ross, Grant Jeffrey, and Fred Heeren, among the Christian apologists. He then turns his guns on Jewish apologists like Aryeh Carmell, Cyril Domb, Nathan Aviezer, Gerald Schroeder, Lee Spetner and the authors of *The Bible Code*, Rips, Witztum and Rosenberg.

The objections Perakh aims at Dembski's many works constitute probably the best critique of those views I have ever read. He begins by noting that for centuries apologists have claimed that design implies a designer. But Dembski and the ID movement are the first apologists to claim that evidence of design does not necessarily mean that there is a designer. He then cites two places where Dembski has made this claim. Perakh then notes that Dembski's use of mathematics in *The Design Inference* is really a mathematism—stating the same thing the text does only in mathematical language.

Of Dembski's famous archery analogy, in which the archer hits the bulls-eye by design (skill), Perakh points out a major flaw. Dembski's scheme requires that one needs to rule out chance and law as the cause of the event, but Perakh notes that the archer depends upon law (the laws of ballistics) for the arrow to hit its target. So, this example is a mixed case. Perakh shows over and over again how Dembski mis-uses information theory and equates meaning with information as in complex specified information. In one interesting analogy, Perakh shows that meaningless gibberish can be designed. He cites gibberish in a Russian poem, but one can think of the Jabberwocky as another example.

Perakh is often inconsistent in his criticisms. He states several times that people have a right to hold theological views, but not to deny scientific data. Yet when Perakh compliments Heeren's correct exposition on science, he then claims that Heeren is hiding a theological agenda! But then he inconsistently claims that it is easier to believe our universe was preceded by many other universes, the evidence for which has been destroyed, than to believe in God.

When Perakh turns to other authors, he becomes repetitive and nitpicky. He picks on small inaccuracies by Ross that heat energy can be transformed into work. Perakh then accuses Ross of not knowing thermodynamics. He criticizes Schroeder for saying, while describing the photoelectric effect (PE), that light shining on certain metals knocks free a stream of electrons. Perakh then claims that Schroeder does not know that all other substances are affected by PE. This, of course, is pure nonsensical skepticism that far overreaches reasonableness.

If one can play that game, then Perakh can be criticized for claiming that there is an Ediacra fauna (it is Ediacaran) or that the famous supernova in the Magellanic cloud is SN1978A (1987A is the truth). Playing by Perakh's own rules, he should be criticized for claiming that the behavior of molecules is governed by Newtonian mechanics (p. 339)! In the true spirit of Perakh's skepticism, this clearly means that Perakh is unaware of van der Waal's forces and quantum! One gets the feeling that Perakh can stomach no mistakes in others, but does not recognize his own.

The book is a very good reference to have merely for the critique of Dembski's views. But the rest of the book gets very tiring. After 400 pages of skeptical rant, one has the feeling that he is dealing with an oversized toddler who asks why to every statement. Just because one can doubt any statement does not mean one *must!* Perakh doubts everything save his own faith that nothing else exists apart from the universe and gives the impression of a person stuck in the throes of puerile teenage nihilism.

Reviewed by Glenn Morton, 10131 Cairn Meadows Dr., Spring, TX 77379.

GOD'S PATTERN FOR CREATION: A Covenantal Reading of Genesis 1 by W. Robert Godfrey. Phillipsburg, NJ: P&R Publishing, 2003. 142 pages, appendices, notes. Paperback; $10.99. ISBN: 087552799X.

Evangelicals often read the opening chapter of Genesis in a literal, chronological fashion regardless of *external scientific evidence* which suggests otherwise. This has led to a variety of concordistic models which satisfy only their author or a "Bible only" reading which ignores revelation in nature. With *God's Pattern for Creation*, Westminster Theological Seminary President and church historian Robert Godfrey offers "a fresh look at Genesis 1" based on a covenantal approach and the literary form this covenant takes in Genesis 1. *PSCF* readers would benefit by working through his exegetical argument leading to the conclusion that "the days of creation are figurative descriptions of the actions of God" (p. 93). This pattern is followed in other historical sections of Scripture, e.g., Exod. 12:42; Gen. 11:4,5; Ps. 113:5-6; Heb. 8:2, and so forth.

Godfrey views Genesis 1 as foundational: "detailing the grand story of creation and the meaning of creation before the entrance of sin into the world" (p. 20). He works, verse by verse, through the text, drawing out the implications for a covenantal people—then and now. Using *internal biblical evidence* alone, he brings the reader to see the value of a topical arrangement of "days" instead of the traditional chronology. The meaning is seen in the *form* as well as the scriptural *text*. In this the message is more fully portrayed.

The Bible reveals the covenantal pattern of God's relations with humans fundamentally captured in the biblical expression, "I will be your God and you will be my people" (p. 16)—first in creation, then in redemption. Genesis 1 offers basic historical background with its account of the story of creation and meaning of creation before sin entered the world. God uniquely, among the gods of the Near East, creates matter from nothing and shapes it according to his will. His purpose is played out in time and ultimately looks forward to a consummation of the first creation and the creation of a new heaven and a new earth.

Genesis 1:2 initiates the process that leads to the creation of humanity. Three obstacles to human habitation need to be removed: first, the world was barren, unfit for habitation; second, it was dark; third, it was covered with water. The days of creation reflect the action of God in constructing a place for humankind to live. Space limitations prevent further development of this topic.

The author suggests that the current controversy over the interpretation of Genesis 1

> ... is not the result of new discoveries of modern science [or] new discoveries in the interpretation of the Bible that strengthen the ordinary day approach. It appears to be the result of a heightened sense of alienation from our dominant culture that conservative Christians have come to feel in the last ten to twenty years ... betrayed by politicians, the public schools, and even many church leaders (pp. 90–1).

One consequence has been the creation of a subculture of institutions and philosophies such as creation science in response to these cultural threats. We must "beware of anti-Christian forms of thought that claim to be science, so we must beware of anti-intellectualism and an inappropriate rejection of science parading itself as Christianity ..." (p. 91). I suspect that the debate over the place of Scripture still has a part in this mix.

Some readers might feel that scientific evidence should have been used to buttress Godfrey's exegetical case for an old earth. I suggest that the exegetical case is *sufficient* and that scientific evidence might be distracting for some audiences.

The freshness of Godfrey's writing is an antidote to the tired polemics abroad today. This well-honed work should be read—and re-read.

Reviewed by J. W. Haas, Jr. Emeritus Professor of Chemistry, Gordon College, Wenham, MA 01984.

PHILOSOPHY & THEOLOGY

ENTERTAINING THE TRIUNE MYSTERY: God, Science, and the Space Between by Jeffrey C. Pugh. Harrisburg, PA: Trinity Press International, 2003. 194 pages. Paperback; $16.00. ISBN: 1563384019.

Pugh, a 52-year-old professor of religious studies at Elon University in Elon, NC, has also written *The Matrix of Faith: Reclaiming a Christian Vision.* He spreads his thoughts in this present volume over nine chapters. The bibliography has more than 100 entries and the index is quite extensive.

This book was shaped by a 2002 Lenton-season study led by the author in Chapel Hill, NC, at the Episcopal Church of the Holy Family. The author "desires for Christian faith to escape its present captivity to elements in culture and tradition that keep it tethered to what I feel is an idolatrous frame of mind" (p. ix). Although not a scientist, Pugh is well-informed about the issues and persons involved in the science and religion interplay.

Most of the book deals with comments on the places where science and faith meet. Pugh states that he writes nothing new; his book is not intended for scholars but for students and laypersons. His approach converges history, science, philosophy, and theology. A general education is helpful in comprehending the discussion.

Pugh admits that much of life and creation seems counter to theism: "Given the vast amount of waste and suffering we find in the world of exploding galaxies and deadly viruses, of predator and prey, how can faith speak a word of hope?" (p. x).

Nature, Pugh thinks, could lead to the conclusion that "God is a sadistic monster, intent on finding ever new and creative ways of making the creation suffer" (p. 11).

Pugh thinks the answer to this conundrum is a redefinition of God, one in which differentiation is made between God's energies (activities) and God's essence (i.e., attributes, p. 10). A better understanding of God's energies, which are plentiful in nature, may lead to a better understanding of God's essence, which is somewhat hidden.

Pugh thinks part of the conflict between science and religion results because both have claimed too much (p. 6). He believes that our thoughts and images of God have been shaped by historical circumstances and human reflection (p. 19). In one tradition, a personal God arose through stories from prophets and visionaries. In another tradition, an impersonal deity arose via Greek rationalism which saw the world as orderly and predictable (p. 23). Jewish, Greek, and Christian perspectives have all influenced contemporary ideas of God. Pugh thinks modern Christian thought is shaped greatly by the synthesis which originated with St. Augustine, "the man who set the table for the ensuing banquet of Christian tradition and theology" (p. 37).

Topics dealt with by Pugh include seemingly undeserved suffering ("the issue we will never be through with in this life" p. 47), creation stories ("the natural order is not inherently ill-designed ..." p. 68), eschatology ("hope is necessary for the furtherance of both science and faith" p. 131), and the Trinity ("The story ... begins with the triune God" p. 118).

This book succeeds in reaching its audience of students, neophytes, and laypersons. Professional theologians and scientists, as well, might pick up some nifty tidbits from the data, analysis, and quotes. Pugh raises many important issues, and he does a commendable job in addressing them. This book is recommended as an excellent choice for a college course, a church study group, a book club, or some friendly dichotomous dialogue.

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

Book Reviews

RELIGION AND CHRISTIAN FAITH

MINDING SPIRITUALITY by Randall Lehmann Sorenson. Hillsdale, NJ: The Analytic Press, 2004. 191 pages. Hardcover; $39.95. ISBN: 0881633445.

This book was a strenuous pleasure to read—only in part because it was authored by a former student in whom I take great pride. More to the point, in a number of ways, the volume will take its place as a seminal contribution to the ongoing dialogue concerning psychotherapy and the religious quest. This volume is a testimony to the truth that the issues of why and how "religion" shall be dealt with by psychoanalysts (read *all* counselors) are but themselves indices of broader cultural history and change.

Sorenson is a graduate school professor in a doctoral program that combines theological study with clinical psychological training. He is a practicing psychoanalyst. His experience and reflection are broad and deep. While his intentional focus is psychoanalytic theory and treatment, the insights he brings to the issues are worthy of broader application. The book title *Minding Spirituality* was not chosen casually. Early in the book he suggests a helpful three-fold model for the corpus to follow. He recommends: (1) being mindful (bothered, aware) of spirituality; (2) being mindful of the gap in counseling where counselors subtly communicate spirituality often; and (3) being good store-minders who care for and cultivate spirituality. These are the implicit guides for much that follows.

In some ways, the book reads like a compilation of articles written by Sorenson on various religion/psychoanalysis topics that have fascinated him and his students through the years. Chapters deal with changes in psychoanalytic theory and the implications of these changes for the treatment of religious experience, the ways that psychoanalytic journals have dealt with religion, the historical development of psychoanalytic institutes, and the history of the relationship between science and religion.

Four issues Sorenson considers worthy of more extensive comment are: changes in conceptions of God during psychoanalysis; the question of whether psychoanalysis and religion are in the same business; the false presumption that the Enlightenment was spawned by anti-religious motivations; and the persistence of the religious quest.

In an effort to better understand the forces impacting understandings of God among counselors and clients, the book includes reports of a series of well-designed, quasi-empirical studies undertaken by Sorenson and his students. Contrary to prediction, God concepts brought to therapy did not seem to influence after therapy concepts as much as the interaction during the therapeutic process. Further, therapists' own God concepts were deeply influenced by the therapeutic relationship. These results lent credence to a contructivist epistemology that does not mesh with Freud's understanding of the analyst as an "archeologist" who discovers truth. Sorenson's research is a noteworthy example of how empirical and theoretical research can be combined in clinical research.

In an intriguing discussion, Sorenson deals with the issue of whether psychotherapists and pastors are competitors—those who deal in the same business. This is not a new issue. A stream of articles in the last two decades have considered the question of "scholarly distance" as a predictor of rivalry among branches of science. This concept was used to explain why natural scientists tended to be more religious than social/behavioral scientists. Sorenson, however, discusses the issue from a different perspective—love. He contends that both the great religions and psychoanalysis purpose to cure human ills through *love* and are, thereby, engaged in a similar endeavor.

Sorenson's discussions reflect the type of intellectual pursuit that goes beyond easy acceptance of popular truth. In his treatment of the rise of science in the Enlightenment—a discussion that has been widely considered to be based on anti-religious secularism—Sorenson joins a number of contemporary writers in noting that exploration in science has been, and continues to be, motivated often by the desire to better understand the creation of a monotheistic God.

Finally, Sorenson is unapologetic in his contention that the religious quest remains part of what it means to be human. This is, in part, his basis for asserting that psychoanalysts would do well to become acquainted with the well informed, post-modern, hermeneutical reflection going on in theological seminaries. Contrary to some thinking "secularism" is not obliterating religion.

This book is not an easy read—nor was it intended to be so. However, if one wades through some of the analytic discussions and keeps translating the insights into those that apply both to counselors and scientists of all stripes, I predict that the experience will be more than rewarding. It will be exhilarating.

Reviewed by H. Newton Malony, Senior Professor, Graduate School of Psychology, Fuller Theological Seminary, 180 North Oakland Avenue, Pasadena, CA 91101.

UNIVERSAL SALVATION: The Current Debate by Robin A. Parry and Christopher H. Partridge, eds. Grand Rapids, MI: Eerdmans Publishing Company, 2004. 292 pages. Paperback; $27.00. ISBN: 0802827640.

The main question addressed in this book is whether everybody will eventually be saved. Other questions explored include: (1) Is universal salvation a reasonable hope or a definite certainty? (2) Do the biblical hell texts offer a possible destiny never realized? (3) Will the devil and demons be saved? (3) Is the New Testament consistently universalist or in a tension with other views? (4) Must one have conscious faith in Christ to be saved? and (5) Is God bound by his nature to save everyone?

The format of the book involves Thomas Talbott offering his view of universalism followed by critical and affirming responses by scholars from historical, biblical, philosophical, and theological perspectives. Jerry Walls makes the trenchant point that "No one involved in this dispute can fairly pronounce their view *the* biblical view if by that they mean to imply that other positions have nothing going for them ..." (p. 106).

Reitan agrees: "Thus, even if we regard Scripture as infallible, it is not self-evident that Scripture offers more support for DH (Doctrine of Hell) than DU (Doctrine of Universalism)" (p. 125).

The approach Talbott takes is to accept the universalist's texts in the Bible and then to re-interpret the hell texts to mean that the damnation of the unsaved is only temporary. One of the strongest arguments against universalism is the fact that most past theologians have sided against it. The universalists counter that the Reformation would never have occurred if the Reformers relied on tradition rather than Scripture.

Morwenna Ludlow writes a relevant and informative chapter entitled "Universalism in the History of Christianity." She expresses the opinion "that analytic philosophers of religion who are universalists usually express their conclusions with more certainty than systematic theologians" (p. 211). Since the 1960s, evangelical theologians endorsing or seriously considering the idea of a "second chance" or "post-mortem" evangelism include Donald Bloesch, Clark Pinnock, Nigel Wright, and Charles Cranfield. While the Roman Catholic Church rejects the view that "we can say with certainty that all will in fact be saved" (p. 108), it does not brand as heretical those who hope that all will be.

In the last chapter, Talbott responds to his critics. He makes the salient point that Arminians and Calvinists consider each other mistaken, but not heretical. However, they consider universalists not just mistaken but heretical (p. 250). (David Hilborn and Don Horrocks indicate in their chapter, "Universalistic Trends in the Evangelical Tradition: An Historical Perspective," that there are precedents within the evangelical tradition for universalism.)

Talbott finds deficient the Calvinistic view that salvation is determined by the mystery of God's election. He also rejects the Arminian view that free will is the determining factor inasmuch as it puts the redeemed in the position to boast of their wise choice. "Do you really believe that the difference between you and those who will supposedly be lost forever ... lies in the superior character of your own free choices? For my own part, I can find nothing either in myself or the New Testament that would justify such belief as that" (p. 260).

Perspicuity, the concept that ideas in the Bible are clearly presented and easy to understand, is relevant to this topic. Martin Luther thought that some parts of the Bible are obscure but "if the words are obscure in one place, yet they are clear in another." However, it is obvious that the Bible is not clear enough to align Christian belief on this or on a plethora of other doctrines. Perhaps Paul gave wise counsel when he wrote concerning other matters, "make up your own mind" (Romans 14:13).

For those who want a better historical, biblical, theological, and philosophical understanding of the issues involved in universalism, this book is a great place to start. It may at times be difficult for the neophyte to follow the discourse. However, although erudite, it is understandable. I recommend it for those who want to consider evidence on both sides of this important, intriguing, and controversial topic.

The late Kenneth Kantzer, who was editor of *Christianity Today*, expressed the desire of most people when he wrote: "I would like to believe that hell can only be the anteroom to heaven, a temporary and frightful discipline to bring the unregenerate to final moral perfection." Like many others, Kantzer could not. However, today some can.

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

THE C. S. LEWIS ENCYCLOPEDIA: A Complete Guide to His Life, Thought, and Writings by Colin Duriez. Wheaton, IL: Crossway Books, 2000. 256 pages, bibliography, reference guide. Paperback; $17.99. ISBN: 1581341369.

Lewis needs no introduction to readers of *Perspectives*. He may be the most widely read believer in modern times, in spite of the popularity of Hal Lindsey, Frank Peretti, and the *Left Behind* series. Dead for over forty years, Lewis' varied writings (*The Chronicles of Narnia*; works of science fiction, apologetics, and literary criticism) are still in print, undiminished in popularity, and highly esteemed by Christians of all stripes and by non-Christians as well.

The C. S. Lewis Encyclopedia is organized alphabetically rather than topically, a feature I found helpful. Entries are cross-referenced, however, such that a reader who wants to pursue a topic or read everything dealing with a particular book can easily do so. A reference guide at the end of the book also groups the entries topically in twelve categories: Life of C. S. Lewis, Works of C. S. Lewis, The Literary Criticism of C. S. Lewis, The Themes of C. S. Lewis, The Thought and Context of C. S. Lewis, Science Fiction, *The Screwtape Letters, Till We Have Faces, The Pilgrim's Regress, The Great Divorce, The Chronicles of Narnia*: (a) Who's Who in Narnia, (b) What's What in Narnia.

Entries cover a variety of topics. Some identify and describe persons and places encountered in Lewis' fictional writings. The coverage seems to be complete. As to his nonfictional works, entries include summaries of themes he wrote on and beliefs and convictions expressed in his writings, BBC radio talks, and conversations with friends. Other entries identify persons who knew Lewis: family members, friends (the Inklings and others), students and teachers of his, writers who influenced him, and interlocutors. Incidents and places important to him also are identified and described. All of his published works—books, essays, letters—are summarized.

Colin Duriez, general books editor at InterVarsity Press in England and a major authority on C. S. Lewis, has done Lewis fans a valuable service in compiling this encyclopedia. In the Preface, he states:

> *The C. S. Lewis Encyclopedia* has been written to encourage an exploration and discovery (or rediscovery!) of the "Christian world of C. S. Lewis," ... a world that has been a permanent part of my life ... strengthening my faith and opening both my mind and imagination.

Duriez achieves his purpose. The reader can relax with one of Lewis' books in one hand and *The C. S. Lewis Encyclopedia* in the other. He or she will find the encyclopedia an aid and stimulus to appreciating and enjoying both familiar and unfamiliar writings of this most thoughtful and imaginative writer.

Reviewed by Robert Rogland, Science Teacher, Covenant High School, Tacoma, WA 98465.

Book Reviews

SCIENCE EDUCATION

CHRISTIANITY IN THE ACADEMY: Teaching at the Intersection of Faith and Learning by Harry Lee Poe. Grand Rapids, MI: Baker Book House, 2004. 208 pages. Paperback; $19.99. ISBN: 0801027233.

Poe writes that this book has been a long time in the making but a short time in the writing. The author states his purpose in his preface: "This book attempts to illustrate the kinds of issues that are about faith, issues that different academic disciplines regularly treat ... This book does not advocate the 'add Jesus and stir' approach" (p.14). Poe lists six ways to stimulate thinking about faith and learning (p. 29). He also explores how religions relates to various academic disciplines such as art, biology, chemistry, English, and so forth. In the process of expressing his views, Poe gives an overview of his educational experiences as a student in a secular setting.

Poe puts his thoughts on the intersection of faith and learning into seven chapters. The book contains an index, endnotes, and an appendix which lists addresses for Christian Scholarly and Academic Societies (fifty-three in the USA and sixteen for the UK). The American Scientific Affiliation (ASA) is among them. Poe commends the ASA for its stand against the National Association of Biology Teachers' claim that evolution is unsupervised and impersonal (p. 28).

Baker Academic Books and the Council for Christian Colleges and Universities (CCCU) are partners in producing textbooks and academic resources which help readers to think about topics of faith and learning. The books, of which this is one, are published under the Renewed Minds imprint.

Harry Lee Poe, the author of this volume, is program director of the C. S. Lewis Foundation's Summer Institutes, where faith and scholarship topics are the focus for Christian faculty from secular settings. In addition, Poe is Charles Colson Professor of Faith and Culture at Union University; this book is the first by-product of his position.

Arthur Holmes, a faith-learning guru and the author of books on this same topic (i.e., *The Idea of a Christian College*), thinks Poe "raises critical questions for teachers and scholars in any field." Other scholars interested in the integration of faith and learning (including the Baylor Provost, CCCU Vice-President, and Fellow at the Center for Christian Studies) also give Poe's book high marks.

The audience for this book is big. In addition to the faculty in nearly one hundred schools in the CCCU, many Christians teach in secular institutions. There may be as many as 50,000 Christians teaching in higher education (p. 27). If they agree with Poe that "any effort to deal with the cognitive issue of faith in the academy must also deal with the broader spiritual dynamics" (p. 178), they will appreciate this book.

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

DARWINISM, DESIGN, AND PUBLIC EDUCATION by John Angus Campbell and Stephen Meyer, eds. East Lansing, MI: Michigan State University Press, 2003. 634 pages, five appendices, glossary. Paperback; $27.95. ISBN: 0870136755.

This book, part of Michigan State University's Rhetoric and Public Affairs Series, is a collection of twenty-six essays dealing with the controversy engendered by the push to teach Intelligent Design (ID) alongside evolution in the public schools. John Angus Campbell, one of the editors, is a professor and director of graduate studies in the Department of Communication at the University of Memphis. In his research he has specialized in the study of the rhetoric of science and has published numerous articles and book chapters analyzing the rhetorical strategy of Darwin's *Origin of Species*. The other editor, Stephen Meyer, is director of the Discovery Institute's Center for Science and Culture in Seattle. He is a prominent spokesman for ID.

Design, Darwinism, and Public Education (*DDPE*) was written for science teachers. In his Introduction, Campbell writes:

> This volume seeks to introduce science educators to the arguments of the design theorists and to those of prominent critics of ID, so that educators may consider the merits of the main pedagogical argument of this volume, namely, that science teachers would do well to "teach the controversy" or "controversies" over contemporary evolutionary theory.

The thirty contributors to this volume represent both pro-ID and anti-ID scientists as well as rhetoricians, philosophers, and attorneys (who argue the case for teaching the controversy on free speech grounds). None of the contributors speaks on behalf of Christian creationism, though the Christian convictions of some are well known.

Part I of *DDPE*, "Should Darwinism Be Presented Critically and Comparatively in the Public Schools? Philosophical, Educational, and Legal Issues," contains three essays laying out the case for "teaching the controversy." They make the case on the grounds of fostering dialectical scientific thinking and free speech (none of the essays urge "teaching the controversy" on the grounds of freedom of religion). Three of the essays in Part IV, *Critical Responses*, deny that "the controversy" should be taught.

Part II, "Scientific Critique of Biology Textbooks and Contemporary Evolutionary Theory," contains six essays. They deny the validity of some of the frequently cited evidences of evolution (Haeckel's embryos, peppered moths, vestigial structures) and confess the mystery of life's origin (the latter from Massimo Pigliucci, a prominent Darwinian and anti-creationist, whose anti-ID essay is also included in this volume). The intent of these essays is to show that evolution as it is frequently presented in textbooks should not be accepted uncritically.

Part III, "The Theory of Intelligent Design: A Scientific Alternative to Neo-Darwinian and/or Chemical Evolutionary Theories," contains essays by Stephen Meyer, Michael Behe, Paul Nelson, Johathan Wells, Marcus Ross, Paul Chien, and William Dembski, heavy hitters in the ID movement. They deal with the key ID concepts of specified complexity and irreducible complexity, and seek to

show how ID provides a better explanation for the origin of life, homology, and the Cambrian Explosion. Their intent is to establish ID as a *scientific* endeavor.

Part IV, "Critical Responses," contains rejoinders from biologists, philosophers, and rhetoricians, including such noted anti-ID spokesmen as William Provine, Michael Ruse, and Massimo Pigliucci.

DDPE is an important book, one any ASA member involved in education ought to read. Implacable foes of ID will reject its central thesis, that the schools should teach the controversy *qua* scientific controversy; they will maintain that no controversy exists among informed, intellectually honest scientists. But, in my opinion, the ID contributors demonstrate that there are scientific grounds for doubting some of the assumptions and conclusions of neo-Darwinism and also scientific reasons for considering the claims of ID. For their part, the philosophers and rhetoricians make a strong case for a dialectical approach in the science classroom ("let a thousand flowers bloom, a hundred schools of thought contend"). Together they have shifted the burden of proof to the anti-ID crowd: the latter ought to make a convincing case for not "teaching the controversy" or else be willing to argue it out on scientific grounds in the public school classroom.

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SOCIAL SCIENCE

FOR THE GLORY OF GOD: How Monotheism Led to Reformations, Science, Witch-Hunts, and the End of Slavery by Rodney Stark. Princeton: Princeton University Press, 2003. 488 pages, index. Hardcover; $35.00. ISBN: 0691114366.

Stark, sociology professor at the University of Washington, is a perennial iconoclast. He challenges the all-too-common presumption that the rise of science has rescued history from the regressive evils of monotheistic religion, e.g., Christianity. In this volume, he does a masterful job of recounting the significant constructive effects of faith in God on cultural change without, at the same time, denying the limits of human frailty, perfidy, and sin.

Stark begins with an introductory statement about the significance of religions that are theistic and whose god (or gods) consider the behavior of humans to be important. He further notes that only in the great monotheistic religions do we find morality defined as the will of God for ethical interactions among human beings. While he alludes to Islam and Judaism on occasion, Stark's major focus is on the Christian tradition. The rest of the volume shows how these insights have been applied to the rise of science, to the European witch-hunts, and to the abolition of slavery.

Prefacing consideration of science, witch-hunts, and slavery is a section entitled "God's Truth," in which Stark concludes that the reformulation of God's will by systematic reflection has been an essential and inevitable process in Christian history. His analysis of the roots of deviations, sects, and reformations is detailed and incisive. Contrary to theorists which decry such developments, Stark considers these attempts to refine human understandings of the divine will as integral to the nature of high monotheism.

In the section entitled "God's Handiwork," Stark demonstrates that the impulse toward scientific investigation originated in the minds of faithful Christians desiring to further understand how God had created the world. Contrary to popular opinion, science did not release culture from the regressive religion of the Dark Ages. He ridicules the type of "scientism" that implies religion and science are not related. Science was nurtured by Christians and their religious motivations were basic to the rise of science in the sixteenth century and later.

Turning to a consideration of witch-hunts, Stark notes, in a section entitled "God's Enemies," that heresy hunting was focused in regions where magic persisted and where clerical malfeasance was rampant. Earlier he contrasted the "church of piety" with the "church of power," and it would seem that witch-hunts were more characteristic of the latter rather than the former. Stark does not diminish the horror of this period in Europe, but he does show that treatment of witches differed from region to region.

The most fascinating section of the volume is entitled "God's Justice" and deals with the abolition of slavery. His observation of the difference in stated principles underlying Catholic and Protestant slaveholding is very significant even though this did not make an absolute difference in the way slaves were actually treated. Nevertheless, it is important to acknowledge that as early as the 800s Saints Bathilde and Anskar worked hard to abolish slavery and Pope Paul III in 1537 followed Thomas Aquinas and made three major pronouncements against slavery. In spite of these proscriptions, Catholic settlements in the Caribbean and South America did have slaves but the church had lists of their entitlements that included the right to baptism, rest on Sunday, private enterprise, personal money, and the right to ultimate freedom. No such principles guided slavery in North America although very early in US history the Quakers explicitly forbade any of their members to own slaves. Slavery in the USA reflected no religious guidelines. Slaves were not considered human. They were not permitted to marry and were not provided religious services. As late as the mid 1840s, the debate over slavery still persisted in some religious circles and at least one Methodist bishop still owned slaves. However, Stark's main point is that the abolition of slavery was due far less to economic considerations than to religious motivations—ideas about the sacredness of human beings that had existed for centuries in Roman Catholicism.

Stark has done his homework. Once again he has illustrated the value of a social scientist who refuses to accept current dogma and who is willing to use his skills of historical analysis to demonstrate the constructive value of religious faith. The book is somewhat ponderous and detailed. It is not easy reading. But as a counter to the twentieth-century dogma perpetuated by some scholars that science rose in spite of religion, this book is a worthy contribution. It is definitely worthy of attention by the scientific and public world.

Reviewed by H. Newton Malony, Senior Professor, Graduate School of Psychology, Fuller Theological Seminary, 180 North Oakland Avenue, Pasadena, CA 91101.

Letters

On Gaps in Genealogies

William H. Gilbert wrote an interesting letter in the June 2004 issue, referring to the article in the December 2003 issue by Carol Hill. I wish to comment on that letter.

Hill's main point was that numbers in the Old Testament were not always meant to be taken at face value. Gilbert challenges some of Hill's conclusions, and cites evidence to show that, in particular, the gaps that Hill claims to find in the genealogies of the Old Testament do not exist.

Gilbert's interpretation of the meaning of Exod. 12:40 ("Now the length of time the Israelite people lived in Egypt was 430 years," NIV) differs from Hill's and mine. Our interpretation is that the time from Jacob's entry into Egypt and the Exodus was 430 years, and there is a gap in the genealogy given for Aaron and Moses in 1 Chronicles 6. Either one or more generations are omitted, or the lengths of the lives of one or more of those given are not long enough. Gilbert, and Bible scholars before him (for references, see my http://home.earthlink.net/~mflabar/AgeEarth.htm), state that the actual length of the captivity was 200 years, which, of course, does not indicate a gap. Why depart from what seems to be the plain meaning? Gilbert cites Gal. 3:16–17, "The promises were spoken to Abraham and to his seed ... What I mean is this: the law, introduced 430 years later ..." (NIV). In other words, these authors are, they say, following Paul in believing that the 430 years refers to the time between the covenant between God and Abraham, and the Exodus.

I disagree. The reason is Scripture itself. Genesis 15:13, which is part of the description of the covenant between God and Abraham, reads as follows: "Then the Lord said to him, 'Know for certain that your descendants will be strangers in a country not their own, and they will be enslaved and mistreated four hundred years'" (NIV). I am not a Hebrew scholar, but this reads like it means a captivity of Abraham's descendants in Egypt amounting to considerably more than 200 years. Other Bible scholars agree. One such is Eugene H. Merrill, writing in *Bibliotheca Sacra* ("Fixed Dates in Patriarchal Chronology," 137 [Jul–Sep 1980]: 241–51), who said: "This places the Exodus in 1446 BC ... There is, moreover, the statement in Exod. 12:40 that Israel was in Egypt 430 years, thus yielding the date of 1876 for Jacob's migration there from Canaan" (p. 242).

To reconcile Paul's statement in Galatians with Gen. 15:13, various suggestions have been made. One is that the captivity of Abraham's descendants began with Ishmael. This seems contrived. Genesis 17:19 says that Isaac, not Ishmael, is the son of the covenant. Also, even though Ishmael is described as being the enemy of his neighbors, Scripture says nothing that would suggest captivity for Ishmael's family. It was, after all, Ishmaelites, independent traders, not slaves, who took Joseph to Egypt (Gen. 37:25–28). Another way of reconciling Gen. 15:13 with Gal. 3:16–17 is to say that when Gen. 15:13 said "a country," it is legitimate to interpret Canaan and Egypt as a single country. I find this a strange interpretation, also. I am not sure what the final explanation is, but the weight of the evidence seems to be with a more literal interpretation of Gen. 15:13 and Exod. 12:40. Hill, Merrill, Francis Schaeffer and others agree.

How can this be reconciled with Paul's statement in Galatians? One possibility is that one of the "promises" Paul included was the promise to Jacob, in Gen. 46:2–5, where God spoke to Jacob at Beersheba, on the way to Egypt to join Joseph, and promised him that his descendants would return to Canaan as a mighty nation. If so, the Exodus could, indeed, have been 430 years after this promise, which was right before the entry into Egypt. That seems no more contrived than some of the arguments for a shorter captivity.

I believe that Scripture teaches that 430 years elapsed between the time when Jacob and his family went to Egypt, and the escape from that country, and, therefore, that there is at least one gap in the genealogy in 1 Chronicles 6. I certainly could be wrong, but this is, at least, a tenable position. Better Bible scholars than I have agreed with it, although certainly not all do.

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More on Genesis Numbers: A Response to Gilbert and LaBar

This brief letter is in response to the letters of William Gilbert (*PSCF* 56, no. 2 [June 2004]: 153–4) and Martin LaBar (above), which refer to my article "Making Sense of the Numbers of Genesis" (*PSCF* 55, no. 4 [Dec. 2003]: 239–51).

Whether or not the "gaps" in the genealogies of the Old Testament exist (LaBar), or do not exist (Gilbert), does not matter with respect to two important points that I was trying to make in my Numbers of Genesis article:

(1) The numbers in the Old Testament are not always meant to be taken at face value. Sometimes they are to be taken numerically as real numbers, and sometimes they are to be taken numerologically as sacred or figurative numbers.

(2) "Gaps" amounting to a few hundred years at the most (if at all) cannot possibly push the biblical chronologies back thousands to tens of thousands to hundreds of thousands years to a "mitochondrial Eve" or "Y-chromosome Adam" as claimed by some concordists. Biblical chronologies place Adam and Eve at about 6,000 years or so ago.

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Dangerous Animals?

David Snoke (*PSCF* 56, no. 2 [2004]: 117–25) argues that dangerous animals form part of God's "very good" creation (Gen. 1:31). He omits to mention that the animals in Genesis 1 were entirely herbivorous (vv. 29–30). Nature at this stage was not "red in tooth and claw."

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A Plea for Relevance in Discussing hES

Whatever one's final conclusion about the ethics of human embryonic stem cell (hES) research, the arguments should be logical and well-founded. Mannoia's "An Evaluation of Three Religious Perspectives in Stem Cell Research" (*PSCF* 56, no. 3 [2004]: 216–25) unfortunately repeats some common errors and adds a novel one.

Following our intuitions (p. 221) is not an adequate basis for moral standards. True, "whatsoever is not of faith is sin" (Rom. 14:23), but this applies to the individual. Paul is clear in this passage that an individual may be self-condemned for what is not sinful. "Let my conscience be your guide" is not a valid principle, but comes close to what is often argued.

Mannoia assumes that a zygote is a "someone." The argument is that anything that has a history is a person: fetus, therefore embryo (p. 221)—therefore zygote, therefore ovum, therefore polar cell, which may be fertilized but can never develop for lack of cytoplasm—etc. Since cells, and even the components of cells, have histories, the claim needs more justification than an *ipse dixit*, hers or Percy's (p. 223). Another evangelical, Richard Bube, had a different, thoughtful take on the matter.[1] Something he could not at the time note is that at least one-third of naturally fertilized ova do not implant. Herb Spencer claims 70%, adding that this means that, assuming all zygotes to be persons in God's sight, the vast majority of the redeemed will be these entities that perish early.[2] Or will these add to the number in limbo or perdition, for they cannot be christened?

Mannoia writes: "Nowhere in Scripture do we find justification for sacrificing an innocent life to help others" (p. 222). But, as she notes later, is this not what our Lord did, gave himself for our salvation? Does personal choice make a vital difference, as claimed? How does Mannoia's claim fit with the biblical statement that Caiaphas the high priest was inspired when he said: "Ye know nothing at all, nor consider that it is expedient for us, that one man die for the people, and that the whole nation perish not" (John 11:49–51). It is well that she provides a momentary qualification (the embryo may not be a person) lacking in the previous section (p. 221) and rejected in the following one (p. 222).

While in the normal production of young, neither ovum nor sperm cell "is capable of producing a viable human on its own" (p. 222), ova may be manipulated to produce embryos. At least in other species, a manipulated ovum can substitute for a zygote. This has not been proved impossible in *Homo sapiens*.

The concurrence of the church fathers regarding total opposition to abortion must be qualified. They could not be fully confident of pregnancy until quickening, the time when the fetus is large enough for its movement to be felt. The lack of menses is an earlier indicator, to be sure. But, since amenorrhea has multiple causes, it is not a certain sign.

The claim, "One could argue that this holds not only for abortion, but also for hES research, as it too involves something 'conceived in the womb'" (p. 223) is ridiculous. The ova involved in hES research and *in vitro* fertilization for assisted reproduction do not pass through the womb. This is so blatant an error as to suggest blindness among the reviewers as well as the author. A related minor problem is that normal fertilization takes place before the ovum reaches the uterus.

The arguments from Scripture (p. 223), while representative of the evangelical position, hardly support the claim that all zygotes are persons. One needs to ask what is the *terminus a quo* of God's knowledge. Is it the moment of conception? Paul says it is "before the foundation of the world" (Eph. 1:4; see also Acts 15:18; Rev. 13:8; 17:8). It is necessary that God know an individual at the moment of conception if his knowledge extends back before creation.[3] His knowledge also includes sparrows and every hair (Matt. 10:29f; Luke 12:6f), but they are not persons.

One may analyze this matter further. The verses quoted by Mannoia are all statements from adults who are clearly persons, who recognize God's involvement in their entire lifetimes. This fails to claim that God ascribes personhood to every zygote, embryo, or even fetus. It may be so, for nothing in these verses contradicts this strong claim. But there is no support either.

It has been often noted that advocates of "choice" and of "life" do not communicate: they yell at each other, or at best, talk past each other. Mannoia's study, which repeats arguments common among evangelicals with claims that exceed their support, does not promote dialogue. She is thus only "preaching to the choir," though one has to wonder whether the choir is nodding in agreement, or has nodded off. While "God was pleased through the foolishness of what was preached to save those who believe" (1 Cor. 1:21 NIV), there is no premium on any Christian presenting foolish arguments.

Notes

[1]Richard H. Bube, *The Human Quest: A New Look at Science and the Christian Faith* (Waco: Word, 1971), 221–30.
[2]"Readers Write," *Christianity Today* (September 2004): 12.
[3]This phrasing is not technically correct, but to express timeless divine knowledge is very difficult.

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